BIOLOGICAL CONTROL OF WEEDS

A WORLD CATALOGUE OF AGENTS AND THEIR TARGET WEEDS

FIFTH EDITION

The Forest Health Technology Enterprise Team (FHTET) was created in 1995 by the Deputy Chief for State and Private Forestry, Forest Service, U.S. Department of Agriculture, to develop and deliver technologies to protect and improve the health of American forests. This book was published by FHTET as part of the technology transfer series.

http://www.fs.fed.us/foresthealth/technology/

Winston, R.L., M. Schwarzländer, H.L. Hinz, M.D. Day, M.J.W. Cock and M.H. Julien, Eds. 2014. Biological Control of Weeds: A World Catalogue of Agents and Their Target Weeds, 5th edition. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. FHTET-2014-04. 838 pp.

Photo Credits

Front Cover: Tambali Lagoon, Sepik River, Papua New Guinea before (left) and after (right) release of *Neochetina* spp. (center). Photos (left and right) by Mic Julien and (center) by Michael Day, all via the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Back Cover: Nomorodu, New Ireland, Papua New Guinea before (left) and after (right) release of *Cecidochares connexa*. Photos (left and right) by Michael Day, Queensland Department of Agriculture Fisheries and Forestry (DAFF), and (center) by Colin Wilson, Kangaroo Island Natural Resources Management Board, South Australia.

Title Page: Caboolture River, Queensland, Australia before (left) and after (right) release of *Agasicles hygrophila*. Photos by Queensland DAFF.

For additional copies of this publication, contact:

Mark Schwarzländer
University of Idaho
PSES Department
Moscow, ID 83844
208.885.9319
markschw@uidaho.edu

Richard C. Reardon
U.S. Forest Service
180 Canfield Street
Morgantown, WV 26505
304.285.1566
rreardon@fs.fed.us

www.ibiocontrol.org/catalog/

BIOLOGICAL CONTROL OF WEEDS

A WORLD CATALOGUE OF AGENTS AND THEIR TARGET WEEDS

FIFTH EDITION

Edited by Rachel L. Winston, Mark Schwarzländer, Hariet L. Hinz, Michael D. Day, Matthew J.W. Cock, and Mic H. Julien; with assistance from Michelle Lewis

Rachel L. Winston, MIA Consulting, 316 N. Hansen Ave., Shelley, ID 83274 USA, rachel@getmia.net

Mark Schwarzländer, University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339, Moscow, ID 83844-2339 USA, markschw@uidaho.edu

Hariet L. Hinz, CABI, Rue des Grillons 1, CH-2800, Delémont, Switzerland, h.hinz@cabi.org

Michael D. Day, Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia, michael.day@daff.qld.gov.au

Matthew J.W. Cock, CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, United Kingdom, m.cock@cabi.org

Mic H. Julien, Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, 41 Boggo Road, Dutton Park, QLD 4102, Australia, mic.julien@csiro.au

Michelle Lewis, MIA Consulting, 316 N. Hansen Ave., Shelley, ID 83274 USA, michelle@getmia.net

TABLE OF CONTENTS

GEOGRAPHIC ABBREVIATIONS

AUSTRALIA

ACT	Australian Capital Territory
NSW	New South Wales
NT	Northern Territory
QLD	Queensland
SA	South Australia
TAS	Tasmania
VIC	Victoria
WA	Western Australia

CANADA

AB	Alberta
BC	British Columbia
MB	Manitoba
NB	New Brunswick
NL	Newfoundland and Labrador
NS	Nova Scotia
NT	Northwest Territories
NU	Nunavut
ON	Ontario
PEI	Prince Edward Island
QC	Quebec
SK	Saskatchewan
YT	Yukon

HAWAII USA

HA	Hawai'i
KA	Kaua'i
LA	Lāna'i
MA	Maui
MO	Moloka'i
NI	Ni'ihau
OA	O'ahu

PAPUA NEW GUINEA

CHM	Chimbu (Simbu)
CTL	Central
EHL	Eastern Highlands
ENB	East New Britain
ENG	Enga
ESP	East Sepik
GLF	Gulf
HEL	Hela
MBP	Milne Bay
MDG	Madang
MNS	Manus
MRB	Morobe
NCD	National Capital District
NIP	New Ireland
NSP	North Solomons (Bougainville autonomous region)
SHL	Southern Highlands
WHP	Western Highlands
WNB	West New Britain
WSP	West Sepik (Sandaun)
WST	Western Province (Fly)

REPUBLIC OF SOUTH AFRICA

EC	Eastern Cape
FS	Free State
GP	Gauteng
KZN	KwaZulu-Natal
LP	Limpopo (formerly Northern Province)
MP	Mpumalanga
NC	Northern Cape
NWP	North West
WC	Western Cape

UNITED STATES OF AMERICA

AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
CA	California
CO	Colorado
CT	Connecticut
DE	Delaware
FL	Florida
GA	Georgia
HI	Hawaii
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
NC	North Carolina
ND	North Dakota
NE	Nebraska
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma
OR	Oregon
PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming

FOREWORD

Biological control is a fascinating discipline where experimental projects are conducted at ecoregional scales. Biological control using natural enemies and native organisms is an important tool in the land manager's arsenal of weed control techniques. The practice has been expanding from use primarily on rangelands and aquatic systems into other environments. The editors of this comprehensive work have embarked on the difficult task of cataloging the biological control of invasive plants (noxious weeds) on a global scale. With each successive edition of this World Catalogue of Biological Control of Weeds since 1982, the monumental task of pulling together so much information has been compounded by the ever changing geo-political landscape and the increasing number of targeted weeds and new biocontrol agents. This book will serve as a valuable reference to practitioners and scientists throughout the world, help foster cooperation of partnerships on new and old projects, and advance the science of biocontrol. Some biological control agents are redistributed to countries, states, regions, etc., where the political entity has relied on host specificity testing conducted in another country or by an adjoining neighbor.

Since the Fourth Edition by M.H. Julien and M.W. Griffiths (1998), the science of plant taxonomy has been greatly enhanced through genetic analysis, often redefining the associations among genera and families beyond that which was previously done through plant morphology. This has led to a slowdown in the approval rate of classical biological control agents in some countries, as they scramble to redefine host specificity protocols. This should, however, lead to the increased safety of implementing biocontrol in the long run.

Biological control is not without risk, but with each passing decade it has become safer when compared to the alternative of allowing invasive weeds to spread unchecked. In recent years there has been a greater concern about evolutionary processes and how these may affect biocontrol agents after they are released in novel environments, and how native plants and crops may be at risk. We should be aware, but cautious, when comparing nontarget impacts of old projects and protocols against new host specificity testing methodology.

For each weed biocontrol system, the editors report the validated status by: the weed and its origin; biocontrol agent, country, release year; notes on establishment, abundance, success/failure; research organization; and references. It is easiest to report the status of biocontrol agents by political units, as there are specific boundaries and conditions that can be easily recorded. It would be nice to report status by ecoregion, since that is where the evolutionary forces act upon their populations, but those units are not always well defined, making reporting more difficult. Care should be taken when analyzing the data herein, as the subjectivity is proportional to the scale at which it is applied.

Not all regional experts are equal in their experience. It has been my personal experience to observe that about one third of all biocontrol agents reported to have failed were later found to have established. There are numerous examples of this reported in this Fifth Edition. However, just because a biocontrol agent is established, this does not mean it is successful or widespread. Regional success usually requires several decades; therefore care should be exercised when analyzing the success of projects. Biocontrol projects less than 10 years old should generally not be included in the analysis of efficacy. Furthermore, the successful control of a weed in some habitats does not always guarantee overall success, especially where land management practices do not change and other weeds present in the system simply move up the ladder. The generally accepted success rate of one third of biocontrol agents being successful is still a very good track record, when one considers those weed systems were likely spreading unchecked before biocontrol was implemented.

Biological control should be part of an interdisciplinary integrated approach to ecologically based vegetation management. This catalog is a great and convenient resource to land managers and practitioners alike, as they apply ecological principles and sound management practices to control noxious and invasive plants. I encourage those who practice weed biological control to continue to make important observations, report their findings, and promote interaction amongst their peers, so that this important World Catalogue may continue to be updated in the future.

Eric M. Coombs
Biological Control Entomologist
Oregon Department of Agriculture
635 Capitol St. NE
Salem, OR 97301 USA

ACKNOWLEDGMENTS

Biological Control - A World Catalogue of Target Weeds and Their Agents has proven to be one of the most important publications in the field of biological control. By 2010, the steady citation of the Fourth Edition (despite its publication date in 1998) illustrated the great need for a new revision. While brainstorming ways to make this possible, it became apparent that any new update should be expanded to incorporate technological and academic advancements of the previous decade. In addition to updating all of the information collated in previous editions, it was our desire to create a database with greater accessibility, usability, and potential for future growth. We needed four main components in order to accomplish this goal: the expertise of the creator and lead author of the previous editions of the catalogue, collaborations with biocontrol practitioners worldwide, human resources capable of orchestrating the new expanded approach, and a funding body willing to publish the new edition as well as house a new comprehensive and electronic database.

All four previous editions of this catalogue were collated and edited by **Mic H. Julien** (CSIRO retired), with support from other key individuals. Those earlier editions were compiled at a time when references were more difficult to obtain and contacts were more challenging and time-intensive to establish worldwide. This Fifth Edition would not have been possible were it not for Mic's willingness to share his painstakingly collected data, references, and contacts. Despite retiring *prior* to the onset of this major effort, Mic played a crucial role in the revision. He always made himself available for guiding us through all questions and issues we encountered. He also personally handled the collation and updating of numerous weed systems spanning multiple countries. Mic's dedication to this project through all five editions helps explain why many in our discipline continue to affectionately refer to this and previous versions simply as "Julien's Catalogue". We are very grateful to have been able to join him in this effort.

Michelle Lewis (Private Contractor, Idaho, USA) was key to the revision process. Michelle designed the electronic database, migrated existing information to the new format, completed the entire first draft of the update and expansion, and maintained the integrity of the database during subsequent editing phases. Long after her involvement with the effort was to have ended, she continued to volunteer her time and skills to ensure this project was completed and with the highest quality possible.

An enormous amount of collaboration and cooperation with biocontrol practitioners worldwide was required to make this revision possible. Many researchers contributed newly discovered and/or unpublished information for this and earlier revisions of the catalogue. Some were helpful on weed systems of their particular expertise, while others coordinated and/or collated larger amounts of material from particular regions, countries, or organizations. Numerous taxonomists were also integral to this effort. We are *immensely* grateful for all input received. While much of this help is documented with "personal communication" citations included throughout the reference list, the "Contributors" section which follows also includes individuals who provided significant help and information during this project. In particular, we wish to extend our sincere gratitude to the following individuals, whose contributions usually addressed numerous entries and required back and forth communication often spanning several days, months, or even years: **Obi Ajuonu**, **Dan W. Bean**, **Rob S. Bourchier**, **Ted D. Center**, **Christian Cocquempot**, **Enzo Colonnelli**,

Pat Conant, **Eric M. Coombs**, **Rosemarie A. De Clerck-Floate**, **Carol A. Ellison**, **Simon V. Fowler**, **John A. Goolsby**, **Richard W. Hansen**, **Lynley Hayes**, **Tim A. Heard**, **Martin P. Hill**, **John H. Hoffmann**, **Royce H. Holtkamp**, **John R. Hosking**, **Fiona A.C. Impson**, **John E. Ireson**, **Hildegard Klein**, **Janis N. Matsunaga**, **Alec S. McClay**, **Rachel E. Crutwell McFadyen**, **Louise Morin**, **Hernán Norambuena**, **William A. Palmer**, **Mike J. Pitcairn**, **Paul D. Pratt**, **Sergey Ya. Reznik**, **Urs Schaffner**, **Richard H. Shaw**, **Philip W. Tipping**, **Ivo Tosevski**, **Alan J. Urban**, **Baldo Villegas**, **Arne Witt**, **Alan R. Wood**, **Costas Zachariades**, **Zhong-Shi Zhou**, and **Helmuth G. Zimmermann**. The table on bioherbicides was developed with key input from **Raghavan Charudattan**, **David O. TeBeest**, **William L. Bruckart III**, and **Susan M. Boyetchko**.

Carol Randall (U.S. Forest Service, Forest Health Protection) and **Richard Reardon** (U.S. Forest Service, Forest Health Technology Enterprise Team) funded the production costs of this Fifth Edition of the printed catalogue as well as provided the financial resources that allowed us to compile and analyze all the information included herein. This revision effort included many elements not originally anticipated. Without the continued support and dedication of Carol and Richard there would, in all likelihood, be no Fifth Edition. They have provided an invaluable service to the discipline of biological weed control. Additional financial support was provided by the U.S. Bureau of Land Management, the University of Idaho and CABI Switzerland.

Many thanks to **Wendy W. Harding** for her patience and skill in designing the layout.

CONTRIBUTORS

Adair, R.J. Australis Biological, PO Box 151, Bittern 2918 Australia

Ajuonu, O. International Institute of Tropical Agriculture-Benin, 08 BP 0932 Tri Postal, Cotonou, Republic of Benin

Akpabey, F.J. CSIR Water Research Institute, P.O. Box AH 38, Achimota-Accra, Ghana

Andreas, J.E. Washington State University Extension, Integrated Weed Control Project, Puyallup Research Center, 2606 W. Pioneer, Puyallup, WA 98371 USA

Bean, D.W. Colorado Department of Agriculture, Conservation Services, 750 37.8 Rd., Palisade, CO 81526 USA

Bhumannavar, B.S. National Bureau of Agriculturally Important Insects, P.Bag No:2491, H.A. Farm Post, Bellary Road, Bangalore - 560 024. Karnataka, India

Biondi, M. Dipartimento di Scienze Ambientali, University of L'Aquila, 67100 Coppito-L'Aquila, Italia

Blossey, B. Cornell University, Department of Natural Resources, 211 Bruckner Hall, Ithaca, NY 14853 USA

Boughton, A.J. University of Florida, Tropical Research & Education Center 18905 S.W. 280 Street, Homestead, FL 33031 USA

Bourchier, R.S. Agriculture and Agri-Food Canada, Weed Biocontrol, Lethbridge Research Centre, 5403 1 Ave S, Lethbridge, Alberta, Canada T1J 4B1

Boyetchko, S.M. Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, Saskatchewan S7N 0X2 Canada

Briese, D.T. (Retired) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia

Brinon, L. Southern Province, Department of Rural Development, BP. 2386 - 98 846 Nouméa cedex, Nouvelle-Calédonie

Bruckart, W.L., III United States Department of Agriculture, Agricultural Research Service, Foreign Disease-Weed Science Research Unit, 1301 Ditto Ave., Ft. Detrick, MD 21702 USA

Bule, S. Biosecurity Vanuatu, Private Mail Bag 9095, Port Vila, Vanuatu

Byrne, M.J. University of the Witwatersrand, School of Animal, Plant and Environmental Sciences, Private Bag 3, Johannesburg, 2050 South Africa

Cabrera Walsh, G. Fundación para el Estudio de Especies Invasivas, Bolivar 1559, Hurlingham, Buenos Aires, Argentina

Caldara, R. Via Lorenteggio 37, I-20146 Milano, MI, Italia

Center, T.D. (Retired) United States Department of Agriculture, Agricultural Research Service, Invasive Plant Research Laboratory, 3225 College Ave., Fort Lauderdale, FL 33314 USA

Charudattan, R. BioProdex, Inc.; Emeritus Professor, University of Florida, Plant Pathology Department, 3131 NW 13th Street, Suite 54, Gainesville, FL 32609-2183 USA

Cocquempot, C. INRA - UMR 1062 CBGP, International Campus of Baillarguet, CS 30016, 34988 Montférrier-sur-Lez cedex, France

Colonnelli, E. Via delle Giunchiglie, 56, 00172 Roma, Italia

Conant, P. Hawaii Department of Agriculture, Plant Pest Control Branch, Hilo, Hawaii 96720 USA

Cook, R. National Park Service, 99 Marconi Site Road, Wellfleet, MA 02667 USA

Coombs, E.M. Oregon Department of Agriculture, Noxious Weed Control Program, 635 Capitol St. NE, Salem, OR 97301 USA

Cuda, J.P. University of Florida, Entomology and Nematology Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, Gainesville, FL 32611 USA

Cullen, J.M. Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia

De Clerck-Floate, R.A. Agriculture and Agri-Food Canada, Weed Biocontrol, Lethbridge Research Centre, 5403 1 Ave S, Lethbridge, Alberta, Canada T1J 4B1

Dhileepan, K. Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia

Dolgovskaya, M. Russian Academy of Sciences, Zoological Institute, 199034 St. Petersburg, Russia

Ellison, C.A. CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, United Kingdom

Fowler, S.V. Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand

Ganeshan, S. Mauritius Sugarcane Industry Research Institute, Crop Protection Programme, Reduit, Mauritius

Garcia, J.N. Hawaii Department of Agriculture, Plant Pest Control Branch, Honolulu, Hawaii 96814 USA

Gaskin, J.F. United States Department of Agriculture, Agricultural Research Service, Northern Plains Agricultural Research Laboratory, 1500 North Central Avenue, Sidney, MT 59270, USA.

Gatimel, B. Southern Province, Department of Rural Development, BP. 2386 - 98 846 Nouméa cedex, Nouvelle-Calédonie

Gitonga, W. Kenya Agricultural Research Institute- Mwea, P.O. Box 298-10300, Kerugoya, Kenya

Goolsby, J.A. United States Department of Agriculture, Agricultural Research Service, Knipling-Bushland U.S. Livestock Insects Research Laboratory, Cattle Fever Tick Research Laboratory, 22675 N. Moorefield Rd., Moore Airbase, Building 6419, Edinburg, Texas 78541 USA

Gordon, A.J. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7600 South Africa

Grevstad, F.S. Oregon State University, Department of Botany and Plant Pathology, 2082 Cordley Hall, Corvallis, OR 97331-2902 USA

Gültekin, L. Atatürk University, Faculty of Agriculture, Plant Protection Department, 25240, Erzurum, Turkey

Hansen, R.W. United States Department of Agriculture, Agricultural Research Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology, 2301 Research Bldg., Suite 108, Fort Collins, CO 80526-1825 USA

Harding, G. Invader Plant Specialists, P.O. Box 3879, Durbanville 7551 South Africa

Hayes, L. Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand

Heard, T.A. Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, 41 Boggo Road, Dutton Park, QLD 4102, Australia

Hemachandra, K.S. University of Peradeniya, Department of Agricultural Biology, Faculty of Agriculture, Peradeniya, Sri Lanka

Heystek, F. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa

Hight, S. United States Department of Agriculture, Agricultural Research Service, Center for Medical, Agricultural, and Veterinary Entomology, 6383 Mahan Drive, Tallahassee, FL 32308 USA

Hill, M.P. Rhodes University, Zoology and Entomology, P.O. Box 94, Grahamstown 6140 South Africa

Hoffmann, J.H. University of Cape Town, Department of Biological Sciences, P/B, Rondebosch 7701 South Africa

Holtkamp, R.H. Tamworth Agricultural Institute, NSW DPI, 4 Marsden Park Road, Calala, NSW 2340, Australia

Hosking, J.R. Tamworth Agricultural Institute, NSW DPI, 4 Marsden Park Road, Calala, NSW 2340, Australia

Hough-Goldstein, J. University of Delaware, Department of Entomology & Wildlife Ecology, Newark, DE 19716 USA

Impson, F.A.C. University of Cape Town, Department of Biological Sciences, P/B, Rondebosch 7701 South Africa; Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7600 South Africa

Ireson, J.E. University of Tasmania, Tasmanian Institute of Agriculture, New Town Research Laboratories, 13 St John's Avenue, New Town 7008 Australia

Johnson, J.D. University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339, Moscow, ID 83844-2339 USA

Kikodze, D. Ilia State University, Institute of Botany, 1 Kojori Road, 0105, Tbilisi, Georgia

King, A. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa

Klein, H. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa

Korotyaev, B. Russian Academy of Sciences, Zoological Institute, 199034 St. Petersburg, Russia

Kurose, D. National Institute for Agro-Environmental Sciences, Natural Resources Inventory Center, 3-1-3 Kannondai, Tsukuba, 305-8604, Japan

Kurugundla, C.N. Principal Botanist, Private Bag 002, Maun, Botswana

Le Bourgeois, T. Cirad, UMR AMAP, TA A51/PS2, Boulevard de la Lironde, F34398 Montpellier Cedex 5, France

Littlefield, J. Montana State University, Department of Land Resources & Environmental Sciences, PO Box 173120, Bozeman, MT 59717-3120 USA

Madire, L.G. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Pretoria 0001 South Africa

Mahmood, R. CABI, Opposite 1-A, Data Gunj Baksh Road, Satellite Town, P.O. Box 8, Rawalpindi, Pakistan

McClay, A.S. McClay Ecoscience, 15 Greenbriar Crescent, Sherwood Park, Alberta, Canada T8H 1H8

McConnachie, A.J. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag 6006, Hilton 3245 South Africa

McFadyen, R.E. Crutwell PO Box 88, Mt Ommaney Qld 4074 Australia

Merickel, F.W. University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339, Moscow, ID 83844-2339 USA

Meyer, J.-Y. Délégation à la Recherche, Gouvernement de la Polynésie Française B.P. 20981 Papeete, Tahiti

Miles, J.E. Bureau of Agriculture, P.O. Box 460 Ministry of Natural Resources, Environment & Tourism, Republic of Palau 96940

Morin, L. Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia

Neser, S. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa

Norambuena, H. Pasaje El Acantilado Oriente 740, Temuco, Chile

O' Brien, C.W. 2313 W. Calle Balaustre, Green Valley, AZ 85622-8047 USA

Olckers, T. University of Kwazulu-Natal, School of Biological & Conservation Sciences, Private Bag X01, Scottsville, 3209 South Africa

Orapa, W. National Agricultural Quarantine and Inspection Authority, PO Box 741, Port Moresby, NCD, Papua New Guinea

Palmer, W.A. Research Fellow, Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia; Adjunct Associate Professor, University of Queensland, School of Biological Sciences

Park, I.J. University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339, Moscow, ID 83844-2339 USA

Peschken, D.P. (Retired) 2900 Rae Street Regina, SK S4S 1R5 Canada

Petanović, R. Department of Entomology and Agricultural Zoology, Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 BelgradeZemun, Serbia

Pitcairn, M.J. California Department of Food and Agriculture, Biological Control Program, 3288 Meadowview Road, Sacramento, California 95832 USA

Poswal, A. CABI, Opposite 1-A, Data Gunj Baksh Road, Satellite Town, P.O. Box 8, Rawalpindi, Pakistan

Pratt, P.D. United States Department of Agriculture, Agricultural Research Service, Invasive Plant Research Laboratory, 3225 College Ave., Fort Lauderdale, FL 33314 USA

Purea, M. Ministry of Agriculture, P.O. Box 96 Rarotonga, Cook Islands

Reddy, G.V.P. Montana State University, Western Triangle Ag Research Center, 9546 Old Shelby Rd, Conrad, MT 59425 USA

Reznik, S.Ya. Zoological Institute, Universitetskaya nab., 1, St. Petersburg 199034 Russia

Rodríguez, N.S. Universidad Autonoma Metropolitana Xochimilco, Departamento de Producción Agrícola y Animal, Calzada del Hueso No. 1100, Col. Villa Quietud, CP 04960, México

Sastroutomo, S.S. CABI Southeast and East Asia, P.O. Box 210, Serdang, Selangor, Malaysia

Schaffner, U. CABI, Rue des Grillons 1, CH-2800 Delémont, Switzerland

Schooler, S.S. University of Wisconsin-Superior, Lake Superior National Estuarine Research Reserve, 14 Marina Drive, Superior, WI 54880 USA

Scott, J.K. Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, P/B 5, PO Wembley, WA 6913 Australia

Shaw, R.H. CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, United Kingdom

Sheppard, A.W. Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia

Shivas, R.G. Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia

Shrestha, B.B. Tribhuvan University, Central Deptartment of Botany, Kirtipur, PO Box 5275, Kathmandu, Nepal

Sing, S.E. United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, 1648 South 7th Avenue – MSU Campus, Bozeman, MT 59717-2780 USA.

Sohn, J.C. University of Maryland, Department of Entomology, College Park, MD 20742 USA

Strathie, L.W. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag 6006, Hilton 3245 South Africa

Szűcs, M. Colorado State University, Department of Bioagricultural Sciences and Pest Management, 1177 Campus Mail, Fort Collins, CO 80523 USA

TeBeest, D.O. University of Arkansas, Plant Sciences Building 210 , 495 N. Campus Drive, Fayetteville, AR 72701 USA

Tipping, P.W. United States Department of Agriculture, Agricultural Research Service, Invasive Plant Research Laboratory, 3225 College Ave. Fort Lauderdale, FL 33314 USA

Tosevski, I. CABI, Rue des Grillons 1, CH-2800 Delémont, Switzerland

Turner, S.C. Ministry of Forests, Lands and Natural Resource Operations, Provincial Range Operations - Kamloops, 441 Columbia Street, Kamloops, BC V2C 2T3

Tzean, S.S. Taiwan National University, Department of Plant Pathology and Microbiology, No.1, Sec.4, Roosevelt Road, Taipei 106, Taiwan, ROC

Urban, A.J. (Retired) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa

van Harten, A. (Retired) Vaiamonte, Portugal

van Klinken, R.D. Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, 41 Boggo Road, Dutton Park, QLD 4102, Australia

van Valkenburg, J. National Reference Centre, National Plant Protection Organization, Geertjesweg 15, 6708 EA Wageningen, The Netherlands

Vargo, D. American Samoa Community College, Community and Natural Resources, P.O. Box 5319, Pago Pago, American Samoa 96799-5319

Vassiliou, V.A. Agricultural Research Institute, Plant Protection Section, P.O. Box 22016, 1516 Nicosia, Cyprus

Villegas, B. Formerly California Department of Food and Agriculture; currently 7556 Hickory Avenue, Orangevale, CA 95662 USA

Volkovitch, M.G. Russian Academy of Sciences, Laboratory of Insect Taxonomy, Zoological Institute, Universitetskaya nab. 1, 199034 St. Petersburg, Russia

Watson, A.K. McGill University, 21,111 Lakeshore Rd., Ste-Anne-de-Bellevue, Québec, Canada H9X 3V9

Weaver, D.K. Montana State University, Department of Land Resources & Environmental Sciences, 334 Leon Johnson Hall, Bozeman, MT 59717-3120 USA

Weiss, J. La Trobe University, Department of Environment and Primary Industries, CRC for Plant Biosecurity, AgriBio, Centre for AgriBioscience, 5 Ring Road, Bundoora, Vic, 3083 Australia

Wilson, D. University of Ghana, Department of Animal Biology & Conservation Sciences, P.O. Box LG 67, Legon-ACCRA, Ghana

Windham, M.T. University of Tennessee, Entomology and Plant Pathology Department, 2505 E. J. Chapman Drive, 138 Biotechnology Bldg., Knoxville, TN 37996-4560 USA

Winotai, A. Biological Control Research Group, Plant Protection Research and Development Office, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand

Witt, A. CABI, ICRAF Complex, United Nations Avenue, Gigiri, P.O. Box 633-00621, Nairobi, Kenya

Wood, A.R. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7600 South Africa

Zachariades, C. Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag 6006, Hilton 3245 South Africa

Zhou, Z.S. Chinese Academy of Agricultural Sciences, Institute of Plant Protection, Biological Invasion Department, Beijing, China

Zimmermann, H.G. Helmuth Zimmermann & Associates, P.O. Box 974, Faerie Glen 0043, South Africa

CONTACT THE EDITORS

This edition of the catalogue documents biological control work conducted through December 31, 2012. A more updated version of this dataset has been created in electronic format with cooperation between the U.S. Forest Service, University of Georgia, University of Idaho, and MIA Consulting. It can be accessed at **www.ibiocontrol.org/catalog/**. Its purpose is to present an expanded biological control dataset in a freely accessible, searchable format.

The integrity of the information presented in this printed edition and included in the electronic database relies greatly on past, current, and continued assistance from researchers worldwide. Please notify us of omissions, inaccurate information, or updates to any and all weed biological control systems. All edits and updates can be sent to:

Rachel L. Winston
rachel@getmia.net

For additional copies of this printed catalogue, please contact:

Mark Schwarzländer
University of Idaho
PSES Department
Moscow, ID 83844
208.885.9319
markschw@uidaho.edu

Richard Reardon
U.S. Forest Service
180 Canfield Street
Morgantown, WV 26505
304.285.1566
rreardon@fs.fed.us

INTRODUCTION

This Fifth Edition of the catalogue includes all previously catalogued releases with updated information and updated references where applicable. It also includes information on releases made since the previous edition was collated, that is, releases made after 1996 until the end of 2012. Releases overlooked in previous editions which occurred prior to 1996 have also been added.

The original catalogue (published in 1982) recorded 499 releases of exotic agents between the late 19th century and 1980. The Second Edition (published in 1987) recorded 100 new releases in the 5 year period to the end of 1985. The Third Edition (published in 1992) recorded 130 new releases in the 5 year period to the end of 1990. The Fourth Edition (published in 1998) recorded 220 new releases during the 6 years since the Third Edition. This Fifth Edition records 319 new releases during the 16 years since the Fourth Edition.

The 2,042 entries in this Fifth Edition span 130 countries and 551 biocontrol agents targeting 224 weeds (when groups such as *Opuntia* spp. are counted as a single target weed). The most active countries continue to be the USA, Australia, Canada, South Africa and New Zealand. The Fourth Edition highlighted the absence of weedy grass species as targets for biological control. Since that time, *Poa annua* L. has been targeted by a registered bioherbicide in Japan, *Arundo donax* L. has been targeted for classical biocontrol on the border of the USA and Mexico, and two *Spartina* spp. have been targeted in the USA with native agents.

New to this Edition

Previous editions of this catalogue contained four distinct sections, referred to as four different “Lists”. This Fifth Edition of the catalogue replaces “List” with “Table”. Vertebrate weed biological control is omitted in this version, but added is a dedicated section on bioherbicides (Table 4).

The dataset has been greatly expanded in this edition, with additional information added to each entry of all tables. All information is presented with more detail and with increased separation compared to previous editions, making specific content easier to locate within table entries.

In the interest of space, not all additional information could be included in this print version. In particular, the majority of release/redistribution history and establishment information that was collected at the sub-country level (e.g. state, province, island) is omitted. The complete dataset has been maintained, however, and is publicly available in an online, searchable format accessible at: **www.ibiocontrol.org/catalog/**.

In this Catalogue:

Table 1

Table 1 lists **exotic organisms** that have been **intentionally introduced** and released for the biological control of their target weeds. The numerous organisms that have been studied, and in many cases introduced into quarantine facilities in exotic countries, but were not released, are not included in this catalogue. Organisms that were introduced accidentally or illegally into a country prior to their official approval and subsequent redistribution are not listed in this section but are included in Table 3.

Table 2

Table 2 lists **native organisms** utilized within their native ranges to control weeds. Only those organisms that have been **intentionally redistributed** are included in this catalogue.

Table 3

Far too many exotic organisms have been found adventively attacking weeds within the introduced range for all to be listed in this catalogue. Table 3, therefore, includes only those exotic organisms that are currently utilized and/or are of particular interest to weed biological control practitioners. This table typically includes **exotic organisms** which have been released as biological control agents and **now occur in countries other than those into which they were released**. In other words, they were accidentally or illegally moved, or they spread naturally to another country. This table also includes organisms which are found in exotic ranges where they were not deliberately released but have since been intentionally redistributed or are of interest to researchers or practitioners to potentially be approved for future use. It should be noted that even when an organism on this table has been intentionally redistributed, this redistribution could have been done illegally and further inquiry should be made before extending the practice.

Table 4

Table 4 deals solely in **bioherbicides**. The term "bioherbicide" is applied to various types of biologically based herbicides. In this catalogue, bioherbicide refers to a pathogen that is utilized in a manner akin to a chemical herbicide application—namely in a deliberate, prescriptive, intensively managed, and relatively large-scale application where the pathogen of interest is the active ingredient of a standardized product. Bioherbicide research is an active field that has tested an extensive number of pathogens and formulations. Included in this catalogue are only those that have been or currently are formally registered, as well as those that are approved for public use without registration. When utilizing bioherbicides for weed control, it is important to always follow the label or official guidelines for properly applying the organism and to only use the product in the manner for which it was designed.

Table Structure

An explanation of the sections and headings are given below. There are differences in the structure and information included in each table; consequently, separate explanations are provided at the start of each section. Weed and agent taxonomy, research organizations, and the use of references are similar for all tables.

Weed Taxonomy

In Tables 1-3, the target weeds are listed alphabetically in green shaded boxes under their respective plant family names which are also listed alphabetically. In Table 4, entries are first listed alphabetically according to the name of the biological control agent. Table 4 entries are then secondarily listed alphabetically by target weed name. The country or region of origin of the weed is included in all four tables. Every effort was made to utilize the most updated and accurate taxonomy for each weed species. This was accomplished with help from numerous taxonomists as well as worldwide and regional Floras. Many weeds have been previously associated with several different names. In this catalogue, we include only those past names that appear in the literature cited for this catalogue. Past names known to have been misidentifications or misspellings are included under the heading "Incorrect Past Names/Synonyms". All past names are included in the index, with appropriate referencing to the currently accepted name used in the tables. Common names listed in the literature cited for this catalogue are included in the table entries for each weed. When more than 10 common names appear in the literature, only the most frequently encountered are included in this catalogue.

Agent Taxonomy

In Tables 1-3, biological control agents are listed alphabetically in tan shaded boxes following their target weed. Table 4 entries are listed first alphabetically by agent and secondarily by target weed. In all tables, class and order are included for fungi, while order and family are included for insects, mites, and nematodes. Every effort was made to utilize the most updated and accurate taxonomy for each species. This was accomplished with help from numerous taxonomists, references, and taxonomic databases. Many agents have been previously associated with several different names. In this catalogue, we include only those past names that appear in the literature cited for this catalogue. Past names known to have been misidentifications or misspellings are included under the heading “Incorrect Past Names/ Synonyms”. All past names are included in the index, with appropriate referencing to the currently accepted name used in the tables.

Research Organizations

Abbreviations/acronyms for the research entities involved with the releases are given when known. A list of the acronyms and the full organization names is provided following Table 4. Please note that many organization names have since changed; the new names are added whenever these changes are known. Research organization abbreviations in the tables that are followed by an asterisk no longer exist.

References

All references utilized in the catalogue are referred to by numbers. The numbered references are listed numerically following the “Research Organizations” section. The reference list is not exhaustive for the biological control of a particular weed species. It is limited to only those references that provided the information included in the catalogue. Where published references were not available for information cited, the name of the expert who provided the information via a personal communication is included, along with their current address. Some information stated in previous editions of this catalogue was gleaned from very old personal communications. All attempts were made during this revision to use new and/or published references to update this information. Where this was not possible, personal communications from previous editions of the catalogue are retained and cited, using the old dates and contact information provided at the time. In the interest of space, references utilized solely for weed and agent taxonomy, weed common names and origin are not included, unless the accepted name of the weed or agent has changed since the last version of this catalogue.

TABLE 1. EXOTIC ORGANISMS INTENTIONALLY INTRODUCED

Release Information

Releases are listed alphabetically according to the country of release and are accompanied by the year the first field release was made. Some species have been released in the same country multiple times. When subsequent releases originated from different sources, were separated by five years or more, or were successfully established following the failure of the original release(s), then these subsequent releases are given their own entries. In those cases, sequential entries are listed numerically by the release year. The original source of release material is preceded by "Ex." When the release material was not obtained directly from its native range, the countries or regions from where it was obtained are given, preceded by "via". For example: "Australia; Ex. Argentina via USA via India" means that the species that was released in Australia originated in Argentina (probably its native range) from where it was sent to the USA. Thereafter a colony was sent to India, and Australia obtained material from India.

Current Status

The establishment status of each species is given when known. The current abundance and impact of established agents are then stated using key choices pre-determined for the ease of quick data summary. Agent abundance is represented by seven categories: Rare, Limited, Moderate, High, Variable, Too early post release, and Unknown. Agent impact is represented by eight categories: None, Slight, Medium, Heavy, Variable, Too early post release, Unknown, and Compromised (the latter for sites destroyed post release). In order to place the agent impact into a geographical context, the scale of impact is also provided. The four categories for scale of impact include: Localized, Regional, Widespread throughout range, and Unknown. Because the choices selected for abundance, impact, and scale of impact are subjective estimates by the editors, an additional notes section is provided which includes a brief summary of the status for each release system. Abbreviations used in the notes section to denote sub-regions of a country are provided along with their corresponding regions at the front of this catalogue immediately following the Table of Contents. If the biocontrol agent has been observed in the field attacking plant species other than those targeted for control, this information is included. Likewise, factors believed to limit the efficacy of any particular release are listed when known.

TABLE 1

AMARANTHACEAE

WEED	
Family	Amaranthaceae
Species	*Alternanthera philoxeroides* (Mart.) Griseb.
Notes	Can grow as a terrestrial and aquatic plant. Terrestrial form produces solid stems; aquatic form produces buoyant hollow stems.
Origin	South America
Common Name	alligator weed, alligatorweed

AGENT	
Species	*Agasicles hygrophila* Selman & Vogt
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1977
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Successful control of floating mats within 2 years of release. No effect in terrestrial habitat.
Limiting Factors	Habitat
Research Organization	CSIRO
References	934, 942

AMARANTHACEAE
Alternanthera philoxeroides; Agasicles hygrophila *(continued)*

RELEASE	
Country	New Zealand
Year	1982
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Variable
Notes	Can destroy large amounts of foliage annually, which suppresses weed. In other locations, weed mat regrows in spring. Efficacy restricted by low temperatures and flooding. Not able to attack terrestrial infestations.
Limiting Factors	Climate; Habitat
Research Organization	DSIR
References	720, 761, 1064, 1493, 1575, 1576, 1725

RELEASE	
Country	People's Republic of China
Year	1986
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Provides good control of aquatic infestations in rivers, ponds and lakes; causes heavy damage to terrestrial plants growing nearby but does not provide control. Cannot overwinter in cooler areas, but inoculative releases after winter provide significant control.
Limiting Factors	Climate
Research Organization	CAAS-BCI
References	350, 418, 920, 1095, 1119, 1935, 2063

AMARANTHACEAE
Alternanthera philoxeroides; Agasicles hygrophila *(continued)*

RELEASE	
Country	Puerto Rico
Year	1997
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Weed has been successfully controlled by this agent at original two release sites and replaced by *Lemna* sp. and *Eichhornia crassipes*.
Research Organization	USAE, UPR
References	2, 237, 1528

RELEASE	
Country	Thailand
Year	1981
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Firmly established throughout range of weed. Substantial control seasonally.
Limiting Factors	Season
Research Organization	NBCRC
References	934, 942, 1326, 1328, 1939

RELEASE	
Country	United States of America
Year	1964
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

AMARANTHACEAE
Alternanthera philoxeroides; Agasicles hygrophila *(continued)*

Country	United States of America (continued)
Notes	Abundance varies by season; populations decline during summer due to reduced fecundity associated with high temperature. Impact variable. Highly successful in FL and warmer, coastal areas where the insects can overwinter, variable elsewhere. Not effective against terrestrial form. No evidence insects released later from the southernmost part of the native range performed better than these populations established since 1964.
Limiting Factors	Climate
Research Organization	USDA (3,5,7,13)
References	195, 196, 197, 350, 1578, 1719

RELEASE	
Country	United States of America
Year	1964
Source	Ex. Uruguay
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Not differentiated from Argentina population. Abundance varies by season; populations decline during summer due to reduced fecundity associated with high temperature. Impact variable. Highly successful in FL and warmer, coastal areas where the insects can overwinter, variable elsewhere. Not effective against terrestrial form. No evidence insects released later from the southernmost part of the native range performed better than these populations established since 1964.

(continued on next page)

AMARANTHACEAE
Alternanthera philoxeroides; Agasicles hygrophila *(continued)*

Country	United States of America (continued)
Research Organization	USDA (3,5,7,13)
References	195, 196, 197, 350, 1719

RELEASE

Country	United States of America
Year	1979
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Released in attempt to increase cold tolerance. No evidence these insects from the southernmost part of the native range performed better than populations established since 1964. Abundance varies by season; populations decline during summer due to reduced fecundity associated with high temperature. Impact variable. Highly successful in FL and warmer, coastal areas where the insects can overwinter, variable elsewhere. Not effective against terrestrial form.
Limiting Factors	Climate
Research Organization	USDA (3,5,7,13)
References	195, 196, 197, 199, 1719

AMARANTHACEAE
Alternanthera philoxeroides *(continued)*

AGENT

Species	*Amynothrips andersoni* O'Neill
Classification	(Thysanoptera: Phlaeothripidae)

RELEASE

Country	United States of America
Year	1967
Source	Ex. Argentina
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Damage usually light, causing some leaf deformation. Least widespread of species released in USA but most cold tolerant; only species to impact terrestrial form. Predation limits some populations.
Limiting Factors	Predation
Research Organization	USDA (3,5,7,13)
References	195, 197, 303, 350, 1578, 1921

AMARANTHACEAE
Alternanthera philoxeroides (continued)

AGENT

Species	*Arcola malloi* (Pastrana)
Past Names/Synonyms	*Vogtia malloi* Pastrana
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Australia
Year	1977
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Effects masked by *Agasicles hygrophila* damage in aquatic infestations. Effective in small semi-aquatic habitats not destroyed by *A. hygrophila*. Present but not effective in terrestrial situations.
Limiting Factors	Habitat
Research Organization	CSIRO
References	934, 939, 942

RELEASE

Country	New Zealand
Year	1984
Source	Ex. Argentina via USA (FL) via Australia
Established	No
Notes	Establishment failure likely influenced by microsporidia infection.
Limiting Factors	Disease
Research Organization	DSIR
References	1493, 1575

AMARANTHACEAE
Alternanthera philoxeroides; Arcola malloi (continued)

RELEASE

Country	New Zealand
Year	1987
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Moderate
General Impact	Variable
Notes	Large populations aid in successful control in some lakes and ponds. Not as abundant as *Agasicles hygrophila*. Can establish on edge of terrestrial infestations but still does not control these populations. Efficacy limited by low temperatures and flooding.
Limiting Factors	Climate; Habitat
Research Organization	DSIR
References	720, 1064, 1493, 1575, 1725

RELEASE

Country	United States of America
Year	1971
Source	Ex. Argentina
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Larval burrowing causes stem collapse and waterlogging. Useful adjunct to (but not as good a competitor as) *Agasicles hygrophila*, but individual effects difficult to parse out. Contributes effectively to control in MS and FL, and in TX when not limited by adverse conditions. Excellent dispersal ability with annual spread of up to 1,000 km; likely overwinters in warmer areas and migrates to inland infestations. Most effective against floating plant mats.

(continued on next page)

TABLE 1

AMARANTHACEAE
Alternanthera philoxeroides; Arcola malloi *(continued)*

Country	United States of America (continued)
Other Species Attacked	Collected from the native *Philoxerus vermicularis* (L.) Sm. whose name has since been changed to *Blutaparon vermiculare* (L.) Mears
Research Organization	USDA (3,5,7,13)
References	195, 196, 197, 231, 303, 350, 1921

AGENT

Species	*Disonycha argentinensis* Jacoby
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1980
Source	Ex. Brazil (south eastern)
Established	No
Research Organization	CSIRO
References	942, 943

RELEASE

Country	New Zealand
Year	1982
Source	Ex. Brazil (southern) via Australia
Established	No
Notes	Establishment failure likely due to lack of warm temperatures at release sites in New Zealand.
Limiting Factors	Climate
Research Organization	DSIR
References	720, 1575, 1576, 1725

ANACARDIACEAE

WEED

Family	Anacardiaceae
Species	*Schinus terebinthifolius* Raddi
Origin	South America
Common Name	christmas berry, Brazilian pepper tree, Brazilian holly, wilelaiki, Florida holly

AGENT

Species	*Crasimorpha infuscata* Hodges
Classification	(Lepidoptera: Gelechiidae)

RELEASE

Country	Hawaii USA
Year	1961
Source	Ex. Brazil
Established	No
Research Organization	HDOA
References	407, 635, 796, 1022, 1024, 1035

AGENT

Species	*Episimus unguiculus* Clarke
Past Names/Synonyms	*Episimus utilis* Zimmerman, *Episimus* sp.
Classification	(Lepidoptera: Tortricidae)
References	326, 1552

RELEASE

Country	Hawaii USA
Year	1954
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	None

(continued on next page)

ANACARDIACEAE
Schinus terebinthifolius; Episimus unguiculus *(continued)*

Country	Hawaii USA (continued)
Notes	Though widespread and well established, impact negligible.
Limiting Factors	Parasitism
Research Organization	HDOA
References	326, 373, 398, 635, 762, 796, 1024, 1951, 2068

AGENT

Species	*Lithraeus atronotatus* (Pic)
Past Names/Synonyms	*Bruchus atronotatus* Pic, *Acanthoscelides atronotatus* (Pic)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Hawaii USA
Year	1960
Source	Ex. Brazil
Established	Yes
Abundance	Limited
General Impact	None
Notes	Though well established initially, control only partial on KA, OA and HA. Subsequently believed to have been displaced for most part by accidentally introduced *Megastigmus transvaalensis*.
Limiting Factors	Interspecific competition
Research Organization	HDOA
References	44, 326, 400, 762, 796, 1022, 1024, 1035, 1964

APOCYNACEAE

TABLE 1

WEED

Family	Apocynaceae
Species	*Cryptostegia grandiflora* R. Br.
Origin	Madagascar
Common Name	rubber vine

AGENT

Species	*Euclasta whalleyi* Popescu-Gorj & Constantinescu
Incorrect Past Names/Synonyms	*Euclasta gigantalis* Viette
Classification	(Lepidoptera: Crambidae)
References	1218, 1251, 1425

RELEASE

Country	Australia
Year	1988
Source	Ex. Madagascar
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Not recovered until four years after releases ceased. Initially caused total defoliation during localized outbreaks, but more recently impacts considered minimal.
Other Species Attacked	Minor spillover attack occurs on the native *Gymnanthera oblonga* (Burm. F.) P.S. Green, only when it is growing in close association with *Cryptostegia grandiflora* R. Br. plants.
Research Organization	QLD State
References	1218, 1227, 1251, 1418, 1425, 1916

APOCYNACEAE
Cryptostegia grandiflora *(continued)*

TABLE 1

AGENT

Species	*Maravalia cryptostegiae* (Cummins) Ono
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Australia
Year	1993
Source	Ex. Madagascar
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Strain IMI 331455, isolated from *Cryptostegia madagascariensis*. Established initially though did not cause severe symptoms on the weed. Due to difficulty in distinguishing from second strain which did establish, currently unknown if this first strain is established as well. If established, impact likely negligible.
Limiting Factors	Climate; Specificity
Research Organization	IIBC, QLD State
References	556, 1413, 1425

APOCYNACEAE
Cryptostegia grandiflora; Maravalia cryptostegiae *(continued)*

RELEASE

Country	Australia
Year	1995
Source	Ex. Madagascar
Established	Yes
Abundance	High
General Impact	Variable
Notes	Strain IMI 366461, isolated from *Cryptostegia grandiflora*. Established rapidly and significant damage observed 20 months after release in both wet and drier areas. Rust activity highest in wet regions where weed populations decreasing significantly due to reduction of seed bank and seedling recruitment. At drier sites sub-optimal for the rust, weed continues to spread.
Limiting Factors	Climate
Research Organization	IIBC, QLD State
References	556, 1425, 1814, 1815

ARACEAE

WEED

Family	Araceae
Species	*Pistia stratiotes* L.
Origin	tropical Americas, Asia, Malesia, Australia (NT)
Common Name	water lettuce, Nile cabbage, chok, jawg

AGENT

Species	*Neohydronomus affinis* Hustache
Incorrect Past Names/Synonyms	*Neohydronomus pulchellus* Hustache
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1982
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Successful control in northern QLD. Southern QLD *Pistia stratiotes* populations fluctuate widely and are less conducive to maintaining high populations of *Neohydronomus affinis*. Agent reintroduced often from other populations in state.
Limiting Factors	Land use; Climate
Research Organization	CSIRO
References	417, 716, 718

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE

Country	Benin
Year	1995
Source	Ex. Brazil via Australia via Zimbabwe
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Spread rapidly throughout country. Total plant biomass and weed cover declined ten-fold. After 3 to 4 years, *Pistia stratiotes* had disappeared almost completely from many sites.
Research Organization	IITA, GTZ
References	16, 505, 1346, 1347

RELEASE

Country	Botswana
Year	1987
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Weed was not a serious problem in Botswana but agent introduced as preventative measure to reduce risk of spread within the country. Very effective in stopping spread of weed, eradicating infestations at release locations and keeping other infestations under control.
Research Organization	DWAB, CSIRO
References	113, 578, 1040, 1041

TABLE 1

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	Cote d'Ivoire
Year	1998
Source	Ex. Brazil via Australia via Zimbabwe via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Deliberately released in 1998, though found to already be present in some regions likely as a result of natural spread from Ghana. Populations subsequently not differentiated. Less than two years post release, *Neohydronomus affinis* had controlled over 90% of the weed at the six major infestations that were inspected.
Research Organization	IITA
References	939, 1347

RELEASE	
Country	Ghana
Year	1996
Source	Ex. Brazil via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Complete control of *Pistia stratiotes* occurred within a year although the effect may not be solely attributed to the introduction of *Neohydronomus affinis*.
Research Organization	EPA
References	22, 297, 448, 449, 450, 1347

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	Kenya
Year	1999
Source	Ex. Brazil via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	At time of release, dam receiving agents completely filled with the weed. Project considered successful as no further infestations of *Pistia stratiotes* reported after late 1999. Establishment not verified in recent times due to assumed control success.
Research Organization	KARI, KENGEN, ARC-PPRI
References	279, 297, 505, 630, 894, 1347

RELEASE	
Country	Nigeria
Year	1997
Source	Ex. Brazil via Australia via Zimbabwe via Benin
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Unknown
Notes	Intentionally introduced from Benin in 1997; additional populations from Benin also spread naturally across the western border of Nigeria. Though formal evaluation lacking, mats observed with heavy infestations.
Research Organization	IITA
References	14, 16, 505, 1347, 1382

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	Papua New Guinea
Year	1985
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Very good control in the Sepik River systems, variable control in other lakes and ponds. Seasonal flooding may limit population in some areas.
Limiting Factors	Flooding
Research Organization	PNGDAL, CSIRO
References	718, 1078, 1347, 1401

RELEASE	
Country	Puerto Rico
Year	1998
Source	Ex. Brazil via Australia via USA (FL)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	USAE, UPR
References	2, 237

RELEASE	
Country	Republic of Congo
Year	1999
Source	Ex. Brazil via Australia via Zimbabwe
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional

(continued at top of next column)

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

Country	Republic of Congo (continued)
Notes	By 2003, no water lettuce could be found in release area in the Cuvette and coverage on lakes in south had diminished considerably. Because of weevil's mobility, the releases in the Congo (Brazzaville) may spread to infestations in the Democratic Republic of Congo.
Research Organization	IITA, PPRIZ, MFE
References	1177, 1347

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Well established at various sites and considered complete success in South Africa. Rapidly successful in dams and large perennial rivers. In eutrophic waters, still successful though full control takes more time. Results poorer when released on fast flowing rivers and in areas subject to alternate wet and dry regimes or frosting. In these areas chemical control and continuous inundative releases still required.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	270, 274, 281, 297, 417, 522, 800, 992, 1253

TABLE 1

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	République Togolaise
Year	2001
Source	Ex. Brazil via Australia via Republic of South Africa via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	UGL
References	21, 297, 1347, 1987

RELEASE	
Country	Senegal
Year	1994
Source	Ex. Brazil via Australia via Zimbabwe via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Populations sourced from Benin were laboratory colonies as this species had not yet been field released in Benin at the time of release in Senegal. Very effective. Water bodies cleared of water lettuce within 8 months of release. At water body 150 km away where no release occurred, control achieved within 18 months of original release.
Research Organization	IITA, GTZ
References	505, 1346, 1347

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	Senegal
Year	2005
Source	Ex. Brazil via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Weed reappeared in 2005, but controlled completely within the year following new releases.
Research Organization	ARC-PPRI, DPV
References	297, 505, 1347

RELEASE	
Country	United States of America
Year	1987
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Weed eliminated from three of four original release sites in FL within 18-30 months of release, but establishment and control not universal. Disperses well naturally.
Research Organization	USAE, USDA (3,4,13), State (3,18,19)
References	235, 238, 335, 522, 523, 684, 1347

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	Vanuatu
Year	2006
Source	Ex. Brazil via Australia via Papua New Guinea
Established	Yes
Abundance	High
General Impact	Variable
Notes	Populations still increasing post release. Effective control thus far in full sunlight but lacking in shady areas.
Limiting Factors	Habitat
Research Organization	SPC, DLQS
References	418, 718, 1347, 1401, 1402, 1940

RELEASE	
Country	Zambia
Year	1991
Source	Ex. Brazil via Australia via Zimbabwe
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	At the time of this release, the weevil was found to be already present. Both populations subsequently not differentiated in the literature. Providing excellent control in the region of release.
Research Organization	PPRIZ
References	255, 1314, 1347, 1587

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

RELEASE	
Country	Zimbabwe
Year	1988
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Successful control within 16 months such that *Pistia stratiotes* no longer considered problematic in Zimbabwe. Reduced infestation by 80% or more at all release sites and spread up to 9 km.
Research Organization	PPRIZ, CSIRO
References	255, 257, 261, 417, 418, 1347

RELEASE	
Country	Zimbabwe
Year	1998
Source	Ex. Brazil via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	In 1998, new infestations appeared in eastern part of country and *Neohydronomus affinis* was released again from a population sourced in South Africa. Release immediately resulted in control; *Pistia stratiotes* no longer considered problematic in Zimbabwe.
Research Organization	PPRIZ, ARC-PPRI
References	418, 800, 1347

TABLE 1

TABLE 1

ARACEAE
Pistia stratiotes *(continued)*

AGENT	
Species	*Spodoptera pectinicornis* (Hampson)
Past Names/Synonyms	*Namangana pectinicornis* (Hampson), *Epipsammea pectinicornis* (Hampson)
Incorrect Past Names/Synonyms	*Epipsammia pectinicornis*, *Episammia pectinicornis* (Hampson)
Classification	(Lepidoptera: Noctuidae)

RELEASE	
Country	United States of America
Year	1990
Source	Ex. Thailand
Established	No
Notes	Initially believed to have established following multiple and varying release attempts; populations have since dwindled and are no longer detectable.
Research Organization	USAE, USDA (4), State (3), NBCRC
References	235, 417, 521, 523, 680, 1347

ASPARAGACEAE

WEED	
Family	Asparagaceae
Species	*Asparagus asparagoides* (L.) Druce
Origin	southern Africa
Common Name	bridal creeper, smilax

AGENT	
Species	*Crioceris* sp. undescribed
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	2002
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established at just one site in SA and two in WA. Ineffective agent, likely due in part to predation.
Limiting Factors	Possibly Predation and Parasitism
Research Organization	CSIRO
References	1261, 1267, 1269

TABLE 1

ASPARAGACEAE
Asparagus asparagoides *(continued)*

AGENT	
Species	*Puccinia myrsiphylli* (Thüm.) Wint.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Australia
Year	2000
Source	Ex. Republic of South Africa
Established	Yes
Abundance	High
General Impact	Variable
Notes	Provides substantial reduction of biomass and shoot production in wet conditions; effects increased over sequential years and in combination with undescribed leafhopper. Impact minimal in dry inland infestations. Helping to suppress the weed on Flinders Island, TAS; impact on mainland TAS unknown.
Limiting Factors	Climate
Research Organization	CSIRO
References	883, 886, 1261, 1267, 1269

ASPARAGACEAE
Asparagus asparagoides *(continued)*

AGENT	
Species	Tribe Erythroneurini undescribed
Incorrect Past Names/Synonyms	*Zygina* sp.
Classification	(Hemiptera: Cicadellidae)
Notes	Undescribed genus of Erythroneurini leafhopper. There are no plans to describe and name this insect.

RELEASE	
Country	Australia
Year	1999
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Has caused significant damage in some years and at some sites, but populations fluctuate widely, likely a result of parasitism. Impacts can be greater in combination with rust, but may also (when at high densities) regulate the weed alone in drier inland areas less conductive for the rust.
Limiting Factors	Parasitism; Possibly Climate
Research Organization	CSIRO
References	883, 886, 921, 1261, 1267, 1269

TABLE 1

ASTERACEAE

WEED

Family	Asteraceae
Species	*Ageratina adenophora* (Spreng.) R. M. King & H. Rob.
Past Names/Synonyms	*Eupatorium adenophorum* Spreng., *Eupatorium glandulosum* Michx.
Origin	Mexico
Common Name	crofton weed, Mexican devil weed, Maui pamakani, pamakani, banmara

AGENT

Species	*Oidaematophorus beneficus* Yano & Heppner
Classification	(Lepidoptera: Pterophoridae)

RELEASE

Country	Hawaii USA
Year	1973
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Weed now confined mostly to wet rocky cliffs, and riparian areas on MA and OA, though not clear if biocontrol alone can be credited. This agent introduced originally for the control of *Ageratina riparia* so impact likely slight to none on *A. adenophora*. On *A. riparia*, most effective above 2,000 ft.
Research Organization	HDOA
References	322, 325, 413, 762, 1325, 1824

ASTERACEAE
Ageratina adenophora *(continued)*

AGENT

Species	*Passalora ageratinae* Crous & A.R. Wood
Past Names/Synonyms	*Phaeoramularia* sp.
Incorrect Past Names/Synonyms	*Cercospora eupatorii* Peck, *Phaeoramularia eupatorii-odorati* (Yen) Liu & Guo
Classification	(Dothideomycetes: Capnodiales)
References	362, 987

RELEASE

Country	Republic of South Africa
Year	1987
Source	Ex. Unknown via Hawaii USA via Australia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	In NWP up to 95% of plants infected; however, infection severity is low with <50% of leaves on individual stems infected. No evaluation of impact in KZN, MP, WC. Observed that weed is not as aggressive an invader as expected in the bioclimatically ideal KZN interior. Neither the fly nor pathogen, individually or in combination, significantly affects vegetative growth of the weed. Additional introductions warranted.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	190, 791, 992, 995, 1281, 1307, 2006

ASTERACEAE
Ageratina adenophora *(continued)*

AGENT	
Species	*Procecidochares utilis* Stone
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Australia
Year	1952
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established readily and spread rapidly with initially high impacts. Populations have since decreased to ineffective levels. Though still widespread, agent numbers are kept in check by high levels of parasitism.
Limiting Factors	Parasitism
Research Organization	QLD State
References	513, 1223, 1307, 1989

RELEASE	
Country	Hawaii USA
Year	1945
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

ASTERACEAE
Ageratina adenophora; Procecidochares utilis *(continued)*

Country	Hawaii USA (continued)
Notes	Control substantial to complete throughout MA, partial on OA, low on MO. Weed now confined mostly to wet rocky cliffs, and riparian areas on MA and OA. Parasitism and predation impact efficacy but vary by climate. Control high in areas of low moisture, moderate in areas of intermediate moisture, lower in areas of high moisture.
Limiting Factors	Parasitism; Predation; Climate
Research Organization	HDOA
References	111, 112, 325, 512, 612, 635, 762, 1452

RELEASE	
Country	India
Year	1963
Source	Ex. Mexico via Hawaii USA via Australia via New Zealand
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes some reduction in vigor, growth, and density of the plant; however, heavy parasitism has reduced efficacy.
Limiting Factors	Parasitism
Research Organization	IIBC
References	965, 1307, 1548, 1607

TABLE 1

TABLE 1

ASTERACEAE
Ageratina adenophora; Procecidochares utilis *(continued)*

RELEASE

Country	New Zealand
Year	1958
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established readily and spread rapidly with initially high impacts. Populations have since decreased, due at least in part to parasitism. No formal impact evaluation occurred so it is uncertain if subsequent decrease in weed was due entirely to impact from the fly and fungus or changes in land management. Most effective under dry conditions.
Limiting Factors	Parasitism; Climate
Research Organization	DSIR
References	807, 857, 1307

RELEASE

Country	Republic of South Africa
Year	1984
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	30% of stems are galled and 10% exhibit repeated galling. May reduce reproductive potential of the plant. Populations limited by parasitism and phenological asynchrony with the weed. Neither the fly nor pathogen, individually or in combination, significantly affects vegetative growth of the weed.

(continued at top of next column)

ASTERACEAE
Ageratina adenophora; Procecidochares utilis *(continued)*

Country	Republic of South Africa (continued)
Limiting Factors	Parasitism; Agent-host synchronization
Research Organization	ARC-PPRI
References	190, 788, 791, 992, 995, 1307

RELEASE

Country	Thailand
Year	1991
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Though initially believed to have failed establishment, has since been observed in northern Thailand. Though abundance is high in this region, impact is limited.
Research Organization	NBCRC
References	1329, 1997

AGENT

Species	*Xanthaciura connexionis* Benjamin
Classification	(Diptera: Tephritidae)

RELEASE

Country	Hawaii USA
Year	1955
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	325, 1951

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Ageratina riparia* (Regel) R. M. King & H. Rob.
Past Names/Synonyms	*Eupatorium riparium* Regel
Origin	Mexico
Common Name	mistflower, Hamakua pamakani, creeping crofton weed
AGENT	
Species	*Entyloma ageratinae* Barreto & Evans
Incorrect Past Names/Synonyms	*Cercosporella ageratina*, *Cercosporella* sp., *Entyloma compositarum* Farlow, *Entyloma compositarum* f.sp. *ageratinae*
Classification	(Exobasidiomycetes: Entylomatales)

RELEASE	
Country	Hawaii USA
Year	1975
Source	Ex. Jamaica
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	In combination with *Procecidochares alani* and *Oidaematophorus beneficus* provides substantial to complete control throughout the island of HA. *Ageratina riparia* not an important pasture pest on other islands. Agent does well in areas with high rainfall and favorable temperatures.
Limiting Factors	Climate
Research Organization	State (52), HDOA
References	325, 413, 598, 1047, 1324, 1824, 1826

ASTERACEAE
Ageratina riparia; Entyloma ageratinae (continued)

RELEASE	
Country	New Zealand
Year	1998
Source	Ex. Jamaica via Hawaii USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Spread rapidly and unaided throughout North Island infestations. Reduced percentage cover of weed dramatically at all study sites within 4-5 years of release, corresponding with increase in native plants.
Research Organization	MWLR
References	85, 413, 587, 598, 761, 1061, 1064

RELEASE	
Country	Republic of South Africa
Year	1989
Source	Ex. Jamaica via Hawaii USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Though not formally evaluated since establishment in 1990, by 2009 *Ageratina riparia* rarely observed in the field, and *Entyloma ageratinae* noted to be present over most of weed's range, providing circumstantial evidence the weed has been brought under biological control by this fungus.
Research Organization	ARC-PPRI
References	413, 791, 992, 1281, 2006

TABLE 1

ASTERACEAE
Ageratina riparia *(continued)*

AGENT	
Species	*Oidaematophorus beneficus* Yano & Heppner
Classification	(Lepidoptera: Pterophoridae)

RELEASE	
Country	Hawaii USA
Year	1973
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Released intentionally on *Ageratina adenophora* but found fortuitously attacking *A. riparia*. In combination with *Procecidochares alani* and *Entyloma ageratinae* provides substantial to complete control on the island of HA, especially at elevations above 2,000 ft. *Ageratina riparia* not an important pasture pest on other islands. Parasites observed attacking this agent.
Limiting Factors	Elevation; Parasitism
Research Organization	HDOA
References	322, 325, 413, 612, 762, 1047, 1170, 1324, 1325, 1951, 2045

ASTERACEAE
Ageratina riparia *(continued)*

AGENT	
Species	*Procecidochares alani* Steyskal
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Australia
Year	1986
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established in northeastern NSW and southeastern QLD, but effects negligible due to high amounts of parasitism.
Limiting Factors	Parasitism; Predation (also an effect of elevation)
Research Organization	CSIRO
References	1623, 1625, 1978

RELEASE	
Country	Hawaii USA
Year	1974
Source	Ex. Mexico
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional

(continued on next page)

ASTERACEAE
Ageratina riparia; Procecidochares alani *(continued)*

Country	Hawaii USA (continued)
Notes	Beneficial indirectly by stunting *Ageratina riparia*, favoring competing vegetation. In combination with *Oidaematophorus beneficus* and *Entyloma ageratinae* contributes to substantial to complete control on island of HA, especially at elevations below 3,000 feet. Populations hampered by parasitism. *Ageratina riparia* not an important pasture pest on other islands.
Limiting Factors	Elevation; Parasitism
Research Organization	HDOA
References	325, 413, 598, 612, 762, 1047, 1323, 1324, 1349

RELEASE

Country	New Zealand
Year	2001
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Impacts of this species not formally evaluated in New Zealand. Gall counts higher in New Zealand than Hawaii where galls stunt plants, favoring competing species and contributing indirectly to control.
Research Organization	MWLR
References	85, 413, 598, 1061, 1064

ASTERACEAE
Ageratina riparia *(continued)*

AGENT

Species	*Xanthaciura connexionis* Benjamin
Classification	(Diptera: Tephritidae)

RELEASE

Country	Hawaii USA
Year	1960
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	325, 400

TABLE 1

TABLE 1

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Ambrosia artemisiifolia* L.
Origin	North America
Common Name	common ragweed, ragweed, annual ragweed

AGENT

Species	*Epiblema strenuana* (Walker)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Australia
Year	1984
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Causes significant reduction in plant size and vigor. Provides good control in most areas of eastern Australia. Parasitism has been recorded though is generally quite low.
Limiting Factors	Parasitism
Research Organization	IIBC, QLD State
References	1215, 1421

RELEASE

Country	People's Republic of China
Year	1990
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High

(continued at top of next column)

ASTERACEAE
Ambrosia artemisiifolia; Epiblema strenuana (continued)

Country	People's Republic of China (continued)
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Reduces seed yields and may stunt plant growth. Alone does not suppress weed population absolutely, but in conjunction with *Ophraella communa*, control is often complete.
Research Organization	CAAS-BCI
References	499, 624, 696, 920, 1123, 1933, 2064, 2065

AGENT

Species	*Euaresta bella* (Loew)
Classification	(Diptera: Tephritidae)

RELEASE

Country	Former Union Of Soviet Socialist Republics
Year	1969
Source	Ex. USA
Established	No
Research Organization	ZIAS, USDA (1)
References	624, 1016, 1567, 1568

RELEASE

Country	People's Republic of China
Year	1987
Source	Ex. USA via Canada
Established	No
Research Organization	CAAS-BCI
References	624, 696, 2064

ASTERACEAE
Ambrosia artemisiifolia; Euaresta bella *(continued)*

RELEASE	
Country	Russia
Year	1977
Source	Ex. USA (MD), Canada
Established	No
Research Organization	ZIAS, USDA (1)
References	351, 624, 1016, 1017, 1567, 1568

RELEASE	
Country	Russia
Year	1988
Source	Ex. USA
Established	No
Research Organization	ZIAS
References	624, 1014, 1017, 1567, 1568

AGENT	
Species	*Ponometia candefacta* (Hübner)
Past Names/Synonyms	*Tarachidia candefacta* (Hübner)
Classification	(Lepidoptera: Noctuidae)

RELEASE	
Country	Russia
Year	1969
Source	Ex. Canada, USA (CA)
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Populations steadily increasing in recent years, possibly due to warmer weather and limited insecticide usage. Despite higher numbers, overall impact limited.
Research Organization	AUPPI, AAFC, ZIAS, State (5)
References	628, 640, 1014, 1015, 1020, 1168, 1520, 1567, 1568

ASTERACEAE
Ambrosia artemisiifolia *(continued)*

AGENT	
Species	*Stobaera concinna* (Stål)
Classification	(Hemiptera: Delphacidae)

RELEASE	
Country	Australia
Year	1984
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Populations small and effects negligible.
Research Organization	QLD State
References	960

AGENT	
Species	*Trigonorhinus tomentosus* (Say)
Past Names/Synonyms	*Brachytarsus tomentosus* (Say)
Classification	(Coleoptera: Anthribidae)

RELEASE	
Country	Russia
Year	1977
Source	Ex. USA (MD)
Established	No
Research Organization	ZIAS, USDA (1)
References	351, 624, 1014, 1567, 1568

TABLE 1

ASTERACEAE
Ambrosia artemisiifolia; Trigonorhinus tomentosus *(continued)*

RELEASE	
Country	Russia
Year	1990
Source	Ex. USA
Established	No
Research Organization	ZIAS
References	624, 1017, 1567, 1568

AGENT	
Species	*Zygogramma bicolorata* Pallister
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1980
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established but only locally abundant as populations vary by location and season. Together with *Epiblema strenuana* provides effective control except in cooler areas or where rain is delayed until late in year.
Limiting Factors	Parasitism; Predation; Climate
Research Organization	IIBC, QLD State
References	1215, 1219, 1421

ASTERACEAE
Ambrosia artemisiifolia *(continued)*

AGENT	
Species	*Zygogramma disrupta* (Rogers)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Russia
Year	1980s
Source	Ex. USA (KS, NE, OK, TX)
Established	No
Notes	Repeatedly released in 1980s, but never established.
Research Organization	ZIAS
References	624, 1017, 1019, 1567, 1568

AGENT	
Species	*Zygogramma suturalis* (Fabricius)
Past Names/Synonyms	*Zygospila suturalis* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1990
Source	Ex. Tennessee USA
Established	No
Notes	Rearing difficulties due to inadequate daylight periods in subtropical introduced region compared to temperate native region led to insufficient release sizes.
Limiting Factors	Small release size; Biome differences
Research Organization	QLD State
References	1421

ASTERACEAE
Ambrosia artemisiifolia; Zygogramma suturalis *(continued)*

RELEASE	
Country	Former Yugoslavia
Year	1985
Source	Ex. USA (MD, MO, NE, KS)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Though established, populations too low to inflict significant impact. Population from Russia contaminated by *Beauveria*, likely contributing to overwintering mortality at Zagreb.
Limiting Factors	Disease
Research Organization	USDA (9), UZ
References	352, 864, 865, 1567

RELEASE	
Country	Former Yugoslavia
Year	1990
Source	Ex. Canada, USA via Russia
Established	Yes
Abundance	Limited
General Impact	None
Notes	This second release from Russia made at Zagreb and subsequently not differentiated from the original introduction in Zagreb sourced from the USA. Though established, populations too low to inflict significant impact. Population from Russia contaminated by *Beauveria*, likely contributing to overwintering mortality at Zagreb.
Limiting Factors	Disease
Research Organization	ZIAS, UZ
References	865, 1567

ASTERACEAE
Ambrosia artemisiifolia; Zygogramma suturalis *(continued)*

RELEASE	
Country	Georgia
Year	1978
Source	Ex. Canada, USA (OH, MD)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Establishment still not confirmed. Very few experts in insects available in Georgia and none are dealing with this group.
Research Organization	ZIAS, AAFC, USDA (1)
References	351, 352, 980, 1017

RELEASE	
Country	Kazakhstan
Year	1978
Source	Ex. Canada, USA
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established readily, but abundance and impact unknown.
Research Organization	ZIAS
References	624, 1017, 1019

TABLE 1

TABLE 1

ASTERACEAE
Ambrosia artemisiifolia; Zygogramma suturalis *(continued)*

RELEASE	
Country	People's Republic of China
Year	1987
Source	Ex. Canada
Established	No
Notes	Initially believed to establish in low numbers; limited by predation. Establishment subsequently considered failed.
Limiting Factors	Predation
Research Organization	CAAS-BCI
References	696, 920, 1123, 1932, 2064

RELEASE	
Country	People's Republic of China
Year	1988
Source	Ex. Canada, USA via Former Union Of Soviet Socialist Republics
Established	No
Notes	Initially believed to establish in low numbers; limited by predation. Establishment subsequently considered failed.
Limiting Factors	Predation
Research Organization	CAAS-BCI
References	696, 920, 1123, 1567, 1932, 2064

RELEASE	
Country	Russia
Year	1978
Source	Ex. Canada, USA (OH, MD)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

ASTERACEAE
Ambrosia artemisiifolia; Zygogramma suturalis *(continued)*

Country	Russia (continued)
Notes	Initially reached high population levels, causing severe damage and eliminating the weed in localized areas. Populations since plummeted. Where densities are high, causes some damage to plants but overall ineffective. Cropping practices interfere with population build up.
Limiting Factors	Land use
Research Organization	ZIAS, AAFC, USDA (1)
References	351, 1016, 1564, 1565, 1566, 1567, 1568, 1569

RELEASE	
Country	Ukraine
Year	1980s
Source	Ex. Canada (ON), USA (OH, MD, FL) via Stavropol Territory
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though not formally studied, abundance and impact are most likely similar to Russia where agent initially successful but more recently limited in abundance and impact.
Research Organization	ZIAS, AAFC, USDA (1)
References	352, 1016, 1291, 1568

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Ambrosia psilostachya* DC.
Origin	North America
Common Name	western ragweed

AGENT

Species	*Ponometia candefacta* (Hübner)
Past Names/Synonyms	*Tarachidia candefacta* (Hübner)
Classification	(Lepidoptera: Noctuidae)

RELEASE

Country	Russia
Year	1969
Source	Ex. Canada, USA (CA)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Introduced primarily on *Ambrosia artemisiifolia* but also released on *A. psilostachya*. Establishment not confirmed.
Research Organization	AUPPI
References	624, 628, 640, 641, 1015, 1020, 1567, 1568

ASTERACEAE
Ambrosia psilostachya (continued)

TABLE 1

AGENT

Species	*Zygogramma suturalis* (Fabricius)
Past Names/Synonyms	*Zygospila suturalis* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Kazakhstan
Year	1978
Source	Ex. Canada, USA
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established readily, but abundance and impact unknown.
Research Organization	ZIAS
References	624, 1017, 1019

RELEASE

Country	Russia
Year	1978
Source	Ex. Canada, USA (OH, MD)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Introduced primarily on *Ambrosia artemisiifolia* but also released on *A. psilostachya*. Initially believed to have established, but establishment no longer considered confirmed.
Research Organization	ZIAS
References	351, 1016, 1017, 1019, 1567, 1568

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Baccharis halimifolia* L.
Origin	North America
Common Name	groundsel bush, sea myrtle, consumption-weed

AGENT	
Species	*Anacassis fuscata* (Klug)
Past Names/Synonyms	*Stolas fuscata* (Klug)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1975
Source	Ex. Brazil
Established	No
Research Organization	QLD State
References	1203, 1424, 1976

AGENT	
Species	*Anacassis phaeopoda* Buzzi
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1975
Source	Ex. Brazil
Established	No
Research Organization	QLD State
References	1203, 1424, 1976

ASTERACEAE
Baccharis halimifolia (continued)

AGENT	
Species	*Aristotelia ivae* Busck
Past Names/Synonyms	*Aristotelia* sp.
Classification	(Lepidoptera: Gelechiidae)

RELEASE	
Country	Australia
Year	1969
Source	Ex. USA
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though established widely, population densities vary according to site conditions and are typically too low to provide any significant control.
Research Organization	QLD State
References	502, 1203, 1424, 1976

AGENT	
Species	*Bucculatrix ivella* Busck
Classification	(Lepidoptera: Bucculatricidae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. USA
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

ASTERACEAE
Baccharis halimifolia; Bucculatrix ivella (continued)

Country	Australia (continued)
Notes	Though established widely, population densities vary and overall exhibit little to no control.
Research Organization	QLD State
References	1414, 1424, 1813

AGENT

Species	*Heilipodus intricatus* (Boheman)
Incorrect Past Names/Synonyms	*Helipodus intricatus* (Boheman)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1983
Source	Ex. Brazil
Established	No
Notes	Colonies never mass reared and only few individuals released.
Limiting Factors	Small release size
Research Organization	QLD State
References	346, 1424

ASTERACEAE
Baccharis halimifolia (continued)

AGENT

Species	*Hellinsia balanotes* (Meyrick)
Past Names/Synonyms	*Oidaematophorus balanotes* (Meyrick)
Incorrect Past Names/Synonyms	*Hellensia balanotes* (Meyrick)
Classification	(Lepidoptera: Pterophoridae)

RELEASE

Country	Australia
Year	1969
Source	Ex. USA
Established	No
Notes	Release sizes likely too small for successful establishment.
Limiting Factors	Small release size
Research Organization	QLD State
References	1203, 1416, 1424

RELEASE

Country	Australia
Year	1985
Source	Ex. USA (FL, TX)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Can be very damaging visually, but has little impact overall as weed can recover rapidly
Research Organization	QLD State
References	1416, 1424

TABLE 1

ASTERACEAE
Baccharis halimifolia; Hellinsia balanotes *(continued)*

RELEASE	
Country	Former Union Of Soviet Socialist Republics
Year	1990
Source	Ex. USA (FL) via Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ZIAS
References	1017, 1424

AGENT	
Species	*Lioplacis elliptica* Stål
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1977
Source	Ex. Brazil
Established	No
Notes	Thousands of adults and eggs released. Recoveries made up to 3 years after release, but damage and numbers low, and subsequently field populations slowly declined to extinction.
Research Organization	QLD State
References	1203, 1207, 1424, 1976

ASTERACEAE
Baccharis halimifolia *(continued)*

AGENT	
Species	*Lorita baccharivora* Pogue
Past Names/Synonyms	*Phalonia* sp.
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Australia
Year	1969
Source	Ex. USA
Established	No
Notes	Only one release made; consisted of 90 adults.
Research Organization	QLD State
References	1203, 1413, 1976

RELEASE	
Country	Australia
Year	1986
Source	Ex. USA
Established	No
Research Organization	QLD State
References	502, 1424

ASTERACEAE
Baccharis halimifolia (continued)

AGENT	
Species	*Megacyllene mellyi* (Chevrolat)
Classification	(Coleoptera: Cerambycidae)

RELEASE	
Country	Australia
Year	1978
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Established only in coastal areas having shallow, saline soils. On such sites, and particularly in sunny or lightly shaded areas, plant densities have been reduced by 50-100%. Ineffective on plants growing in better soil where larval mortality is high from heavier plant sap flow.
Limiting Factors	Habitat
Research Organization	QLD State
References	1204, 1424, 1812, 1818

ASTERACEAE
Baccharis halimifolia (continued)

AGENT	
Species	*Metallactus nigrofasciatus* Suffrian
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1982
Source	Ex. Brazil
Established	No
Notes	Releases likely only limited at best.
Limiting Factors	Small release size
Research Organization	QLD State
References	1206, 1413, 1424

AGENT	
Species	*Metallactus patagonicus* Suffrian
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1975
Source	Ex. Brazil
Established	No
Research Organization	QLD State
References	1203, 1208, 1413, 1424, 1976

TABLE 1

ASTERACEAE
Baccharis halimifolia *(continued)*

AGENT	
Species	*Puccinia evadens* Harkn.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Australia
Year	1997
Source	Ex. USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	Initially caused severe dieback in shaded areas and on small plants. More recent studies indicate impact is minimal and may even promote growth.
Limiting Factors	Habitat
Research Organization	QLD State
References	1413, 1418, 1424, 1818

AGENT	
Species	*Rhopalomyia californica* Felt
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	Australia
Year	1969
Source	Ex. USA (CA)
Established	No
Notes	Establishment failure likely influenced by only small releases being made.
Limiting Factors	Small release size
Research Organization	QLD State
References	1205, 1413, 1415, 1424

ASTERACEAE
Baccharis halimifolia; Rhopalomyia californica *(continued)*

RELEASE	
Country	Australia
Year	1982
Source	Ex. USA (CA)
Established	Yes
Abundance	Moderate
General Impact	Variable
Notes	Initially very effective in reducing growth and fecundity when galls were abundant, particularly in wetter, cooler regions. More recently populations are limited by parasitism.
Limiting Factors	Parasitism
Research Organization	QLD State
References	1205, 1415, 1424

RELEASE	
Country	Australia
Year	1989
Source	Ex. USA (CA)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Introduced from hotter, drier region in attempt to increase efficacy in dry areas. As the cooler, wetter population was already widespread and abundant, establishment of the new introduction could not be confirmed. Efficacy in hot, dry regions did not increase following this release.
Research Organization	QLD State
References	1413, 1415, 1424

ASTERACEAE
Baccharis halimifolia; Rhopalomyia californica *(continued)*

RELEASE	
Country	Former Union Of Soviet Socialist Republics
Year	1989
Source	Ex. USA (CA) via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ZIAS
References	1017, 1424

AGENT	
Species	*Trirhabda bacharidis* (Weber)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1969
Source	Ex. USA (FL)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established at only two sites in QLD. Poor establishment due largely to change in phenology (it overwinters in the egg stage in its native range and as pupae in Australia).
Limiting Factors	Change in phenology (possibly result of climate)
Research Organization	QLD State
References	1203, 1417, 1424, 1976

ASTERACEAE
Baccharis halimifolia; Trirhabda bacharidis *(continued)*

RELEASE	
Country	Australia
Year	1983
Source	Ex. USA (TX)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Introduced from different source in attempt to prevent change in phenology, but change still occurred and impact/ establishment did not increase.
Limiting Factors	Change in phenology (possibly result of climate)
Research Organization	QLD State
References	1417, 1424

RELEASE	
Country	Former Union Of Soviet Socialist Republics
Year	1990
Source	Ex. USA (GA, MD)
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ZIAS
References	1017, 1424

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Carduus acanthoides* L.
Origin	Europe, Asia, northern Africa
Common Name	plumeless thistle, spiny plumeless thistle, bristly thistle

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	Argentina
Year	1981
Source	Ex. France (Rhine Valley) via Canada via USA and via Canada via New Zealand
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though the weevil reduces healthy achene production by up to 80%, resulting impact on overall population has not been studied. Efficacy likely decreased by large suite of parasites.
Limiting Factors	Parasitism
Research Organization	INTA
References	344, 540, 541, 563, 1609

ASTERACEAE
Carduus acanthoides; Rhinocyllus conicus (continued)

RELEASE	
Country	Canada
Year	1968
Source	Ex. France (Rhine Valley)
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Reduces seed production by approximately 10%, as only the early capitula are attacked.
Limiting Factors	Agent-host synchronization
Other Species Attacked	Also feeds on native *Cirsium* spp.
Research Organization	AAFC, MU
References	432, 437, 729, 735, 742, 748, 1186, 1628

RELEASE	
Country	Canada
Year	1969
Source	Ex. France, USSR
Established	No
Notes	Released in attempt to increase establishment results.
Research Organization	AAFC, MU
References	729

ASTERACEAE
Carduus acanthoides; Rhinocyllus conicus *(continued)*

RELEASE	
Country	New Zealand
Year	1977
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Redistributed from *Carduus nutans* subsp. *nutans* to *C. acanthoides*. Impact to *C. acanthoides* not studied formally; however, impact on its preferred host (*C. nutans* subsp. *nutans*) insufficient to control the weed population.
Other Species Attacked	Also feeds on the exotic hybrid of *Carduus nutans* L. subsp. *nutans* and *Ca. acanthoides* L. as well as the exotic *Cirsium vulgare* (Savi) Ten.
Research Organization	DSIR
References	688, 689, 761, 915, 916, 918, 1064, 1650

RELEASE	
Country	United States of America
Year	1969
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Carduus acanthoides; Rhinocyllus conicus *(continued)*

Country	United States of America (continued)
Notes	Sourced from *Carduus nutans*. Anecdotal evidence suggests successful in some areas, however field studies indicate provides only partial control of *C. acanthoides* because ovipositional period only coincides with development of terminal thistle buds and not lateral buds that develop later in growing season.
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	USDA (1), State (1,9)
References	335, 1011, 1457, 1501, 1502, 1506, 1578, 1600, 1750, 1751, 1799

TABLE 1

TABLE 1

ASTERACEAE
Carduus acanthoides *(continued)*

AGENT

Species	*Trichosirocalus horridus* (Panzer)
Past Names/Synonyms	*Ceuthorhynchidius horridus* (Panzer)
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The authors of this revision stated "it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n." However, because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular (continued at top of next column)

ASTERACEAE
Carduus acanthoides *(continued)*

Species	*Trichosirocalus horridus* (Panzer) (continued)
Notes (continued)	studies are currently underway to determine if the species complex is truly a complex, and to what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.
References	27, 689

RELEASE

Country	Argentina
Year	1983
Source	Ex. Italy via USA
Established	No
Research Organization	INTA
References	344, 540, 563

RELEASE

Country	Canada
Year	1975
Source	Ex. Germany
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	ON populations result of redistribution from *Carduus nutans* to *C. acanthoides*. Damage overall is limited on *C. acanthoides*. Where large rosettes attacked, they frequently survive to produce seed later in the season.
Research Organization	AAFC, MU
References	25, 117, 432, 729, 735

ASTERACEAE
Carduus acanthoides; Trichosirocalus horridus *(continued)*

RELEASE	
Country	United States of America
Year	1974
Source	Ex. Italy
Established	Yes
Abundance	Moderate
General Impact	Variable
Notes	In some areas, substantial declines in *Carduus acanthoides* densities attributed at least in part to *Trichosirocalus horridus* alone or in combination with *Rhinocyllus conicus*. Successful sites had high amounts of grass competition. At most locations, this agent is seldom effective alone. Here, weed reductions have not been observed, with some infestations actually increasing. Prefers *C. nutans* over *C. acanthoides*.
Other Species Attacked	Also found feeding on five native *Cirsium* spp. in the USA. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders. Observed on the exotic *Cirsium arvense* (L.) Scop., though impact likely minimal.
Research Organization	USDA (1), State (1)
References	47, 226, 335, 710, 1007, 1008, 1011, 1012, 1502, 1506, 1578, 1778

ASTERACEAE
Carduus acanthoides *(continued)*

AGENT	
Species	*Urophora solstitialis* (L.)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1990
Source	Ex. Germany
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Overall impact limited. Average of 4.5 larvae in seed heads of *Carduus acanthoides*. Believed to be no conflict between this agent and *Rhinocyllus conicus*.
Research Organization	INTA
References	25, 432, 735

RELEASE	
Country	United States of America
Year	1993
Source	Ex. Italy
Established	No
Research Organization	State (20)
References	1011, 1506, 1578, 1799

TABLE 1

TABLE 1

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Carduus nutans* L.
Past Names/Synonyms	*Carduus thoermeri* (Weinman)
Notes	*Carduus nutans* is part of a variable complex that has been treated as one to several species or, more recently, as a single species with several subspecies. Various intermediates are evident, and many North and South American specimens cannot be reliably assigned. It is believed Canadian populations comprise two subspecies with *C. nutans* subsp. *nutans* distributed in eastern Canada from NL to ON and *C. nutans* subsp. *leiophyllus*, which is considered synonymous with *C. thoermeri* (Weinman), from ON to BC. In the USA, subspecies include subsp. *nutans*, subsp. *leiophyllus* [Petrovic] Stoj. and Stef., and subsp. *macrocephalus* [Desf.] Nyman). Presumably, subsp. *nutans* is mainly distributed in the eastern part of the country, while only subsp. *leiophyllus* and subsp. *macrocephalus* are present in the Great Plains.
Origin	Europe, Asia, northern Africa
Common Name	musk thistle, nodding thistle, nodding plumeless thistle

ASTERACEAE
Carduus nutans *(continued)*

AGENT

Species	*Cheilosia grossa* (Fallén)
Past Names/Synonyms	*Cheilosia corydon* (Harris)
Classification	(Diptera: Syrphidae)

RELEASE

Country	United States of America
Year	1990
Source	Ex. Italy
Established	No
Other Species Attacked	Damage similar to that caused by this agent has been observed in several native thistles species (*Cirsium edule* group), thus caution should be used when considering introduction of this fly into new areas.
Research Organization	USDA (10,12), State (7,15,20)
References	332, 334, 335, 620, 621, 1105, 1506, 1799

AGENT

Species	*Psylliodes chalcomera* (Illiger)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	United States of America
Year	1997
Source	Ex. Italy
Established	No
Research Organization	USDA (12), State (20)
References	620, 1506

ASTERACEAE
Carduus nutans *(continued)*

AGENT	
Species	*Puccinia carduorum* Jacky
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	United States of America
Year	1987
Source	Ex. Turkey
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Isolate III. Intentionally introduced on *Carduus nutans* in 1987 for experimental field release but quickly spread across numerous states. This strain very specific to *Carduus nutans*; attacking *C. nutans* subsp. *leiophyllus* but with zero to low incidence on *C. nutans* subsp. *nutans* and *C. nutans* subsp. *macrocephalus* during specificity trials. Reduces seed set and quality in *C. nutans* subsp. *leiophyllus*; effects of rust and established insect biocontrol agents additive.
Research Organization	State (1,2,14)
References	87, 183, 184, 473, 620, 1009, 1506, 1519, 2002

ASTERACEAE
Carduus nutans *(continued)*

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	Argentina
Year	1981
Source	Ex. France (Rhine Valley) via Canada via USA and via Canada via New Zealand
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though significantly reduces healthy achene production, impact of this on overall population has not been studied. Efficacy likely decreased by large suite of parasites.
Limiting Factors	Parasitism
Research Organization	INTA
References	343, 344, 540, 1609

TABLE 1

ASTERACEAE
Carduus nutans; Rhinocyllus conicus *(continued)*

RELEASE	
Country	Canada
Year	1968
Source	Ex. France (Rhine Valley)
Established	Yes
Abundance	High
General Impact	Variable
Notes	Reduces seed production by ~50% and attacks the heads often over 90%. In SK has reduced *Carduus nutans* in pastures to less than 10% of its former density, but has less effect where the thistle is growing without competition. In BC has controlled *C. nutans* for several years.
Other Species Attacked	Also feeds on native *Cirsium* spp.
Research Organization	AAFC
References	117, 432, 729, 742, 748, 1186, 1628, 1841, 2080

RELEASE	
Country	United States of America
Year	1969
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	High
General Impact	Variable
Geographical Scale of Impact	
Notes	Sourced from *Carduus nutans*. In some states, substantial declines in *C. nutans* densities attributed at least in part to *Rhinocyllus conicus* alone or in combination with *Trichosirocalus horridus*. However, many of these claims based on anecdotal observations. At several other locations, reductions

(continued at top of next column)

ASTERACEAE
Carduus nutans; Rhinocyllus conicus *(continued)*

Country	United States of America (continued)
Notes (continued)	have not been observed. More recent studies indicate *R. conicus*, alone or in combination with *T. horridus*, only effective when interspecific plant competition high. Parasitism may limit efficacy in some areas.
Limiting Factors	Parasitism
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	USDA (1,7,9,10,11), State (1,9,13,14,15)
References	47, 83, 231, 332, 335, 620, 1013, 1239, 1242, 1457, 1506, 1540, 1557, 1578, 1731

RELEASE	
Country	United States of America
Year	1974
Source	Ex. Italy
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Sourced from *Silybum marianum*. In Siskiyu County CA, new weed populations spring up following soil disturbance. *Rhinocyllus conicus* continues to provide exellent control of these populations within 10+ years of their re-emergence.
Research Organization	USDA (7), State (14)
References	231, 785, 1512

ASTERACEAE
Carduus nutans *(continued)*

AGENT

Species	*Trichosirocalus horridus* (Panzer)
Past Names/Synonyms	*Ceuthorhynchidius horridus* (Panzer)
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The authors of this revision stated "it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n." However, because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently *(continued at top of next column)*

ASTERACEAE
Carduus nutans *(continued)*

Species	*Trichosirocalus horridus* (Panzer) (continued)
Notes (continued)	underway to determine if the species complex is truly a complex, and to what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.
References	27, 689

RELEASE

Country	Argentina
Year	1983
Source	Ex. Italy via USA
Established	No
Research Organization	INTA
References	344, 540

RELEASE

Country	Canada
Year	1975
Source	Ex. Austria, Germany, Switzerland
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Damage overall is limited. Where large rosettes are attacked, they frequently survive to produce seed later in the season.
Research Organization	AAFC
References	25, 117, 432, 729, 1628

TABLE 1

ASTERACEAE
Carduus nutans; Trichosirocalus horridus (continued)

RELEASE

Country	United States of America
Year	1974
Source	Ex. Italy
Established	Yes
Abundance	Moderate
General Impact	Variable
Notes	In some states, substantial declines in *Carduus nutans* densities attributed at least in part to *Trichosirocalus horridus* alone or in combination with *Rhinocyllus conicus*. At several other locations, reductions have not been observed by this agent alone. More recent studies indicate *T. horridus*, alone or in combination with *R. conicus*, only effective when interspecific plant competition high. Some populations may be hindered by *Nosema* infection.
Limiting Factors	Disease
Other Species Attacked	Also found feeding on five native *Cirsium* spp. in the USA. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders. Also observed on the exotic *Cirsium arvense* (L.) Scop., though impact likely minimal.
Research Organization	USDA (1,7,9,12), State (1,7,9,10,11,13,15,20)
References	47, 74, 226, 332, 335, 620, 710, 1007, 1008, 1242, 1502, 1506, 1578, 1731, 1778, 1799, 1968

ASTERACEAE
Carduus nutans (continued)

AGENT

Species	*Urophora solstitialis* (L.)
Classification	(Diptera: Tephritidae)

RELEASE

Country	Canada
Year	1991
Source	Ex. Austria
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	AAFC
References	117, 432, 735

RELEASE

Country	United States of America
Year	1993
Source	Ex. Italy
Established	No
Research Organization	USDA (10)
References	334, 335, 620, 1105, 1506, 1578, 1799

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Carduus nutans* L. subsp. *nutans*
Notes	*Carduus nutans* is part of a variable complex that has been treated as one to several species or, more recently, as a single species with several subspecies. *Carduus nutans* subsp. *nutans* is the predominant form of the weed in Australia and New Zealand. *C. nutans* subsp. *leiophyllus* occurs in Australia, but only as a ruderal of minor importance, confined to southeastern QLD.
Origin	Europe, Asia, northern Africa
Common Name	nodding thistle, musk thistle
AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457
RELEASE	
Country	Australia
Year	1988
Source	Ex. Franc (southern: Larzac)
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional

(continued at top of next column)

ASTERACEAE
Carduus nutans ssp. *nutans*; *Rhinocyllus conicus* *(continued)*

Country	Australia (continued)
Notes	This population slow to increase despite climatically matching region of release. Eventually built up and mixed with population from New Zealand. Insufficient to control *Carduus nutans* alone but in conjunction with other species significantly reduces seed banks and rosette density.
Research Organization	CSIRO
References	384, 2012, 2013
RELEASE	
Country	Australia
Year	1988
Source	Ex. France (northern: Alsace) via Canada via New Zealand
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Three different populations of *Rhinocyllus conicus* were released in an attempt to climate match to different regions where *Carduus nutans* was problematic. Most successful of the three populations introduced but insufficient to control *C nutans* alone. In conjunction with other species significantly reduces seed banks and rosette density.
Research Organization	CSIRO
References	384, 2012, 2013, 2014, 2015

TABLE 1

ASTERACEAE
Carduus nutans ssp. *nutans; Rhinocyllus conicus* (continued)

RELEASE

Country	Australia
Year	1989
Source	Ex. Italy
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Only weakly established despite climatically matching region of release. Where present, insufficient to control *Carduus nutans* alone but in conjunction with other species significantly reduces seed banks and rosette density.
Research Organization	CSIRO
References	384, 2012, 2013

RELEASE

Country	New Zealand
Year	1973
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed throughout the range of the weed. Can significantly reduce seed production in *Carduus nutans* subsp. *nutans* early in season; however many later inflorescences escape damage such that overall impact insufficient to control weed population.
Other Species Attacked	Also feeds on the exotic hybrid of *Carduus nutans* L. subsp. *nutans* and *Ca. acanthoides* L. as well as the exotic *Cirsium vulgare* (Savi) Ten.
Research Organization	DSIR
References	688, 761, 914, 915, 916, 918, 975, 1064, 1650

ASTERACEAE
Carduus nutans ssp. *nutans* (continued)

AGENT

Species	*Trichosirocalus horridus* (Panzer)
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The editors of this revision stated “it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n.” However, because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently

(continued on next page)

ASTERACEAE
Carduus nutans* ssp. *nutans*; *Trichosirocalus horridus *(continued)*

Species	*Trichosirocalus horridus* (Panzer) (continued)
Notes (continued)	underway to determine if the species complex is truly a complex, and to what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.
References	27, 689

RELEASE	
Country	New Zealand
Year	1979
Source	Ex. Italy
Established	No
Notes	Establishment failure likely due to low numbers of insects released.
Limiting Factors	Small release size
Research Organization	DSIR
References	720, 916

ASTERACEAE
Carduus nutans* ssp. *nutans*; *Trichosirocalus horridus *(continued)*

RELEASE	
Country	New Zealand
Year	1984
Source	Ex. Germany via Canada
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	At many sites, *Carduus nutans* subsp. *nutans* populations appear to have declined within 5 years of release, however efficacy varies and majority of data is anecdotal.
Other Species Attacked	Also feeds on the exotic *Carduus acanthoides* L., *Ca. pycnocephalus* L., *Ca. tenuiflorus* Curtis, *Cirsium vulgare* (Savi) Ten., *Ci. palustre* (L.) Scop., *Onopordum acanthium* L. and hybrids of *C. nutans* L. subsp. *nutans* and *C. acanthoides*.
Research Organization	DSIR
References	689, 720, 761, 916, 1064

TABLE 1

TABLE 1

ASTERACEAE
Carduus nutans* ssp. *nutans *(continued)*

AGENT	
Species	*Trichosirocalus mortadelo* Alonso-Zarazaga & Sanchez-Ruiz
Past Names/Synonyms	*Trichosirocalus horridus* (Panzer) pars, *Ceuthorhynchidius horridus* (Panzer) pars
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. All three are supposedly present in Australia. Because there is a disagreement for the morphological parameters selected by taxonomists for this separation, molecular studies are currently underway to determine if the species complex is truly a complex, and to what level. Until new conclusions are reached, the editors of this catalogue follow the three published names of the separation.
References	27, 689

ASTERACEAE
Carduus nutans* ssp. *nutans*; *Trichosirocalus mortadelo *(continued)*

RELEASE	
Country	Australia
Year	1993
Source	Ex. Germany via Canada via New Zealand
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released under the assumption the species was *Trichosirocalus horridus*, but has since been identified as the cryptic *T. mortadelo*. Most effective of the three species established on this weed. Reduces seed production by 72% alone or 81% in combination with other two species. In addition, larval feeding kills some over-wintering rosettes.
Research Organization	CSIRO
References	384, 886, 2011, 2012

AGENT	
Species	*Urophora solstitialis* (L.)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Australia
Year	1991
Source	Ex. France (southern)
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

ASTERACEAE
Carduus nutans* ssp. *nutans*; *Urophora solstitialis *(continued)*

Country	Australia (continued)
Notes	Though widely distributed, poorly synchronized with *Carduus nutans* bud production which limits population size. Still second most effective agent established. In conjunction with other species significantly reduces seed banks and rosette density
Research Organization	CSIRO
References	384, 2009, 2010, 2012, 2015

RELEASE

Country	New Zealand
Year	1990
Source	Ex. Austria
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Densities limited due to interactions with *Rhinocyllus conicus*, thus hindering ability to significantly impact weed populations.
Limiting Factors	Agent-host synchronization; Interspecific competition
Research Organization	DSIR
References	688, 720, 761, 1064

RELEASE

Country	New Zealand
Year	1992
Source	Ex. France via Australia
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

ASTERACEAE
Carduus nutans* ssp. *nutans*; *Urophora solstitialis *(continued)*

Country	New Zealand (continued)
Notes	This second introduction obtained from Australia because of difficulties re-phasing Austrian population to Southern Hemisphere conditions. Both introductions established and subsequently not differentiated. Densities limited due to interactions with *Rhinocyllus conicus*, thus hindering ability to significantly impact weed populations.
Limiting Factors	Interspecific competition
Research Organization	MWLR
References	688, 720, 761, 1064

TABLE 1

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Carduus pycnocephalus* L.
Origin	Europe, Asia, northern Africa
Common Name	slender winged thistle, Italian thistle
AGENT	
Species	*Cheilosia grossa* (Fallén)
Past Names/Synonyms	*Cheilosia corydon* (Harris)
Classification	(Diptera: Syrphidae)
RELEASE	
Country	United States of America
Year	1993
Source	Ex. Italy
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Not overly abundant but where established, plants with large stem diameters (>10 mm) often attacked. Larval mining interferes with plant function and ultimately results in decrease of seed production, sometimes even death.
Other Species Attacked	Damage similar to that caused by this agent has been observed in several native thistles species (*Cirsium edule* group), thus caution should be used when considering introduction of this fly into new areas. Also rarely found attacking *Carduus acanthoides* L., especially plants with large diameter stems (>10 mm).
Research Organization	USDA (10), State (15)
References	332, 334, 1506, 2002

ASTERACEAE
Carduus pycnocephalus *(continued)*

AGENT	
Species	*Puccinia cardui-pycnocephali* P. Syd. & Syd.
Classification	(Pucciniomycetes: Pucciniales)
RELEASE	
Country	Australia
Year	1993
Source	Ex. Italy (strain IT2), France (strain FR3)
Established	Yes
Abundance	Unknown
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Strains IT2 and FR3. Rust infection decreases reproductive output and plant dry weight. Both strains will attack *Carduus pycnocephalus* and *C. tenuiflorus*, though IT2 from Italy is much more virulent on *C. pycnocephalus*. A third strain of this rust (shown to be ineffective) was known from Australia prior to this release.
Research Organization	VIC State
References	122, 248, 692, 693, 886

ASTERACEAE
Carduus pycnocephalus *(continued)*

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	New Zealand
Year	1973
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially released on *Carduus nutans* subsp. *nutans*; attack to *C. pycnocephalus* largely spillover and highest early in season. Even on its preferred host (*C. nutans* subsp. *nutans*), impact insufficient to control weed population.
Other Species Attacked	Also feeds on the exotic hybrid of *Carduus nutans* L. subsp. *nutans* and *Ca. acanthoides* L. as well as the exotic *Cirsium vulgare* (Savi) Ten.
Research Organization	DSIR
References	688, 761, 914, 915, 916, 918, 1064, 1521, 1650

ASTERACEAE
Carduus pycnocephalus; Rhinocyllus conicus *(continued)*

RELEASE	
Country	United States of America
Year	1973
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Sourced from *Carduus pycnocephalus*. Though widespread in CA and OR, populations limited in ID. Reductions of thistle density occur in pastures not burned annually, but usually only under conditions of high plant competition. Large number of seeds escape predation when capitula produced late in season after oviposition has ceased.
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	USDA (7), State (5,14,15)
References	332, 334, 335, 621, 642, 644, 1457, 1578, 1837

TABLE 1

ASTERACEAE
Carduus pycnocephalus *(continued)*

AGENT

Species *Trichosirocalus horridus* (Panzer)

Classification (Coleoptera: Curculionidae)

Notes A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The editors of this revision stated "it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n." However, because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently

(continued aat top of next column)

ASTERACEAE
Carduus pycnocephalus; Trichosirocalus horridus *(continued)*

Species *Trichosirocalus horridus* (Panzer) (continued)

Notes (continued) underway to determine if the species complex is truly a complex, and to what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.

References 27, 689

RELEASE

Country United States of America

Year 1994

Source Ex. Italy

Established Yes

Abundance Moderate

General Impact Medium

Geographical Scale of Impact Localized

Notes Redistributed from *Carduus nutans* to *C. pycnocephalus*. Developing larvae often cause main stem to die and lead to development of several smaller stems. Adults feed on leaves and cause pitting of stems. However, anecdotal observations indicate other agents more important on *C. pycnocephalus*, and this agent prefers *C. nutans*.

Other Species Attacked Also found feeding on five native *Cirsium* spp. in the USA. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders. Observed on the exotic *Cirsium arvense* (L.) Scop., though impact likely minimal.

Research Organization State (15)

References 47, 332, 334, 335, 710, 1012, 1506, 1578, 1778

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Carduus tenuiflorus* Curtis
Origin	western Europe, northern Africa
Common Name	winged thistle, slenderflower thistle

AGENT

Species	*Cheilosia grossa* (Fallén)
Past Names/Synonyms	*Cheilosia corydon* (Harris)
Classification	(Diptera: Syrphidae)

RELEASE

Country	United States of America
Year	1990
Source	Ex. Italy
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Widespread where weed infestations occur in OR. Plants with large stem diameters (>10 mm) often attacked. Larval mining interferes with plant function and ultimately results in decreased seed production, sometimes even death though overall impact minor. Impact and abundance in MD unknown.
Other Species Attacked	Damage similar to that caused by this agent has been observed in several native thistles species (*Cirsium edule* group), thus caution should be used when considering introduction of this fly into new areas. Also rarely found attacking *Carduus acanthoides* L., especially plants with large diameter stems (>10 mm).
Research Organization	USDA (12), State (20)
References	332, 334, 335, 621, 690, 1506, 2002

ASTERACEAE
Carduus tenuiflorus *(continued)*

AGENT

Species	*Puccinia cardui-pycnocephali* P. Syd. & Syd.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Australia
Year	1993
Source	Ex. Italy (strain IT2), France (strain FR3)
Established	Yes
Abundance	Unknown
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Strains IT2 and FR3. Rust infection decreases reproductive output and plant dry weight. Both strains will attack *Carduus tenuiflorus* and *C. pycnocephalus*, though FR3 from France is much more virulent on *C. tenuiflorus*. A third strain of this rust (shown to be ineffective) was known from Australia prior to this release.
Research Organization	VIC State
References	122, 248, 692, 693, 886

TABLE 1

ASTERACEAE
Carduus tenuiflorus *(continued)*

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	New Zealand
Year	1973
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially released on *Carduus nutans* subsp. *nutans*; attack to *C. tenuiflorus* largely spillover and highest early in season. Even on preferred host (*C. nutans* subsp. *nutans*), impact insufficient to control weed population.
Other Species Attacked	Also feeds on the exotic hybrid of *Carduus nutans* L. subsp. *nutans* and *Ca. acanthoides* L. as well as the exotic *Cirsium vulgare* (Savi) Ten.
Research Organization	DSIR
References	688, 761, 914, 915, 916, 918, 1064, 1650

ASTERACEAE
Carduus tenuiflorus; Rhinocyllus conicus *(continued)*

RELEASE	
Country	United States of America
Year	1979
Source	Ex. Italy
Established	Yes
Abundance	High
General Impact	Variable
Notes	Sourced from *Carduus pycnocephalus*. Reductions of thistle density occur in pastures not burned annually, but usually only under conditions of high plant competition. Populations fare poorly nearer the ocean.
Limiting Factors	Habitat
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	State (15)
References	332, 334, 335, 621, 1457, 1512

AGENT	
Species	*Trichosirocalus horridus* (Panzer)
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The editors of

(continued on next page)

ASTERACEAE
Carduus tenuiflorus (continued)

Species	*Trichosirocalus horridus* (Panzer) (continued)
Notes (continued)	this revision stated “it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n.” However, because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently underway to determine if the species complex is truly a complex, and to what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.
References	27, 689

ASTERACEAE
Carduus tenuiflorus; Trichosirocalus horridus (continued)

RELEASE	
Country	United States of America
Year	1994
Source	Ex. Italy
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Initially introduced onto *Carduus acanthoides* and *C. nutans*. Spread naturally to *C. tenuiflorus*. Developing larvae often cause main stem to die and lead to development of several smaller stems. Adults feed on leaves and cause pitting of stems. However, anecdotal observations indicate other agents more important on *C. tenuiflorus*, and this agent prefers *C. nutans*.
Other Species Attacked	Also found feeding on five native *Cirsium* spp. in the USA. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders. Observed on the exotic *Cirsium arvense* (L.) Scop., though impact likely minimal.
Research Organization	State (15)
References	47, 332, 334, 710, 1012, 1506, 1578, 1778

TABLE 1

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea calcitrapa* L.
Origin	Eurasia
Common Name	purple starthistle

AGENT	
Species	*Bangasternus fausti* (Reitter)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	United States of America
Year	1999
Source	Ex. Greece
Established	No
Notes	Originally released on *Centaurea diffusa*. Redistribution attempted from *C. calcitrapa* but did not establish.
Research Organization	State (14,22)
References	508, 1735, 2017

ASTERACEAE
Centaurea calcitrapa (continued)

AGENT	
Species	*Larinus minutus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	United States of America
Year	1998
Source	Ex. Greece, Romania
Established	No
Notes	Originally released on *Centaurea diffusa*. Redistribution attempted from *C. calcitrapa* but did not establish.
Research Organization	State (14,22)
References	508, 1074, 2017, 2032

AGENT	
Species	*Terellia virens* (Loew)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	United States of America
Year	1998
Source	Ex. Austria, Switzerland
Established	No
Notes	Originally released on *Centaurea diffusa*. Redistribution attempted from *C. calcitrapa* but did not establish.
Research Organization	State (14,22)
References	508, 1728, 2017, 2032

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea cyanus* L.
Origin	Eurasia
Common Name	cornflower, bachelor's button

AGENT	
Species	*Chaetorellia australis* Héring
Classification	(Diptera: Tephritidae)

RELEASE	
Country	United States of America
Year	1988
Source	Ex. Greece (northern)
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially introduced on *Centaurea solstitialis*, but quickly established on *C. cyanus* as well. *C. cyanus* often used by first generation of insects at time when seed heads of intended host, *C. solstitialis*, are not available. At some sites, presence of *C. cyanus* may be requirement to sustain populations of the insect, and attack rates often higher on this plant compared to *C. solstitialis*. Can reduce seed production by up to 70% at sites in WA, though overall it is not leading to control.
Research Organization	USDA (7), State (9,14,15)
References	76, 78, 79, 332, 334, 1502, 1513, 1838

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea diffusa* Lam.
Origin	Eurasia
Common Name	diffuse knapweed

AGENT	
Species	*Agapeta zoegana* (L.)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Canada
Year	1982
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	High populations may have significant impact on knapweed populations, especially when in conjunction with other biocontrol agents. Though this agent is widespread throughout BC, densities decrease as distribution/dispersal increase.
Research Organization	AAFC
References	117, 153, 432, 1299, 1315, 1724

TABLE 1

ASTERACEAE
Centaurea diffusa; Agapeta zoegana (continued)

RELEASE

Country	United States of America
Year	1984
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Principal host *Centaurea stoebe* sens. lat. which it does not damage appreciably. Damages *C. diffusa* to an even lesser extent.
Research Organization	USDA (10,14), State (6,7,9,15)
References	332, 334, 335, 490, 1509, 1578, 1731, 1735

AGENT

Species	*Bangasternus fausti* (Reitter)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1990
Source	Ex. Greece
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Can destroy up to 100% of the seed in attacked capitula. However, abundance limited, not likely due to interspecific competition. Prefers hot, dry areas and does not do well in areas with prolonged rain or at high elevations. Other causes limiting success not well known.
Limiting Factors	Climate; Elevation
Research Organization	USDA (7,10), State (9,14,15)
References	332, 335, 708, 928, 1105, 1502, 1700, 1729, 1735

ASTERACEAE
Centaurea diffusa (continued)

AGENT

Species	*Cyphocleonus achates* (Fåhraeus)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Canada
Year	1987
Source	Ex. Austria, Hungary, Romania
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Preferred host is *Centaurea stoebe* sens. lat. so although distributed widely throughout BC, populations limited on *C. diffusa*. Does best in hot and dry climates with loose soil and in patches with open canopy. Significantly reduced plant density, size, and reproductive output in caged field experiment.
Limiting Factors	Habitat
Research Organization	AAFC
References	117, 150, 153, 432, 1315, 1724, 1870

RELEASE

Country	United States of America
Year	1988
Source	Ex. Austria, Hungary, Romania
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized

(continued on next page)

ASTERACEAE
Centaurea diffusa; Cyphocleonus achates (continued)

Country	United States of America (continued)
Notes	Principal host is *Centaurea stoebe* sens. lat.; also damages *C. diffusa* but to lesser extent so is less abundant on this species. Impacts to *C. diffusa* not studied extensively, but likely less important than other agents (particularly *Larinus* spp.). Impacts also likely greater under drought conditions when plants less capable of compensation.
Research Organization	USDA (10), State (7,15)
References	332, 334, 335, 708, 1105, 1509, 1635, 1727, 1735

AGENT

Species	*Larinus minutus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Canada
Year	1991
Source	Ex. Greece
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding decreases seed output; adult feeding decreases plant function. High weevil populations correspond to widespread decreases in density and cover of *Centaurea diffusa*, which is preferred host over *C. stoebe* sens. lat. More than 5 years required post release before reductions noticeable. Spreads up to 2km/year.
Research Organization	AAFC
References	150, 153, 432, 1315, 1724, 1870

ASTERACEAE
Centaurea diffusa; Larinus minutus (continued)

RELEASE

Country	United States of America
Year	1991
Source	Ex. Greece, Romania
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding decreases seed output, adult feeding decreases plant function. Causes widespread decreases in density of *Centaurea diffusa*, which is preferred host over *C. stoebe* sens. lat. Replacing *Bangasternus fausti* at many CA sites. Mice predation can be high at some sites.
Limiting Factors	Predation
Research Organization	USDA (10,14), State (9,14,15), USDA-APHIS
References	39, 332, 334, 335, 928, 1074, 1105, 1635, 1735, 2018

AGENT

Species	*Larinus obtusus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1992
Source	Ex. Romania, Serbia
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued on next page)

TABLE 1

TABLE 1

ASTERACEAE
Centaurea diffusa; Larinus obtusus *(continued)*

Country	United States of America (continued)
Notes	Principal host is *Centaurea stoebe* sens. lat., but also damages *C. jacea* nothosubsp. *pratensis* and *C. diffusa* to lesser extent. Limits seed production, but not as important as *Larinus minutus* on this species.
Research Organization	State (9,15), USDA (10)
References	335, 1635, 1735

AGENT

Species	*Metzneria paucipunctella* Zeller
Classification	(Lepidoptera: Gelechiidae)

RELEASE

Country	Canada
Year	1981
Source	Ex. Switzerland
Established	Yes
Abundance	Rare
General Impact	None
Notes	Preferred host is *Centaurea stoebe* sens. lat. Only rarely found in C. *diffusa* seed heads when both weeds grow together.
Other Species Attacked	Also attacks the invasive *Centaurea jacea* L. nothosubsp. *pratensis* (W.D.J. Koch) Čelak.
Research Organization	AAFC
References	117, 153, 432, 739

ASTERACEAE
Centaurea diffusa; Metzneria paucipunctella *(continued)*

RELEASE

Country	United States of America
Year	1980
Source	Ex. Switzerland via Canada
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Principal host is *Centaurea stoebe* sens. lat., but spread naturally and damages *C. diffusa* to a lesser extent. Typically less than 5% seed heads attacked; overall seed reduction minor.
Research Organization	State (9,15)
References	332, 335, 1502, 1578, 1729, 1732, 1735

AGENT

Species	*Pelochrista medullana* (Staudinger)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Canada
Year	1982
Source	Ex. Austria
Established	No
Notes	Preferred host is *Centaurea diffusa*, but establishment not confirmed on either *C. diffusa* or *C. stoebe* sens. lat. Failure likely due to overwintering mortality.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 153, 432

ASTERACEAE
Centaurea diffusa; Pelochrista medullana *(continued)*

RELEASE	
Country	United States of America
Year	1984
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Has been very slow to establish for unknown reasons.
Research Organization	USDA (7,10), State (7)
References	897, 1731, 1732, 1735

AGENT	
Species	*Pterolonche inspersa* Staudinger
Classification	(Lepidoptera: Pterolonchidae)

RELEASE	
Country	Canada
Year	1986
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Successfully dispersed up to 20km from some release sites. Dispersal limited by widely spaced *Centaurea* patches, and populations limited to arid climate with period of summer drought. Stunts plants and may reduce number and size of inflorescences though overall impact has not been separated from other agents.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 152, 153, 432

ASTERACEAE
Centaurea diffusa; Pterolonche inspersa *(continued)*

RELEASE	
Country	United States of America
Year	1986
Source	Ex. Austria, Hungary, Greece
Established	Yes
Abundance	Rare
General Impact	None
Notes	Though still exists in one region in OR, has dwindled to low levels because of dramatic control of *Centaurea diffusa* by *Larinus* spp.
Research Organization	USDA (7,10,12), State (6,7,9,15)
References	39, 332, 334, 335, 897, 1735

AGENT	
Species	*Sphenoptera jugoslavica* Obenberger
Classification	(Coleoptera: Buprestidae)

RELEASE	
Country	Canada
Year	1976
Source	Ex. Greece (northern)
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Preferred host is *Centaurea diffusa*, on which it is widely distributed through driest range of weed. At high beetle densities can decrease weed stature and seed production, and reduce densities of seedlings and rosettes. Beetle populations can fluctuate within sites, leading to isolated impacts. Best in combination with other biocontrol agents.

(continued on next page)

TABLE 1

ASTERACEAE
Centaurea diffusa; Sphenoptera jugoslavica (continued)

Country	Canada (continued)
Limiting Factors	Climate
Research Organization	UBC
References	117, 153, 432, 739, 742, 1299, 1525, 1724

RELEASE	
Country	United States of America
Year	1980
Source	Ex. Greece
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread in CA, CO, ID, MT, OR, and WA but limited in NV, UT, WY and elsewhere. Causes some reductions in plant density and seed output, especially among competing vegetation. Does best at hot, dry sites.
Limiting Factors	Climate
Research Organization	USDA (7,10,14), State (6,7,9,14,15), USDA-APHIS
References	39, 74, 332, 335, 897, 928, 1501, 1509, 1578, 1635, 1731, 1735

ASTERACEAE
Centaurea diffusa (continued)

AGENT	
Species	*Subanguina picridis* (Kirjanova) Brzeski
Past Names/Synonyms	*Paranguina picridis* (Kirjanova) Kirjanova & Ivanova, *Mesoanguina picridis* (Kirjanova) Chizhov & Subbotin
Classification	(Tylenchida: Anguinidae)

RELEASE	
Country	Canada
Year	1985
Source	Ex. Kazakhstan
Established	No
Notes	Redistributed from *Rhaponticum repens* to *Centaurea diffusa* but failed to establish.
Research Organization	AAFC
References	117, 735, 1944

AGENT	
Species	*Urophora affinis* (Frauenfeld)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1970
Source	Ex. France
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

ASTERACEAE
Centaurea diffusa; Urophora affinis *(continued)*

Country	Canada (continued)
Notes	High fly populations create numerous galls that stunt plant growth and decrease seed production. Still, no apparent decline in plant density even though flies reduce knapweed seed production substantially.
Research Organization	AAFC, UBC
References	152, 153, 432, 727, 728, 739, 742, 1299, 1315

RELEASE

Country	Canada
Year	1972
Source	Ex. Russia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	No longer differentiated from first release. High fly populations create numerous galls that stunt plant growth and decrease seed production. Still, no apparent decline in plant density even though flies reduce knapweed seed production substantially.
Research Organization	AAFC, UBC
References	152, 153, 432, 727, 728, 739, 742, 1299, 1315

ASTERACEAE
Centaurea diffusa; Urophora affinis *(continued)*

RELEASE

Country	United States of America
Year	1973
Source	Ex. Austria, France; Ex. Russia, France via Canada
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Well established throughout most *Centaurea diffusa* and *C. stoebe* sens. lat.-infested areas of USA, particularly the Northwest. More abundant than *Urophora quadrifasciata* but together contribute to seed reduction of more than 50% at some sites. Seed reduction may retard the rate at which weed spreads, but has not appreciably lowered stand density because sufficient seeds remain. Not considered as important or effective as *Larinus* spp. on this weed, and frequently inferior competitor to *Larinus* spp. and *Metzneria*. Being displaced by other seed feeders in CA.
Limiting Factors	Interspecific competition
Research Organization	USDA (7,10,14), State (6,7,9,13,14,15)
References	39, 83, 332, 335, 728, 1501, 1509, 1578, 1635, 1731, 1735, 2018

TABLE 1

TABLE 1

ASTERACEAE
Centaurea diffusa (continued)

AGENT	
Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1972
Source	Ex. Russia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	High fly populations create numerous galls that stunt plant growth and decrease seed production. Still, no apparent decline in plant density even though flies reduce knapweed seed production substantially.
Research Organization	AAFC, UBC
References	153, 432, 727, 728, 739, 742, 1299, 1315

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea iberica* Trevir. ex Spreng.
Origin	Eurasia
Common Name	Iberian starthistle

AGENT	
Species	*Bangasternus orientalis* (Capiomont)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	United States of America
Year	1994
Source	Ex. Greece
Established	No
Notes	Redistributed from *Centaurea solstitialis* to *C. iberica* but did not establish.
Research Organization	State (14,22)
References	1130, 2026

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Centaurea jacea* L. nothosubsp. *pratensis* (W.D.J. Koch) Čelak.
Past Names/Synonyms	*Centaurea* ×*moncktonii* C. E. Britton, *Centaurea jacea* x *nigra*
Incorrect Past Names/Synonyms	*Centaurea pratensis* auct. N. Amer.
Notes	Meadow knapweed represents an array of intermediates derived by hybridization and backcrossing among the various cytotypes of the *Centaurea jacea* complex.
Origin	Europe
Common Name	meadow knapweed, Protean knapweed, Bemis grass
References	974

AGENT

Species	*Bangasternus fausti* (Reitter)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1998
Source	Ex. Greece
Established	No
Notes	Redistributed from other *Centaurea* spp. to *C. jacea* nothosubsp. *pratensis* but failed to establish.
Research Organization	State (14,15)
References	335, 1512, 1735, 1899

ASTERACEAE
Centaurea jacea nssp. *pratensis* *(continued)*

TABLE 1

AGENT

Species	*Cyphocleonus achates* (Fåhraeus)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1998
Source	Ex. Austria, Hungary, Romania
Established	No
Notes	Redistributed from other *Centaurea* spp. to *C. jacea* nothosubsp. *pratensis* but failed to establish.
Research Organization	State (14,15)
References	335, 1727, 1897, 1899

AGENT

Species	*Larinus minutus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1998
Source	Ex. Greece, Romania
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

TABLE 1

ASTERACEAE
Centaurea jacea* nssp. *pratensis*; *Larinus minutus *(continued)*

Country	United States of America (continued)
Notes	Spread naturally and artificially from other *Centaurea* spp. to *C. jacea* nothosubsp. *pratensis*. 76% of seed heads attacked by *Larinus* spp. in CA with majority of seeds eaten, though whether this affects overall population unknown. Lower abundance and impact in OR and WA. Differentiation between brown and meadow knapweed often difficult in WA and other parts of Pacific Northwest. Additional attention required to confirm identities of past reported infestations.
Research Organization	State (9,15), USDA (7)
References	38, 39, 334, 335, 1074, 1512, 1899, 2020

AGENT

Species	*Larinus obtusus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1999
Source	Ex. Romania, Serbia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Centaurea jacea* nssp. *pratensis*; *Larinus obtusus *(continued)*

Country	United States of America (continued)
Notes	Spread naturally and artificially from other *Centaurea* spp. to *C. jacea* nothosubsp. *pratensis*. 76% of seed heads attacked by *Larinus* spp. in CA with majority of seeds eaten, though whether this affects overall population unknown. Lower abundance and impact in OR and WA. Differentiation between brown and meadow knapweed often difficult in WA and other parts of Pacific Northwest. Additional attention required to confirm identities of past reported infestations.
Research Organization	USDA (10), State (9,14,15)
References	38, 39, 334, 335, 1735, 2020

AGENT

Species	*Metzneria paucipunctella* Zeller
Classification	(Lepidoptera: Gelechiidae)

RELEASE

Country	United States of America
Year	1983
Source	Ex. Switzerland via Canada
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Principal host is *Centaurea stoebe* sens. lat., but damages *C. jacea* nothosubsp. *pratensis* to a lesser extent. Overall seed reduction minor and populations decreasing due to impact of *Larinus obtusus*.
Limiting Factors	Interspecific competition
Research Organization	State (15)
References	332, 334, 1735

ASTERACEAE
Centaurea jacea nssp. *pratensis* (continued)

AGENT	
Species	*Sphenoptera jugoslavica* Obenberger
Classification	(Coleoptera: Buprestidae)

RELEASE	
Country	United States of America
Year	1998
Source	Ex. Greece
Established	No
Notes	Redistributed from other *Centaurea* spp. to *C. jacea* nothosubsp. *pratensis* but failed to establish.
Research Organization	State (15)
References	335, 1735

ASTERACEAE
Centaurea jacea nssp. *pratensis* (continued)

AGENT	
Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1987
Source	Ex. Russia
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	More commonly found on *Centaurea stoebe* sens. lat. than *C. jacea* nothosubsp. *pratensis*. High fly populations on the former create numerous galls that stunt plant growth and decrease seed production. Still, no apparent decline in plant density even though flies reduce knapweed seed production substantially. Impact on *C. jacea* nothosubsp. *pratensis* is likely even less.
Research Organization	AAFC
References	117, 153, 432, 727, 728, 739, 1299

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea jacea* L. subsp. *jacea*
Past Names/Synonyms	*Centaurea jacea* L.
Origin	Europe
Common Name	brown knapweed
AGENT	
Species	*Larinus obtusus* Gyllenhal
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	United States of America
Year	2004
Source	Ex. Romania, Serbia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally released on other *Centaurea* spp. Principal host is *Centaurea stoebe* sens. lat., but also damages seeds of other *Centaurea* spp., though to lesser extent. Spread naturally from *Centaurea jacea* nothosubsp. *pratensis* to *C. jacea* subsp. *jacea*. High attack rates in OR providing good to moderate control for all of *C. jacea* nothosubsp. *pratensis*, *C. jacea* subsp. *jacea*, and *C. jacea* subsp. *nigra* in OR where weed infestations often made up of mix of these three species.
Research Organization	State (9,15), USDA (10)
References	335, 1735

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea jacea* L. subsp. *nigra* (L.) Bonnier & Layens
Past Names/Synonyms	*Centaurea nigra* L.
Origin	Europe
Common Name	black knapweed
AGENT	
Species	*Larinus obtusus* Gyllenhal
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	United States of America
Year	2004
Source	Ex. Romania, Serbia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally released on other *Centaurea* spp. Principal host is *Centaurea stoebe* sens. lat., but also damages seeds of other *Centaurea* spp., though to lesser extent. Spread naturally from *Centaurea jacea* nothosubsp. *pratensis* to *C. jacea* subsp. *nigra*. High attack rates in OR providing good to moderate control for all of *C. jacea* nothosubsp. *pratensis*, *C. jacea* subsp. *jacea*, and *C. jacea* subsp. *nigra* in OR where weed infestations often made up of mix of these three species.
Research Organization	State (9,15), USDA (10)
References	335, 1735

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea solstitialis* L.
Origin	Eurasia, Mediterranean
Common Name	yellow starthistle

AGENT	
Species	*Bangasternus orientalis* (Capiomont)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	United States of America
Year	1985
Source	Ex. Greece (northern)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially most widespread of established agents. Larval feeding typically destroys 60% of seeds within attacked seed heads. However, densities of the weevil have been declining since their peak a few years after initial release; current attack rate only 1% of available capitula. Predation, parasitism, and displacement by other established agents limit populations in some areas.
Limiting Factors	Interspecific competition; Parasitism; Predation
Research Organization	USDA (7,12), State (6,9,14,15)
References	124, 334, 335, 1130, 1513, 1515, 1578, 1835, 2026

ASTERACEAE
Centaurea solstitialis *(continued)*

AGENT	
Species	*Chaetorellia australis* Héring
Classification	(Diptera: Tephritidae)

RELEASE	
Country	United States of America
Year	1988
Source	Ex. Greece (northern)
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding destroys up to 90% of seeds within attacked seed heads. However, attack rates have typically have not exceeded 10% of available capitula, likely due to poor synchrony with *Centaurea solstitialis*. Spring emerging flies often rely on *C. cyanus* because seed heads of *C. solstitialis* not yet available, which limits effectiveness and distribution of this insect. Abundance varies, often in relation to *C. cyanus* presence.
Limiting Factors	Agent-host synchronization
Research Organization	USDA (7,12), State (6,9,14,15)
References	76, 78, 334, 335, 1513, 1514, 1767, 1838

TABLE 1

ASTERACEAE
Centaurea solstitialis *(continued)*

AGENT	
Species	*Eustenopus villosus* (Boheman)
Incorrect Past Names/Synonyms	*Eustenopus hirtus* cf. *abbreviatus* Faust, *Eustenopus hirtus* (Waltl)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	United States of America
Year	1990
Source	Ex. Greece (northern)
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding destroys up to 100% of seeds within attacked seed heads. Adult feeding causes abortion of attacked seed heads, having the largest total effect on the weed's fecundity. However, bud herbivory reduces plant's attractiveness to ovipositing seed predators, reducing direct negative effects of bud herbivory. In conjunction with *Chaetorellia succinea*, can reduce seed production by >70% overall. Only at low initial plant densities can this impact population growth; at many study sites plants compensate for decreased seedling density by growing larger and producing more seeds. Consumes higher proportion of seeds when plants uninfected with *Puccinia jacea* var. *solstitialis*. Parasitism and predation negates impact at some sites.
Limiting Factors	Parasitism; Predation
Research Organization	USDA (7,12), State (6,9,14,15)
References	327, 332, 334, 335, 573, 616, 723, 1369, 1513, 1514, 1515, 1764, 1765, 1766, 1767, 1890, 1892

ASTERACEAE
Centaurea solstitialis *(continued)*

AGENT	
Species	*Larinus curtus* Hochhut
Classification	(Coleoptera: Curculionidae)
Notes	USDA-APHIS revoked permits in 2009 for the interstate transportation of *Larinus curtus* due to concerns of spreading *Nosema*, an internal parasite.
References	334

RELEASE	
Country	United States of America
Year	1992
Source	Ex. Greece (northern)
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding destroys up to 100% of seeds within attacked seed heads. However, attack rates typically low in field. Abundance plateaued within few years of introductions; now varies from high in portions of OR, to moderate in WA, and becoming more limited in ID and CA. Less abundant than other seed feeding agents which have been unable to impact *Centaurea solstitialis* population trajectories. Some weevil populations limited by *Nosema* sp. protozoans.
Limiting Factors	Parasitism
Research Organization	USDA, State (6,9,14,15)
References	39, 124, 332, 335, 616, 1513, 1514, 1515, 1705, 1764, 1835, 1891

ASTERACEAE
Centaurea solstitialis *(continued)*

AGENT	
Species	*Puccinia jacea* var. *solstitialis* Savile
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	United States of America
Year	2003
Source	Ex. Turkey
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Under optimal conditions (moist, mild temperatures) can reduce biomass and number of capitula, especially in conjunction with high plant competition. At drier sites, impact decreased and likely to be of only minor biological significance. Across much of weed's range, suboptimal conditions for rust prevent its persistence and/or significant impact. Infection by this rust sometimes additive with effects of seed predators; under other conditions indirectly causes reduction of seed predation which can cancel out entirely the direct negative impact of the rust.
Limiting Factors	Climate
Research Organization	State (15,22), USDA (2,7)
References	334, 335, 565, 566, 567, 1369, 1763, 1767, 2022, 2023

ASTERACEAE
Centaurea solstitialis *(continued)*

TABLE 1

AGENT	
Species	*Urophora jaculata* Rondani
Classification	(Diptera: Tephritidae)

RELEASE	
Country	United States of America
Year	1969
Source	Ex. Italy
Established	No
Notes	Released in belief it was *Urophora sirunaseva*. Failed to establish because *U. jaculata* is specific to *Centaurea solstitialis* populations in Italy.
Limiting Factors	Specificity
Research Organization	USDA (7,12), State (4,14)
References	1835, 1965

AGENT	
Species	*Urophora sirunaseva* (Héring)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	United States of America
Year	1984
Source	Ex. Greece (northern)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

ASTERACEAE
Centaurea solstitialis; Urophora sirunaseva (continued)

Country	United States of America (continued)
Notes	Gall formation decreases seed production, though multiple galls required per seed head before seed reduction is significant. High gall density per capitulum not common. Though widely distributed, abundance low. Attack rates have decreased from peaks around 50% within few years following successful establishment to usually around 10%. Overall impact limited. Populations at some sites hindered due to competition with other seed head agents.
Limiting Factors	Interspecific competition
Research Organization	USDA (7,12), State (6,9,14,15)
References	124, 332, 334, 335, 1513, 1514, 1515, 1767, 1839, 2029

RELEASE

Country	United States of America
Year	1984
Source	Ex. Turkey
Established	No
References	1800

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Centaurea stoebe* L. sens. lat.
Past Names/Synonyms	*Centaurea stoebe* L. subsp. *micranthos* (Gulger) Hayek, *Centaurea maculosa* Lam.
Notes	The two cytotypes of *Centaurea stoebe* L. sens. lat. are recognized as different species: *C. stoebe* L. is the appropriate name for the diploid form present throughout Europe while the appropriate nomenclature for the tetraploid form invasive in North America remains to be resolved. The editors of this catalogue will refer to this species as *Centaurea stoebe* sens. lat. until the resolution is made.
Origin	Eurasia
Common Name	spotted knapweed
References	1296

AGENT

Species	*Agapeta zoegana* (L.)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Canada
Year	1982
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Variable

(continued on next page)

ASTERACEAE
Centaurea stoebe; Agapeta zoegana *(continued)*

RELEASE

Country	Canada (continued)
Notes	High populations may have significant impact on knapweed populations, especially when in conjunction with *Cyphocleonus achates* and *Larinus* spp. However, though this agent is widespread throughout BC, densities decrease as distribution/dispersal increase.
Research Organization	AAFC
References	117, 153, 432, 1299

RELEASE

Country	United States of America
Year	1984
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Can cause significant reduction in above-ground biomass and number of capitula per plant, but has not demonstrated any obvious effect on plant density. Expected to primarily affect large plants.
Research Organization	USDA (7,10), State (6,7,9,14,15), USDA-APHIS
References	335, 708, 1105, 1509, 1578, 1701, 1728, 1732, 1733, 1734, 1735, 2025

ASTERACEAE
Centaurea stoebe *(continued)*

AGENT

Species	*Bangasternus fausti* (Reitter)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1992
Source	Ex. Greece
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Redistributed from *Centaurea diffusa* to *C. stoebe* sens. lat. Can destroy up to 100% of seed in attacked capitula. However, abundance limited, not likely due to interspecific competition. Prefers hot, dry areas and does not do well in areas with prolonged rain or at high elevations. Other causes limiting success not well known.
Limiting Factors	Climate; Elevation
Research Organization	USDA (10), State (15)
References	332, 335, 708, 1700, 1728, 1729, 1735

TABLE 1

ASTERACEAE
Centaurea stoebe *(continued)*

AGENT	
Species	*Chaetorellia acrolophi* White & Marquardt
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1991
Source	Ex. Switzerland
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially believed to have failed, but establishment confirmed in 2008.
Research Organization	AAFC
References	117, 150, 153

RELEASE	
Country	United States of America
Year	1992
Source	Ex. Austria, Switzerland
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding reduces seed production, however densities limited throughout established range so overall impact minimal. In ID, populations do not vary with abundance of other agents; at some OR sites interspecific competition limits populations.
Limiting Factors	Interspecific competition
Research Organization	State (9,15), USDA (10)
References	332, 335, 708, 1502, 1728, 1735, 2001

ASTERACEAE
Centaurea stoebe *(continued)*

AGENT	
Species	*Cyphocleonus achates* (Fåhraeus)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Canada
Year	1987
Source	Ex. Austria, Hungary, Romania
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Found at higher densities on this species compared to *Centaurea diffusa*. Does best in hot and dry climates with loose soil and in patches with open canopy. High weevil populations can decrease knapweed density and stature, though evidence supporting this is anecdotal. Impact greatest in conjunction with other biocontrol agents. Adults sedentary, moving 0.27m/day.
Limiting Factors	Habitat
Research Organization	AAFC
References	117, 150, 153, 432

TABLE 1

ASTERACEAE
Centaurea stoebe; Cyphocleonus achates *(continued)*

RELEASE	
Country	United States of America
Year	1988
Source	Ex. Austria, Hungary, Romania
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Abundance and impact vary. In some locations, has been attributed with reducing *Centaurea stoebe* longevity, reproductive output, and density. In other studies, reproductive output unchanged, and decreased adult densities (where present) leads to increased seedling recruitment and no change in population overall. Numerous studies claim agent can be effective, but largely in combination with *Larinus* spp. (most important), with high plant competition, under dry conditions, and in loose soil.
Limiting Factors	Climate; Habitat
Research Organization	USDA (10), State (7,9,14,15), USDA-APHIS
References	332, 335, 898, 1004, 1005, 1105, 1406, 1727, 1728, 1733, 1735, 1744, 2025, 2035

ASTERACEAE
Centaurea stoebe *(continued)*

AGENT	
Species	*Larinus minutus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Canada
Year	1991
Source	Ex. Greece
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Frequently occurs in mixed populations with *Larinus obtusus*. Preferred host is *Centaurea diffusa* so although distributed widely throughout BC, populations are limited on *C. stoebe* sens. lat. Where populations sufficiently large, may decrease seed output and plant stature from larval and adult feeding, respectively.
Research Organization	AAFC
References	117, 150, 153, 432

RELEASE	
Country	United States of America
Year	1991
Source	Ex. Greece, Romania
Established	Yes
Abundance	Variable
General Impact	Variable

(continued on next page)

TABLE 1

ASTERACEAE
Centaurea stoebe; Larinus minutus *(continued)*

Country	United States of America (continued)
Notes	Populations slower to build on this species compared to *Centaurea diffusa*. Abundance high in Pacific Northwest and portions of CO, limited in UT. Larval feeding decreases seed output, adult feeding decreases plant function. Weed may compensate early in season and in periods of excess precipitation, but during droughts and late in season impacts on population often significant. Works well in conjunction with high competing vegetation and *Cyphocleonus achates* but *Larinus minutus* and *L. obtusus* cause greater impact than *C. achates* at many sites.
Limiting Factors	Predation; Climate; Habitat
Research Organization	USDA (7,10), State (9,14,15)
References	39, 332, 335, 490, 1005, 1074, 1105, 1728, 1735, 1736, 2025, 2035

AGENT

Species	*Larinus obtusus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Canada
Year	1992
Source	Ex. Romania
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Centaurea stoebe; Larinus obtusus *(continued)*

Country	Canada (continued)
Notes	Frequently occurs in mixed populations with *Larinus minutus*. Larval feeding decreases seed output, adult feeding decreases plant function. High weevil populations correspond to widespread density decreases of *Centaurea stoebe* sens. lat. Prefers moister conditions, so has smaller distribution than *L. minutus*.
Limiting Factors	Habitat
Other Species Attacked	Also attacks the invasive *Centaurea jacea* L. nothosubsp. *pratensis* (W.D.J. Koch) Čelak.
Research Organization	AAFC
References	117, 153, 432

RELEASE

Country	United States of America
Year	1992
Source	Ex. Romania, Serbia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Larval feeding decreases seed output, adult feeding decreases plant function. Very effective in OR, decreasing in abundance and efficacy in WA and ID. Along with *Larinus minutus* infests 47% seed heads in MT, contributing to 84-90% reductions in seed production along with *Urophora* spp. Still insufficient to reduce plant density at many sites even where abundance high.
Research Organization	USDA (10), State (9,15)
References	39, 332, 335, 1105, 1728, 1735, 1736

ASTERACEAE
Centaurea stoebe *(continued)*

AGENT

Species	*Metzneria paucipunctella* Zeller
Classification	(Lepidoptera: Gelechiidae)

RELEASE

Country	Canada
Year	1973
Source	Ex. Switzerland
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Contributes to overall consumer pressure on knapweed seed heads, but generally not at levels sufficient to decrease weed populations. Limited population growth likely due to predation and overwintering mortality.
Limiting Factors	Climate; Predation
Other Species Attacked	Also attacks the invasive *Centaurea jacea* L. nothosubsp. *pratensis* (W.D.J. Koch) Čelak.
Research Organization	AAFC, UBC
References	117, 153, 432, 739, 1469

RELEASE

Country	United States of America
Year	1980
Source	Ex. Switzerland via Canada
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Centaurea stoebe; Metzneria paucipunctella *(continued)*

Country	United States of America (continued)
Notes	Limited in CO MT and VA. Widespread in ID OR WA where reduces seed production, but less than *Urophora* spp. Suffers from high overwintering mortality, predation, and parasitism.
Limiting Factors	Climate; Parasitism; Predation
Research Organization	USDA (7,10), State (1,6,7,9,15)
References	39, 332, 335, 1175, 1578, 1728, 1729, 1731, 1732, 1735, 1736

AGENT

Species	*Pelochrista medullana* (Staudinger)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Canada
Year	1986
Source	Ex. Austria
Established	No
Notes	Preferred host is *Centaurea diffusa*; establishment not confirmed on either *C. diffusa* or *C. stoebe* sens. lat. Failure likely due to overwintering mortality.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 153, 432

TABLE 1

TABLE 1

ASTERACEAE
Centaurea stoebe; Pelochrista medullana (continued)

RELEASE	
Country	United States of America
Year	1984
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Has been very slow to establish for unknown reasons.
Research Organization	USDA (7), State (7)
References	334, 1728, 1732, 1735

AGENT	
Species	*Pterolonche inspersa* Staudinger
Classification	(Lepidoptera: Pterolonchidae)

RELEASE	
Country	Canada
Year	1987
Source	Ex. Hungary, Austria
Established	No
Notes	Preferred host is *Centaurea diffusa*. Released on *C. stoebe* sens. lat. and initially recovered, but not observed on this species in recent years even when it is growing among moth-infested *C. diffusa*.
Research Organization	AAFC
References	117, 152, 153, 432

ASTERACEAE
Centaurea stoebe; Pterolonche inspersa (continued)

RELEASE	
Country	United States of America
Year	1988
Source	Ex. Hungary
Established	No
Research Organization	USDA (7,10), State (7,9,15)
References	335, 1728, 1732

AGENT	
Species	*Sphenoptera jugoslavica* Obenberger
Classification	(Coleoptera: Buprestidae)

RELEASE	
Country	Canada
Year	1987
Source	Ex. Greece (northern)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Redistributed from *Centaurea diffusa* to *C. stoebe* sens. lat. Preferred host is *C. diffusa*, but can be found on *C. stoebe* sens. lat. growing in hot dry areas where the beetle decreases seed production and plant stature. Most *C. stoebe* sens. lat. infestations too moist to support beetle populations.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 153, 432

TABLE 1

ASTERACEAE
Centaurea stoebe; Sphenoptera jugoslavica *(continued)*

RELEASE	
Country	United States of America
Year	1987
Source	Ex. Greece
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Preferred host is *Centaurea diffusa* but spread naturally and artificially to *C. stoebe* sens. lat. which it attacks to lesser extent. Limited distribution and poor efficacy in most states. Widespread in OR and moderate in WA; attack rates at both are good at some sites and may be displacing *Agapeta zoegana* at some locations.
Research Organization	USDA (10), State (15)
References	39, 332, 334, 335, 708, 1105, 1635, 1729, 1735, 1752

AGENT	
Species	*Terellia virens* (Loew)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1991
Source	Ex. Austria, Switzerland
Established	No
Notes	Established initially, but flies not recovered in recent monitoring efforts. Competition with other biocontrol agents likely responsible.
Limiting Factors	Interspecific competition
Research Organization	AAFC
References	117, 153

ASTERACEAE
Centaurea stoebe; Terellia virens *(continued)*

RELEASE	
Country	United States of America
Year	1992
Source	Ex. Austria, Switzerland
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Appears to be having difficult time establishing at many sites because of competition with *Urophora* spp. and *Larinus* spp. Causes only minor reductions in seed production.
Limiting Factors	Interspecific competition
Other Species Attacked	Attacks *Centaurea diffusa* Lam. to a lesser extent.
Research Organization	USDA (10,17), State (9,14,15)
References	39, 332, 335, 1105, 1728, 1735, 2025, 2027, 2028

AGENT	
Species	*Urophora affinis* (Frauenfeld)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1970
Source	Ex. France
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

ASTERACEAE
Centaurea stoebe; Urophora affinis *(continued)*

Country	Canada (continued)
Notes	High fly populations create numerous galls that stunt plant growth and decrease seed production. Still, no apparent decline in plant density even though flies reduce knapweed seed production substantially.
Research Organization	AAFC
References	153, 432, 727, 728, 739, 742, 1299

RELEASE

Country	United States of America
Year	1973
Source	Ex. Austria, France; Ex. Russia, France via Canada
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Well established throughout most *Centaurea diffusa* and *C. stoebe* sens. lat.-infested areas of USA, particularly the Northwest. More abundant than *Urophora quadrifasciata* but together contribute to seed reduction of more than 50% at some sites. Seed reduction may retard rate at which weed spreads, but has not appreciably lowered stand density because sufficient seeds remain. At other sites, direct effect of *Urophora* galls on seed production negligible. Not considered as important or effective as *Larinus* spp. on this weed, and frequently inferior competitor to *Larinus* spp. and *Metzneria*.
Limiting Factors	Interspecific competition
Research Organization	USDA (1,7,10), State (6,7,9,13,15)
References	39, 332, 334, 335, 728, 1005, 1501, 1578, 1728, 1732, 1735, 1736, 1992, 2001, 2025

ASTERACEAE
Centaurea stoebe *(continued)*

AGENT

Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

RELEASE

Country	Canada
Year	1975
Source	Ex. Russia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally released on *Centaurea diffusa* but naturally spread to *C. stoebe* sens. lat. by 1975 and intentionally redistributed thereafter. High fly populations create numerous galls that stunt plant growth and decrease seed production. Still, no apparent decline in plant density even though flies reduce knapweed seed production substantially.
Research Organization	AAFC, UBC, MU
References	153, 432, 727, 728, 739, 742, 1299

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Centaurea virgata* Lam. subsp. *squarrosa* (Boiss.) Gugler
Past Names/Synonyms	*Centaurea squarrosa* Willd.
Origin	Eurasia, Asia Minor
Common Name	squarrose knapweed

AGENT

Species	*Agapeta zoegana* (L.)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	United States of America
Year	1994
Source	Ex. Austria, Hungary
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	USDA (10), State (21)
References	335, 490, 1578, 1735

ASTERACEAE
Centaurea virgata ssp. *squarrosa* *(continued)*

AGENT

Species	*Bangasternus fausti* (Reitter)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1993
Source	Ex. Greece
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Redistributed from *Centaurea diffusa* to *C. virgata* subsp. *squarrosa*. Can destroy up to 100% of seed in attacked capitula. Attack rates increasing in CA. Believed to be contributing to significant control of this weed in conjunction with *Larinus minutus*, though expected to replace *L. minutus* at most sites due to earlier emergence. Abundance limited in UT.
Limiting Factors	Climate; Elevation
Research Organization	State (14,15)
References	490, 1105, 1735, 1912, 1913, 2019, 2030, 2031, 2033, 2034

TABLE 1

TABLE 1

ASTERACEAE
***Centaurea virgata* ssp. *squarrosa* (continued)**

AGENT

Species	*Cyphocleonus achates* (Fåhraeus)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1995
Source	Ex. Austria, Hungary, Romania
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially introduced onto *Centaurea stoebe* sens. lat. (primary host) and *C. diffusa*. Redistributions attempted on *C. virgata* subsp. *squarrosa* with unknown establishment.
Research Organization	USDA (16), State (7), USAE
References	335, 1727, 1897, 2033, 2034

AGENT

Species	*Larinus minutus* Gyllenhal
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1997
Source	Ex. Greece, Romania
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized

(continued at top of next column)

ASTERACEAE
***Centaurea virgata* ssp. *squarrosa; Larinus minutus* (continued)**

Country	United States of America (continued)
Notes	Initially introduced onto *Centaurea stoebe* sens. lat. and *C. diffusa*. Redistributions attempted on *C. virgata* subsp. *squarrosa*. Attacks over 90% of seed heads at some sites in CA, destroying up to 100% seeds in attacked capitula. Believed to be contributing to significant control of this weed in conjunction with *Bangasternus fausti*, though expected to be replaced by *B. fausti* at most sites due to later emergence. Status in UT unknown.
Research Organization	State (14)
References	335, 1074, 1912, 1913, 2019, 2030, 2031, 2033

AGENT

Species	*Pterolonche inspersa* Staudinger
Classification	(Lepidoptera: Pterolonchidae)

RELEASE

Country	United States of America
Year	1990
Source	Ex. Greece
Established	No
Notes	Eggs distributed to *Centaurea virgata* subsp. *squarrosa* but failed to establish.
Research Organization	USDA (10), State (21)
References	335, 553, 1105, 1735

ASTERACEAE
Centaurea virgata ssp. *squarrosa* (continued)

AGENT

Species	*Sphenoptera jugoslavica* Obenberger
Classification	(Coleoptera: Buprestidae)

RELEASE

Country	United States of America
Year	1996
Source	Ex. Greece
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Redistributed from *Centaurea diffusa* and *C. stoebe* sens. lat. to *C. virgata* subsp. *squarrosa*. Somewhat widespread and effective against this weed in CA; distribution limited in UT.
Research Organization	State (14)
References	335, 553, 1735, 1912, 1913, 2017, 2033

AGENT

Species	*Terellia virens* (Loew)
Classification	(Diptera: Tephritidae)

RELEASE

Country	United States of America
Year	1998
Source	Ex. Austria, Switzerland
Established	No
Notes	Redistributed from *Centaurea diffusa* and *C. stoebe* sens. lat. to *C. virgata* subsp. *squarrosa* but failed to establish.
References	1728, 1912, 2017

ASTERACEAE
Centaurea virgata ssp. *squarrosa* (continued)

TABLE 1

AGENT

Species	*Urophora affinis* (Frauenfeld)
Classification	(Diptera: Tephritidae)

RELEASE

Country	United States of America
Year	1988
Source	Ex. Austria, France; Ex. Russia, France via Canada
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Spread naturally and artificially from other *Centaurea* spp. to *C. virgata* subsp. *virgata*. Established in only small numbers on this species. Attack rates to *Centaurea diffusa* and *C. stoebe* sens. lat. much higher.
Research Organization	USDA (10), State (15,21)
References	335, 728, 1572, 1578, 1580, 1732, 2017, 2033

TABLE 1

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Chondrilla juncea* L.
Notes	There are three forms of this weed in Australia: narrow-leaf (A) which was initially most common, intermediate-leaf (B), broad-leaf (C). Seven genotypes of this weed are recognized in North America; five in the Pacific Northwest and two on the East Coast.
Origin	Eurasia
Common Name	skeleton weed, rush skeletonweed

AGENT

Species	*Aceria chondrillae* (Canestrini)
Past Names/Synonyms	*Eriophyes chondrillae* (Canestrini)
Classification	(Acari: Eriophyidae)
References	32, 1698

RELEASE

Country	Argentina
Year	1989
Source	Ex. Italy via USA
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	INTA
References	343, 344, 379, 1698

ASTERACEAE
Chondrilla juncea; Aceria chondrillae (continued)

RELEASE

Country	Australia
Year	1971
Source	Ex. Greece
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Established readily but spread slowly requiring widespread redistribution. Largely specific to common, narrow-leaf form of the weed (A), though infrequently attacks form B. Can cause severe stunting and premature death of stems but not uniformly.
Research Organization	CSIRO
References	375, 379, 381, 456

RELEASE

Country	Australia
Year	1985
Source	Ex. Greece
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	This introduction made for intermediate-leaf form of weed (B). Did not provide effective control, but the importance of that form never reached that of the common form (A) and skeleton weed is no longer considered a significant problem.
Research Organization	CSIRO
References	379, 380, 380

TABLE 1

ASTERACEAE
Chondrilla juncea; Aceria chondrillae *(continued)*

RELEASE	
Country	United States of America
Year	1977
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Widespread in OR and WA where reduces flowering and seed production by 50-90%, depending on plant size and environmental conditions. Efficacy limited in CA due to predation and in ID due to high overwintering mortality.
Limiting Factors	Predation; Climate
Research Organization	USDA (7), State (6,9,14,15)
References	334, 335, 1241, 1505, 1508, 1578, 1698, 1749, 2004

AGENT	
Species	*Bradyrrhoa gilveolella* (Treitschke)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Argentina
Year	1992
Source	Ex. Greece
Established	No
Notes	Released in low numbers. Reproduced for one generation after release but subsequently considered failed.
Limiting Factors	Small release size
Research Organization	INTA
References	344, 379

ASTERACEAE
Chondrilla juncea; Bradyrrhoa gilveolella *(continued)*

RELEASE	
Country	Australia
Year	1974
Source	Ex. Greece
Established	No
Notes	Establishment failure due to rearing difficulties and inbreeding of surviving adults.
Research Organization	CSIRO
References	377, 379, 456

RELEASE	
Country	Australia
Year	1978
Source	Ex. Greece
Established	No
Notes	Established initially in ACT, though not recovered since despite numerous additional releases.
Research Organization	CSIRO
References	377, 379, 456

RELEASE	
Country	Canada
Year	2007
Source	Ex. Greece via USA (ID, MT)
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	AAFC
References	117, 437

ASTERACEAE
Chondrilla juncea; Bradyrrhoa gilveolella *(continued)*

RELEASE	
Country	United States of America
Year	2002
Source	Ex. Greece
Established	Yes
Abundance	Moderate
General Impact	Too early post release
Notes	Becoming locally abundant at original ID and OR release sites. Too early to determine impact and dispersal, though large scale monitoring efforts recently initiated. WA status unknown.
Research Organization	State (6,9)
References	334, 968, 1508, 1630

AGENT	
Species	*Cystiphora schmidti* (Rübsaamen)
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	Argentina
Year	1982
Source	Ex. Greece via Australia
Established	No
Research Organization	INTA
References	363, 379, 1356

ASTERACEAE
Chondrilla juncea; Cystiphora schmidti *(continued)*

RELEASE	
Country	Australia
Year	1971
Source	Ex. Greece
Established	Yes
Abundance	High
General Impact	Variable
Notes	Established widely and generally common, complementing damage by *Puccinia chondrillina*. In early spring/summer can be particularly damaging to flowering stems of all forms of the weed. Parasitism first recorded in 1978 can reach 100% at end of summer, limiting efficacy on late growth.
Limiting Factors	Parasitism
Research Organization	CSIRO
References	375, 376, 379, 456

RELEASE	
Country	United States of America
Year	1975
Source	Ex. Greece via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Attacks all biotypes present in the northwestern USA. Infested plants stunted and have decreased seed production. Impact in many areas limited by parasitism and predation.
Limiting Factors	Parasitism; Predation
Research Organization	USDA (7), State (6,9,14,15)
References	332, 334, 335, 1501, 1505, 1508, 1749, 2004

ASTERACEAE
Chondrilla juncea (continued)

AGENT

Species	*Puccinia chondrillina* Bubák & Syd.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Argentina
Year	1982
Source	Ex. Italy via USA
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initial releases failed to establish. Established after further releases in 1984 and present in most areas where weed occurs, but at low densities. Negligible impact because strain not virulent enough against weed form established in Argentina.
Research Organization	INTA
References	343, 344, 379, 1356

RELEASE

Country	Australia
Year	1971
Source	Ex. Italy
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Chondrilla juncea; Puccinia chondrillina (continued)

RELEASE

Country	Australia (continued)
Notes	Strain IT32. Strain is specific to most widespread (narrow-leaf, A) form of weed only. Provided very high level of control such that remaining less-common forms of weed (B, C) subsequently increased in density and distribution. Forms B and C not controlled by combined agents, but are less economically important weeds.
Limiting Factors	Specificity
Research Organization	CSIRO
References	375, 376, 379, 382, 751

RELEASE

Country	Australia
Year	1980
Source	Ex. Turkey
Established	No
Notes	Strain TU21. Strain is specific to intermediate-leaf form (B) of weed. Persisted 1-2 years following release but has since disappeared. Considered establishment failure.
Research Organization	CSIRO
References	379, 380, 456

RELEASE

Country	Australia
Year	1982
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

ASTERACEAE
Chondrilla juncea; Puccinia chondrillina *(continued)*

Country	Australia (continued)
Notes	Strain IT36. Released against intermediate-leaf form of weed (B). Widespread throughout the form's range except the hotter, drier mallee. Impact has not been measured but much less than that of IT32.
Research Organization	CSIRO
References	379, 380, 380, 751

RELEASE

Country	Australia
Year	1996
Source	Ex. Turkey
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Strain TU788. Strain attacked the broad-leaf form (C) during early studies but was more virulent on the intermediate-leaf form (B). Established and spread initially; fate thereafter unknown. No recoveries from hot, dry mallee and impossible to distinguish from strain IT36 in cooler regions. Not recorded on form C in the field.
Research Organization	CSIRO
References	378, 379, 380, 380, 751

ASTERACEAE
Chondrilla juncea; Puccinia chondrillina *(continued)*

RELEASE

Country	United States of America
Year	1976
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Strains PC-1 and PC-16. Efficacy varies by fungus strain, weed genotype, and site conditions. Considered most effective agent in CA where decreases plant size and reproductive output. Less effective in ID and OR. Fares poorly on hot and dry sites. One strain parasitized.
Limiting Factors	Climate; Specificity (genotypes have differing susceptibility to fungus strains); Parasitism
Research Organization	USDA (2), State (6,9,14,15)
References	332, 334, 335, 1082, 1501, 1505, 1508, 1578, 1749, 2004

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Chromolaena odorata* (L.) R. M. King & H. Rob.
Past Names/Synonyms	*Eupatorium odoratum* (L.)
Notes	Two biotypes of *Chromolaena odorata* have been identified. The form in southern Africa (SA) differs substantially both morphologically and in its higher cold tolerance from the more widespread invasive form found in Asia and West and Central Africa (A/WA). While the widespread A/WA biotype can be found throughout the tropical Americas and the Caribbean, recent molecular studies provide strong support for a Cuban or Jamaican origin for the SA biotype.
Origin	Caribbean, tropical and subtropical Americas
Common Name	chromolaena, Siam weed, triffid weed, paraffienbos, kirinyu, kumpai jepang, rumput gol kar, sam-solokh, sap sua, ya-su'a-mop, Akyeampong weed, hagonoy, agonoi, huluhagonoi, pokok Tjerman, Awolowo weed, cò hoi

ASTERACEAE
Chromolaena odorata (continued)

AGENT	
Species	*Actinote anteas* (Doubleday)
Classification	(Lepidoptera: Nymphalidae)

RELEASE	
Country	Indonesia
Year	1999
Source	Ex. Costa Rica
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Can cause severe defoliation in locations with high moth populations, leading to control of plant in conjunction with *Actinote thalia pyrrha*, *Cecidochares connexa*, and *Pareuchaetes pseudoinsulata*. Populations somewhat limited by predation.
Limiting Factors	Predation
Research Organization	IOPRI
References	426, 486, 2054, 2056

TABLE 1

ASTERACEAE
Chromolaena odorata *(continued)*

AGENT	
Species	*Actinote thalia pyrrha* Fabricius
Classification	(Lepidoptera: Nymphalidae)

RELEASE	
Country	Indonesia
Year	1999
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Can cause severe defoliation in locations with high moth populations, leading to control of plant in conjunction with *Actinote anteas*, *Cecidochares connexa*, and *Pareuchaetes pseudoinsulata*.
Other Species Attacked	Also feeds on the exotic *Austroeupatorium inulaefolium* (Kunth) R.M. King & H. Rob.
Research Organization	IOPRI
References	426, 486, 2054, 2056

ASTERACEAE
Chromolaena odorata *(continued)*

AGENT	
Species	*Actinote thalia thalia* Keifer
Incorrect Past Names/Synonyms	*Actinote anteas* (Doubleday)
Classification	(Lepidoptera: Nymphalidae)

RELEASE	
Country	Indonesia
Year	1999
Source	Ex. Venezuela
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Only established at two sites; considered not as successful as other *Actinote* spp.
Research Organization	IOPRI
References	486, 1309, 2054, 2056

AGENT	
Species	*Apion brunneonigrum* Béguin-Billecocq
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Ghana
Year	1975
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	287, 288, 316, 317, 1309

ASTERACEAE
Chromolaena odorata; Apion brunneonigrum *(continued)*

RELEASE	
Country	Guam
Year	1984
Source	Ex. Trinidad
Established	No
Notes	Released at beginning of dry season when host plants in poor condition.
Limiting Factors	Poor host quality
Research Organization	UOG
References	1305, 1309, 1317

RELEASE	
Country	India
Year	1972
Source	Ex. Trinidad
Established	No
Research Organization	IIBC, IIHR
References	250, 288, 313, 317, 1309

RELEASE	
Country	Malaysia
Year	1970
Source	Ex. Trinidad
Established	No
Notes	Persisted for 1 year but then not recovered.
Research Organization	DAMA
References	55, 288, 312, 313, 1309, 1398

ASTERACEAE
Chromolaena odorata; Apion brunneonigrum *(continued)*

RELEASE	
Country	Nigeria
Year	1970
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	287, 288, 312, 1309, 2052

RELEASE	
Country	Sri Lanka
Year	1975
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	288, 316, 317, 1221

TABLE 1

ASTERACEAE
Chromolaena odorata *(continued)*

AGENT

Species	*Calycomyza eupatorivora* Spencer
Past Names/Synonyms	*Calycomyza flavinotum* Frick pars
Classification	(Diptera: Agromyzidae)
Notes	Originally identified as *Calycomyza flavinotum* Frick. It was subsequently determined that *C. flavinotum* is a Nearctic species and tropical specimens previously included in this species and collected on *Chromolaena odorata* (L.) R. M. King & H. Rob. in Jamaica have since been described as a new species, *C. eupatorivora* Spencer.

RELEASE

Country	Papua New Guinea
Year	2005
Source	Ex. Jamaica via Republic of South Africa
Established	No
Notes	Establishment failure likely due to small release size caused by rearing difficulties attributed to the climate being too hot.
Limiting Factors	Climate; Small release size
Research Organization	NARI
References	418, 419, 2054

ASTERACEAE
Chromolaena odorata; Calycomyza eupatorivora *(continued)*

RELEASE

Country	Republic of South Africa
Year	2003
Source	Ex. Jamaica
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Displays a preference for shady conditions where it may curb recruitment of the weed by stunting the growth of young plants. High larval mortality and highly selective oviposition by females likely to impede fly population growth.
Limiting Factors	Climate; Habitat
Research Organization	ARC-PPRI
References	992, 1742, 2053, 2054, 2056, 2057

AGENT

Species	*Cecidochares connexa* Macquart
Incorrect Past Names/Synonyms	*Procecidochares connexa* Macquart
Classification	(Diptera: Tephritidae)

RELEASE

Country	Cote d'Ivoire
Year	2003
Source	Ex. Colombia via Indonesia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	As of 2009, had spread 100 km from release site.
Research Organization	IOPRI
References	484, 488, 1226, 2052, 2053

ASTERACEAE
Chromolaena odorata; Cecidochares connexa *(continued)*

RELEASE	
Country	Federated States of Micronesia
Year	2004
Source	Ex. Colombia via Indonesia via Guam
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Most successful biocontrol program in Micronesia to date. Chromolaena suppressed and no longer a concern on islands wherein *Pareuchaetes pseudoinsulata* and *Cecidochares connexa* have established.
Research Organization	UOG
References	1226, 1304, 1309

RELEASE	
Country	Guam
Year	2002
Source	Ex. Colombia via Indonesia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	2002 release site destroyed by Typhoon, so additional release made in 2003. Most successful biocontrol program in Micronesia to date. Chromolaena suppressed and no longer a concern on islands wherein *Pareuchaetes pseudoinsulata* and *Cecidochares connexa* have established.
Research Organization	UOG
References	364, 1226, 1304, 1309

ASTERACEAE
Chromolaena odorata; Cecidochares connexa *(continued)*

RELEASE	
Country	India
Year	2005
Source	Ex. Colombia via Indonesia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Most damaging of established agents. Significantly reduces plant growth and reproductive output in low elevation areas and regions with longer wet season. Less effective at high elevations and regions with long dry season where populations slower to build.
Limiting Factors	Climate
Research Organization	BIOTROP, ICAR
References	115, 1226, 2054

RELEASE	
Country	Indonesia
Year	1995
Source	Ex. Colombia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Most damaging of established agents. Significantly reduces plant growth and density in low elevation areas and regions with longer wet season. Less effective at high elevations and regions with long dry season where populations slower to build. Parasitism and predation locally limit populations but overall impact on this insect patchy and isolated.
Limiting Factors	Climate; Elevation; Parasitism; Predation
Research Organization	IOPRI, BIOTROP
References	426, 485, 488, 1216, 1226, 1303, 1309, 1807, 1810, 1985, 2054

TABLE 1

TABLE 1

ASTERACEAE
Chromolaena odorata; Cecidochares connexa *(continued)*

RELEASE	
Country	Northern Mariana Islands
Year	2003
Source	Ex. Colombia via Indonesia via Guam
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	2003 releases failed while 2005, 2006 releases established. Most successful biocontrol program in Micronesia to date. Chromolaena suppressed and no longer a concern on islands wherein *Pareuchaetes pseudoinsulata* and *Cecidochares connexa* have established.
Research Organization	UOG
References	1226, 1304, 1309, 2054

RELEASE	
Country	Palau
Year	1999
Source	Ex. Colombia via Indonesia via Guam
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread and high numbers of galls found on most plants, *Chromolaena odorata* is still widespread and vigorous, blooming and seeding profusely. Impact likely minor at best. Predation may limit populations in some areas.
Limiting Factors	Predation
Research Organization	UOG, PLC
References	549, 1226, 1243, 1304, 1309

ASTERACEAE
Chromolaena odorata; Cecidochares connexa *(continued)*

RELEASE	
Country	Papua New Guinea
Year	2001
Source	Ex. Colombia via Indonesia via Philippines
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Most damaging of established agents. Significantly reduces plant height and percent cover in more moist regions and at low elevations. In drier provinces populations slower to build and large stands of chromolaena still exist.
Limiting Factors	Climate
Research Organization	QLD State, PNGDAL
References	134, 418, 419, 420, 426, 1309, 1404, 2054

RELEASE	
Country	Philippines
Year	2001
Source	Ex. Colombia via Indonesia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Causes a dieback of stems and branches, though overall status unknown.
Research Organization	IOPRI, BIOTROP, PCA
References	61, 426, 487, 1216, 1226, 1309

ASTERACEAE
Chromolaena odorata; Cecidochares connexa *(continued)*

RELEASE

Country	Thailand
Year	2002
Source	Ex. Colombia via Indonesia via Philippines via Papua New Guinea
Established	No
Research Organization	NBCRC
References	426, 939, 1213, 1226, 1309, 2054

RELEASE

Country	Thailand
Year	2009
Source	Ex. Colombia via Indonesia via Philippines via Papua New Guinea
Established	No
Notes	Recent attempts at establishment failed, though releases are likely continuing.
Research Organization	NBCRC
References	418, 426, 1226

RELEASE

Country	Timor Leste
Year	2005
Source	Ex. Colombia via Indonesia via Philippines via PNG
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Controls plant in some regions, particularly moist areas at low elevations. In drier regions populations slower to build.
Limiting Factors	Climate
Research Organization	QLD State, MAFF, UNTL
References	418, 421, 426, 966, 1226, 1309, 2054

ASTERACEAE
Chromolaena odorata *(continued)*

TABLE 1

AGENT

Species	*Lixus aemulus* Petri
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Republic of South Africa
Year	2011
Source	Ex. Brazil
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ARC-PPRI
References	992, 1002, 2053, 2056, 2057

AGENT

Species	*Pareuchaetes aurata aurata* (Butler)
Past Names/Synonyms	*Pareuchaetes aurata* (Butler)
Classification	(Lepidoptera: Erebidae)
References	998, 1742, 2059

RELEASE

Country	Republic of South Africa
Year	1990
Source	Ex. Argentina
Established	No
Notes	All attempts to free this insect of microsporidia failed.
Limiting Factors	Disease
Research Organization	SASRI, DWAF, ARC-PPRI
References	992, 998, 999, 1742, 2054, 2058

TABLE 1

ASTERACEAE
Chromolaena odorata *(continued)*

AGENT

Species	*Pareuchaetes insulata* (Walker)
Classification	(Lepidoptera: Erebidae)

RELEASE

Country	Republic of South Africa
Year	2001
Source	Ex. USA (FL)
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Introduced from three different sources in an attempt to increase host and climate matching. Though one release site confirmed successful and the population subsequently spread rapidly, attempted redistributions failed and populations later dwindled. Populations now typically low but vary by site or year. Can cause high levels of localized damage when populations high or in periods/sites with high moisture.
Limiting Factors	Climate; Habitat
Other Species Attacked	Also found on the exotic *Ageratum conyzoides* L. growing in the vicinity of outbreaks.
Research Organization	SASRI, DWAF, ARC-PPRI
References	992, 1741, 1742, 2053, 2054, 2057

ASTERACEAE
Chromolaena odorata; Pareuchaetes insulata *(continued)*

RELEASE

Country	Republic of South Africa
Year	2002
Source	Ex. Jamaica
Established	No
Notes	The successfully established population from Florida eventually intersected at least two Jamaica-sourced release sites further south. Because these two source populations are genetically indistinguishable and have shown no evidence of reproductive isolation, it is possible they have hybridized in the field. Given the failure of all other Jamaican and Cuban releases for this species, the editors of this catalogue are maintaining Florida as the source of the successfully established populations in South Africa.
Research Organization	SASRI, DWAF, ARC-PPRI
References	1741, 1742, 2053, 2057

RELEASE

Country	Republic of South Africa
Year	2003
Source	Ex. Cuba
Established	No
Research Organization	SASRI, DWAF, ARC-PPRI
References	1741, 1742, 2053, 2057

ASTERACEAE
Chromolaena odorata *(continued)*

AGENT

Species	*Pareuchaetes pseudoinsulata* Rego Barros
Incorrect Past Names/Synonyms	*Ammalo insulata* Walker, *Ammalo arravaca* Jord.
Classification	(Lepidoptera: Erebidae)

RELEASE

Country	Cote d'Ivoire
Year	1991
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	No
Notes	Initially believed to have established, but subsequently considered failed. Failure attributed to predation.
Limiting Factors	Predation
Research Organization	IDEFOR, CIRAD-IRHO
References	250, 1309, 1797, 2052, 2060

RELEASE

Country	Federated States of Micronesia
Year	1988
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

RELEASE

Country	Federated States of Micronesia (continued)
Notes	Most successful biocontrol program in Micronesia to date. Chromolaena suppressed and no longer a concern on islands wherein *Pareuchaetes pseudoinsulata* and *Cecidochares connexa* have established. *P. pseudoinsulata* populations and impact high initially, but decreased and variable here and other islands subsequently.
Research Organization	UOG
References	250, 551, 1304, 1305, 1306, 1309, 2054

RELEASE

Country	Ghana
Year	1973
Source	Ex. Trinidad via India
Established	No
Notes	Although small amounts of feeding damage observed shortly after releases, no recoveries made. Establishment failure attributed to predation by ants.
Limiting Factors	Predation
Research Organization	IIBC
References	158, 287, 288, 292, 314, 315, 1862

TABLE 1

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

RELEASE	
Country	Ghana
Year	1991
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations vary by site and are higher during wet season. Causes noticeable damage to weed throughout established range. In some areas, damage too minimal and insignificant to affect growth rate. At other sites, *Chromolaena odorata* cover and density have decreased significantly due to this agent.
Limiting Factors	Climate
Research Organization	CRIG
References	158, 250, 1309, 1796, 1797, 1862

RELEASE	
Country	Guam
Year	1985
Source	Ex. Trinidad; Ex. Trinidad via India via Sri Lanka via India
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

Country	Guam (continued)
Notes	First releases failed due to predation. Causes 100% defoliation in some areas. By 1989 this weed no longer predominant weed species in Guam; infestations reduced from thickets to scattered patches. One of few countries where impact by this agent has been sustained long-term. Currently effectiveness sometimes reduced by insect-induced defense in *Chromolaena odorata*, and agent's weakness in colonizing scattered distributions of weed.
Limiting Factors	Predation; Host plant resistance
Research Organization	UOG
References	250, 364, 1303, 1304, 1305, 1309, 1311, 1317, 1638, 2054

RELEASE	
Country	India
Year	1973
Source	Ex. Trinidad
Established	No
Notes	Establishment failure likely due to ant predation and viral infection.
Limiting Factors	Predation; Disease
Research Organization	IIBC, IIHR
References	115, 250, 288, 292, 910, 1309, 1612, 1692

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

RELEASE	
Country	India
Year	1984
Source	Ex. Trinidad via India via Sri Lanka
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Because population introduced from Trinidad eventually failed to field establish in India while surviving a later redistribution to Sri Lanka, it was subsequently reintroduced (successfully) from Sri Lanka. Initially this introduction did well and caused significant defoliation. Agent populations have since crashed and the weed has largely recovered. Predation, viral infection, poor climate matching blamed for limited efficacy.
Limiting Factors	Predation; Disease; Climate
Research Organization	IIHR, KAU
References	115, 250, 288, 910, 932, 1612, 1692

RELEASE	
Country	Indonesia
Year	1992
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

Country	Indonesia (continued)
Notes	Likely intermixed with individuals spreading naturally from East Malaysia. Also likely naturally spread from East Malaysia to Sulawesi. Causes massive defoliation during outbreaks, however outbreaks infrequent and sporadic and possibly limited by parasitism. Inflicts most damage in conjunction with *Cecidochares connexa*.
Limiting Factors	Parasitism
Research Organization	BIOTROP, IOPRI
References	250, 416, 485, 488, 1211, 1216, 1309, 1807, 1808, 1984, 1985, 2054

RELEASE	
Country	Malaysia
Year	1970
Source	Ex. Trinidad via India
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Population persisted for a few years at release site but then not located until early 1980s. Now widely distributed at low densities. Outbreaks can cause severe damage. Weed still not under control.
Limiting Factors	Predation
Research Organization	DAMA
References	287, 288, 292, 1309, 1398, 2054

TABLE 1

TABLE 1

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

RELEASE	
Country	Nigeria
Year	1973
Source	Ex. Trinidad via India via Ghana
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially believed to have failed establishment, but discovered in 2009. Unclear if result of initial release, or if naturally spread from nearby Ghana where released and established in 1991. Abundant where observed in Edo State and populations increasing with rainy season. Additional surveys warranted to determine overall establishment, abundance, and impact throughout Nigeria.
Research Organization	IIBC
References	287, 288, 292, 314, 1309, 1863, 2052

RELEASE	
Country	Northern Mariana Islands
Year	1986
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Initially spectacular population increases caused widespread defoliation and high plant mortality; however, after 1-2 years agent population declined and weed recovered. Outbreaks still occur but infrequent and less spectacular.
Research Organization	UOG
References	250, 1304, 1305, 1309, 1311, 1317, 1638, 2054

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

RELEASE	
Country	Palau
Year	1989
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	No
References	250, 1301, 1304, 1305, 1309

RELEASE	
Country	Palau
Year	2005
Source	Ex. Trinidad via India via Sri Lanka via India via Guam via Federated States of Micronesia
Established	No
References	250, 1302, 1304, 1309, 2054

RELEASE	
Country	Papua New Guinea
Year	1999
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Only seasonally damaging. After wet season larvae cause defoliation; however, in dry season numbers are low and damage to plants minimal.
Limiting Factors	Climate
Research Organization	QLD State, PNGDAL
References	134, 250, 418, 419, 420, 1309, 2054

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1989
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	No
Notes	Heavy egg predation by ants probable cause of failure.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	250, 992, 996, 997, 1309, 1740, 1939, 2057, 2058

RELEASE	
Country	Republic of South Africa
Year	1998
Source	Ex. Trinidad via India via Sri Lanka via India via Guam via Indonesia
Established	No
Notes	Initially highly effective at release site but not found in subsequent years. Establishment failure likely due to poor climatic matching.
Limiting Factors	Climate; Habitat
Research Organization	DWAF, ARC-PPRI
References	250, 992, 1309, 1740, 2053, 2057, 2058

RELEASE	
Country	Sri Lanka
Year	1973
Source	Ex. Trinidad via India
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

ASTERACEAE
Chromolaena odorata; Pareuchaetes pseudoinsulata *(continued)*

Country	Sri Lanka (continued)
Notes	Releases made from stock originating from lab colonies in India as this species failed to field establish in India following initial 1973 field releases. Initially spectacular population increase caused widespread defoliation and high plant mortality; however, after 1-2 years agent population declined and weed recovered. Outbreaks still occur, especially during rainy season, but infrequent and less spectacular.
Research Organization	IIBC
References	287, 288, 292, 491, 1309, 2054

RELEASE	
Country	Thailand
Year	1987
Source	Ex. Trinidad via India via Sri Lanka via India via Guam
Established	No
Notes	After repeated releases at numerous sites until 1988, initially believed to be established. Subsequently considered failed.
Research Organization	NBCRC
References	55, 250, 1309, 1326, 1329, 1331, 1332

RELEASE	
Country	Vietnam
Year	1988
Source	Ex. Trinidad via India via Sri Lanka via India via Guam via Thailand
Established	No
Research Organization	VNBCRC, NBCRC
References	250, 944, 1309, 1326, 1329, 2054

TABLE 1

TABLE 1

ASTERACEAE
Chromolaena odorata (continued)

AGENT	
Species	*Phestinia costella* Hampson
Past Names/Synonyms	*Mescinia* nr *parvula* Zeller
Classification	(Lepidoptera: Pyralidae)
References	1710, 2054

RELEASE	
Country	Guam
Year	1984
Source	Ex. Trinidad
Established	No
Notes	Released in very low numbers.
Limiting Factors	Small release size
Research Organization	UOG
References	1309, 1317, 1638

ASTERACEAE (continued)

WEED	
Family	Asteraceae
Species	*Chrysanthemoides monilifera* (L.) Norl. subsp. *monilifera*
Origin	southern Africa
Common Name	boneseed

AGENT	
Species	*Aceria* sp.
Incorrect Past Names/Synonyms	*Aceria neseri* Meyer
Classification	(Acari: Eriophyidae)

RELEASE	
Country	Australia
Year	2008
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Too early post release
Notes	Small colonies persisted 12 months post release. Establishment failure at some sites attributed to drought conditions and possibly predatory mites. Surviving well at only one site in TAS and establishment still uncertain. Under evaluation.
Limiting Factors	Possibly Predation; Climate
Research Organization	VIC State, SA State, TAS State, CSIRO
References	7, 883, 1698

ASTERACEAE
Chrysanthemoides monilifera ssp. *monilifera* (continued)

AGENT	
Species	*Chrysolina fasciata* (De Geer)
Past Names/Synonyms	*Chrysolina picturata* (Clark)
Classification	(Coleoptera: Chrysomelidae)
References	116

RELEASE	
Country	Australia
Year	1992
Source	Ex. Republic of South Africa
Established	No
Research Organization	VIC State, NSW State, SA State, NT, CSIRO
References	6, 7, 8, 519

AGENT	
Species	*Chrysolina scotti* Daccordi
Past Names/Synonyms	*Chrysolina* sp., *Chrysolina* sp. 1
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. Republic of South Africa
Established	No
Notes	Establishment failure likely due to predation by ants and/or spiders.
Limiting Factors	Predation
Research Organization	VIC State, CSIRO
References	6, 7, 8, 519, 843, 885

ASTERACEAE
Chrysanthemoides monilifera ssp. *monilifera* (continued)

AGENT	
Species	*Chrysolina* sp. B
Past Names/Synonyms	*Chrysolina* sp. 2
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1994
Source	Ex. Republic of South Africa
Established	No
Research Organization	CSIRO, VIC State, NSW State, SA State, NT
References	6, 7, 8, 519, 885

AGENT	
Species	*Comostolopsis germana* Prout
Classification	(Lepidoptera: Geometridae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. Republic of South Africa
Established	No
Notes	Initially established at just one site in VIC where rearing of the moth took place in field plots. Subsequently considered establishment failure, possibly due to predation, poor climate matching and host preference.
Limiting Factors	Predation; Climate; Specificity
Research Organization	VIC State, NSW State, SA State, NT, CSIRO, QLD State
References	6, 7, 519, 843, 885, 1958

TABLE 1

ASTERACEAE
Chrysanthemoides monilifera ssp. *monilifera* (continued)

AGENT

Species	*Mesoclanis magnipalpis* Bezzi
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	1998
Source	Ex. Republic of South Africa
Established	No
Research Organization	VIC State, NSW State
References	7, 519, 1272, 1273, 1279

RELEASE

Country	Australia
Year	2005
Source	Ex. Republic of South Africa
Established	No
Research Organization	VIC State
References	7, 519, 1272, 1273, 1279

RELEASE

Country	Australia
Year	2009
Source	Ex. Republic of South Africa
Established	No
Research Organization	VIC State
References	7, 1273

ASTERACEAE
Chrysanthemoides monilifera ssp. *monilifera* (continued)

AGENT

Species	*Mesoclanis polana* Munro
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	1996
Source	Ex. Republic of South Africa
Established	No
Notes	Intentionally released against *Chrysanthemoides monilifera* subsp. *rotundata*, it was hoped that spillover attack would occur on *C. m. monilifera* where the two subspecies overlapped in NSW.
Research Organization	VIC State, NSW State, CSIRO
References	7, 530

AGENT

Species	*Tortrix* s.l. subsp. *chrysanthemoides*
Classification	(Lepidoptera: Tortricidae)
Notes	This species is referred to as *Tortrix* sp. in Australia and *Tortrix* s.l. subsp. *chrysanthemoides* in New Zealand.

RELEASE

Country	New Zealand
Year	2007
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

ASTERACEAE; *Chrysanthemoides monilifera* ssp. *monilifera* *Tortrix* ssp. *chrysanthemoides* (continued)

Country	New Zealand (continued)
Notes	Present at several release sites on the North Island. Impact small to date given short length of establishment. Predation and parasitism also hinder populations.
Limiting Factors	Predation; Parasitism
Research Organization	MWLR
References	161, 761, 1064, 1070

AGENT

Species	*Tortrix* sp.
Classification	(Lepidoptera: Tortricidae)
Notes	This species is referred to as *Tortrix* sp. in Australia and *Tortrix* s.l. subsp. *chrysanthemoides* in New Zealand.

RELEASE

Country	Australia
Year	2000
Source	Ex. Republic of South Africa
Established	No
Notes	Collected from *Chrysanthemoides monilifera* subsp. *monilifera*.
Limiting Factors	Predation
Research Organization	VIC State, NSW State, CSIRO, TAS State
References	5, 7, 519, 841, 885

ASTERACEAE *(continued)*

TABLE 1

WEED

Family	Asteraceae
Species	*Chrysanthemoides monilifera* (L.) Norl. subsp. *rotundata* (DC.) Norl.
Origin	southern Africa
Common Name	bitou bush

AGENT

Species	*Cassida* sp. 3
Past Names/Synonyms	*Cassida* sp.
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1995
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established at most release sites but populations low and impact negligible.
Research Organization	VIC State, NSW State
References	7, 519

TABLE 1

ASTERACEAE
Chrysanthemoides monilifera ssp. *rotundata* (continued)

AGENT	
Species	*Chrysolina scotti* Daccordi
Past Names/Synonyms	*Chrysolina* sp., *Chrysolina* sp. 1, *Chrysolina* sp. A
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1990
Source	Ex. Republic of South Africa
Established	No
Notes	Establishment failure likely due to predation by ants and/or spiders.
Limiting Factors	Predation
Research Organization	VIC State
References	6, 7, 8, 519, 843

AGENT	
Species	*Chrysolina* sp. B
Past Names/Synonyms	*Chrysolina* sp. 2
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1995
Source	Ex. Republic of South Africa
Established	No
Research Organization	CSIRO, VIC State, NSW State, SA State, NT
References	7, 8, 519

ASTERACEAE
Chrysanthemoides monilifera ssp. *rotundata* (continued)

AGENT	
Species	*Comostolopsis germana* Prout
Classification	(Lepidoptera: Geometridae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. Republic of South Africa
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Spread rapidly and now well established throughout range of this subspecies. Overall impact insufficient to control weed alone, but can significantly reduce flowering and seed production leading to decreases in seed bank persistence and dispersal. Impact limited by parasitism at some locations.
Limiting Factors	Parasitism
Research Organization	VIC State, NSW State, SA State, NT, CSIRO, QLD State
References	6, 7, 519, 843, 1958

ASTERACEAE
Chrysanthemoides monilifera ssp. *rotundata* (continued)

AGENT

Species	*Mesoclanis magnipalpis* Bezzi
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	2005
Source	Ex. Republic of South Africa
Established	No
Research Organization	VIC State, NSW State
References	7, 1272, 1279

AGENT

Species	*Mesoclanis polana* Munro
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	1996
Source	Ex. Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Spread rapidly and now well established throughout range of this subspecies. Overall impact insufficient to control weed alone, but can significantly reduce flowering and seed production leading to decreases in seed bank persistence and dispersal. More effective at northern locations in Australia than southern.
Research Organization	VIC State, NSW State
References	5, 7, 519, 529, 530, 841

ASTERACEAE
Chrysanthemoides monilifera ssp. *rotundata* (continued)

AGENT

Species	*Tortrix* sp.
Classification	(Lepidoptera: Tortricidae)
Notes	This species is referred to as *Tortrix* sp. in Australia and *Tortrix* s.l. subsp. *chrysanthemoides* in New Zealand.

RELEASE

Country	Australia
Year	2000
Source	Ex. Republic of South Africa
Established	No
Notes	Collected from *Chrysanthemoides monilifera* subsp. *monilifera*.
Research Organization	VIC State, NSW State
References	774

RELEASE

Country	Australia
Year	2001
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Collected from *Chrysanthemoides monilifera* subsp. *rotundata*. Established at only small percentage of release sites. Predation limits populations such that this is an ineffective agent.
Limiting Factors	Predation
Research Organization	VIC State, NSW State
References	7, 519, 841, 1418, 1756, 1757

TABLE 1

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Cirsium arvense* (L.) Scop.
Origin	Eurasia
Common Name	Canada thistle, creeping thistle, Californian thistle, field thistle

AGENT	
Species	*Altica carduorum* Guérin-Méneville
Past Names/Synonyms	*Haltica carduorum* Guérin-Méneville
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1963
Source	Ex. France, Switzerland
Established	No
Notes	Slow development in cool summers exposed larvae to high predation. Unsuccessful in cold regions.
Limiting Factors	Predation; Climate
Research Organization	AAFC
References	361, 725, 1186, 1468, 1469, 1471, 1628

RELEASE	
Country	England
Year	1969
Source	Ex. France
Established	No
Notes	Overwintered successfully in cages, but climate unsuitable for survival.
Limiting Factors	Climate
Research Organization	IIBC, IC, MAFF
References	72, 283, 1647

ASTERACEAE
Cirsium arvense; Altica carduorum (continued)

RELEASE	
Country	New Zealand
Year	1979
Source	Ex. Switzerland
Established	No
Notes	Establishment failure likely due to unfavorable climatic conditions.
Limiting Factors	Climate
Research Organization	DSIR
References	361, 720, 917, 1064

RELEASE	
Country	New Zealand
Year	1990
Source	Ex. Switzerland
Established	No
Notes	Initially believed to have established on both North and South Island following widespread release effort, but subsequently not recovered.
Research Organization	DSIR
References	361, 720, 1064

RELEASE	
Country	United States of America
Year	1966
Source	Ex. Switzerland via Canada
Established	No
Research Organization	USDA (1,7), State (12)
References	44, 332, 361, 1504, 1506, 1628, 1730

ASTERACEAE
Cirsium arvense; Altica carduorum *(continued)*

RELEASE

Country	United States of America
Year	1970
Source	Ex. France (Atlantic Coast)
Established	No
Research Organization	USDA (1,7), State (12)
References	361, 1504, 1628

RELEASE

Country	United States of America
Year	1982
Source	Ex. Italy
Established	No
Notes	Establishment failure likely due to predation by native carabid.
Limiting Factors	Predation
Research Organization	USDA (1,7), State (12,20)
References	83, 1182, 1578

RELEASE

Country	Wales
Year	1969
Source	Ex. France
Established	No
Notes	Overwintered successfully in cages, but climate unsuitable for survival.
Limiting Factors	Climate
Research Organization	IIBC, IC, MAFF
References	72, 283, 1647

ASTERACEAE
Cirsium arvense *(continued)*

AGENT

Species	*Cassida rubiginosa* O.F. Müller
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	New Zealand
Year	2007
Source	Ex. Austria, France, Switzerland
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Though too early to definitively declare field impact, a field-release experiment indicated competition from typical New Zealand pasture species is more important factor than herbivory by *Cassida rubiginosa* and this agent will likely have insignificant impact on weed though formal evaluation studies will commence soon.
Research Organization	MWLR
References	360, 361, 664, 761, 1059, 1064

TABLE 1

TABLE 1

ASTERACEAE
Cirsium arvense *(continued)*

AGENT	
Species	*Ceratapion onopordi* (Kirby)
Past Names/Synonyms	*Apion onopordi* Kirby
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	New Zealand
Year	2008
Source	Ex. Austria, France, Switzerland
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Only a limited number of releases made as mass-rearing proved difficult.
Research Organization	MWLR
References	361, 664, 1064

AGENT	
Species	*Hadroplontus litura* (Fabricius)
Past Names/Synonyms	*Ceutorhynchus litura* (Fabricius)
Classification	(Coleoptera: Curculionidae)
References	307, 361

RELEASE	
Country	Canada
Year	1965
Source	Ex. France, Germany, Italy, Switzerland
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Cirsium arvense; Hadroplontus litura *(continued)*

RELEASE	
Country	Canada (continued)
Notes	Though established at most release sites, the weevil has low reproductive and dispersal ability. Mining over multiple years decreases root biomass, when in conjunction with other stresses. Even in conjunction with other agents, overall impact limited.
Research Organization	AAFC
References	361, 1138, 1186, 1471, 1474, 1476, 1483, 1628

RELEASE	
Country	New Zealand
Year	1976
Source	Ex. Switzerland
Established	No
Research Organization	DSIR
References	361, 720, 917

RELEASE	
Country	New Zealand
Year	1988
Source	Ex. Great Britain
Established	No
Notes	Establishment failure possibly due to the limited number of individuals released.
Limiting Factors	Small release size
Research Organization	DSIR
References	361, 720, 761, 917

ASTERACEAE
Cirsium arvense; Hadroplontus litura (continued)

RELEASE	
Country	United States of America
Year	1971
Source	Ex. Germany
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though some reports indicate very effective due to reduced overwintering survival of *Cirsium arvense*, most studies show lack of impact. Likely due to only non-essential parenchyma tissue being consumed by larvae, leaving vascular tissues untouched. Some populations infected with *Nosema* pathogens.
Limiting Factors	Disease
Research Organization	USDA (1,7,10), State (6,7,9,13,15)
References	83, 332, 335, 361, 1182, 1501, 1504, 1506, 1512, 1558, 1578, 1730, 1731

AGENT	
Species	*Larinus carlinae* (Olivier)
Past Names/Synonyms	*Larinus planus* (Fabricius)
Classification	(Coleoptera: Curculionidae)
References	694

RELEASE	
Country	Canada
Year	1990
Source	Ex. Unknown via USA (MD)
Established	Yes

(continued at top of next column)

ASTERACEAE
Cirsium arvense; Larinus carlinae (continued)

Country	Canada (continued)
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Although its first arrival was unintentional, this species was intentionally redistributed to four other Canadian provinces. This second population was intentionally introduced. Abundance and survival hindered by harsh overwintering conditions and parasitism.
Limiting Factors	Parasitism; Climate
Other Species Attacked	Also attacks native thistle spp.
References	361, 432, 1186

AGENT	
Species	*Lema cyanella* (L.)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1983
Source	Ex. Switzerland
Established	No
Research Organization	AAFC
References	361, 1186

TABLE 1

ASTERACEAE
Cirsium arvense; Lema cyanella *(continued)*

RELEASE	
Country	Canada
Year	1993
Source	Ex. Switzerland, France via New Zealand
Established	No
Notes	Initially one population established at low densities in AB, but concerns over nontarget attack led to eradication of the population. No longer considered established.
Other Species Attacked	Fed upon native nontarget thistles which led to the intentional eradication of the insect.
Research Organization	AAFC
References	361, 1186

RELEASE	
Country	New Zealand
Year	1983
Source	Ex. Switzerland via Canada
Established	No
Research Organization	DSIR
References	720, 761, 917, 1186

RELEASE	
Country	New Zealand
Year	1990
Source	Ex. Switzerland, France
Established	Yes
Abundance	Rare
General Impact	None
Notes	Established at only one site despite wide release history. Considered insignificant biocontrol agent.
Research Organization	DSIR
References	361, 720, 1064, 1186

ASTERACEAE
Cirsium arvense *(continued)*

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	Canada
Year	1968
Source	Ex. France (Rhine Valley)
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Naturally spread from releases and/or redistributions made on *Carduus acanthoides* and *Ca. nutans*, but also redistributed from *Ca. nutans* to *Cirsium arvense*. Though increasingly widespread on *Ci. arvense* in western provinces, *Carduus* spp. (especially *nutans*) are more preferred and receive higher attack, albeit still insufficient to reduce weed stands in absence of competition. Weevils emerging from *Cirsium* spp. heads smaller than from *Ca. nutans*; low impact on *Ci. arvense* overall.
Other Species Attacked	Also feeds on native *Cirsium* spp.
Research Organization	AAFC
References	117, 361, 437, 729, 735, 742, 1185, 1186, 1628, 2080

ASTERACEAE
Cirsium arvense; Rhinocyllus conicus (continued)

RELEASE	
Country	New Zealand
Year	1973
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially released on *Carduus nutans* subsp. *nutans* but also found feeding on *Cirsium arvense*. Capitulum attack rates lower on *Ci. arvense* than the preferred host (*Carduus nutans* subsp. *nutans*) on which attack levels still insufficient to control weed. Ineffective strategy for controlling *Ci. arvense* since established populations of weed reproduce primarily by vegetative means.
Other Species Attacked	Also feeds on the exotic hybrid of *Carduus nutans* L. subsp. *nutans* and *Ca. acanthoides* L. as well as the exotic *Cirsium vulgare* (Savi) Ten.
References	361, 688, 761, 914, 915, 916, 1064, 1650

RELEASE	
Country	United States of America
Year	1973
Source	Ex. Italy, France (Rhine Valley)
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Cirsium arvense; Rhinocyllus conicus (continued)

Country	United States of America (continued)
Notes	Agents sourced from *Carduus nutans* (Ex. France) and *Ca. pycnocephalus* (Ex. Italy) found attacking *Cirsium arvense* secondarily. Redistributed intentionally from *Ca. nutans* to *Ci. arvense*. Affects seed production potential which is unlikely to impact *Ci. arvense* since established plants/infestations reproduce mainly by vegetative means.
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	State (15)
References	332, 334, 335, 361, 1457, 1501, 1506, 1578

AGENT	
Species	*Urophora cardui* (L.)
Classification	(Diptera: Tephritidae)

RELEASE	
Country	Canada
Year	1974
Source	Ex. Austria, France, Germany
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

ASTERACEAE
Cirsium arvense; Urophora cardui *(continued)*

Country	Canada (continued)
Notes	Populations vary across Canada and by year but are highest in areas with sheltering canopy, near water, and in climates with mild winter temperatures. Rare in the prairie region. Under favorable conditions can reduce density and stature of *Cirsium arvense*. In other areas, even in combination with *Hadroplontus litura* has no measurable impact.
Limiting Factors	Climate; Habitat
Research Organization	AAFC, UG, MU
References	437, 735, 1186, 1469, 1471, 1477, 1478, 1628

RELEASE	
Country	Canada
Year	1986
Source	Ex. Finland
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Populations vary by location and year but are highest in areas with sheltering canopy, near water, and in climates with mild winter temperatures. Under favorable conditions can reduce density and stature of *Cirsium arvense*. In other areas, even in combination with *Hadroplontus litura* has no measurable impact.
Limiting Factors	Climate; Habitat
Research Organization	AAFC
References	1186, 1478

ASTERACEAE
Cirsium arvense; Urophora cardui *(continued)*

RELEASE	
Country	Canada
Year	1996
Source	Ex. Austria, France via USA (OR)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established initially but not intentionally surveyed since 2000 so may no longer be present.
Research Organization	AAFC
References	152, 1185, 1186, 1578

RELEASE	
Country	New Zealand
Year	1976
Source	Ex. Switzerland; Ex. Austria, France, Germany via Canada
Established	No
Notes	Material received from Switzerland was intermixed with material received from Canada (original source Austria, France, Germany). Survived for several years at low densities at one site on South Island but died out by 1985.
Research Organization	DSIR
References	720, 917, 1064

ASTERACEAE
Cirsium arvense; Urophora cardui *(continued)*

RELEASE	
Country	New Zealand
Year	1995
Source	Ex. Austria, Finland, France, Germany via Canada
Established	Yes
Abundance	Rare
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Impact unknown but likely negligible given that galls commonly eaten by stock.
Limiting Factors	Predation
Research Organization	MWLR
References	361, 761, 1064

RELEASE	
Country	New Zealand
Year	1996
Source	Ex. Austria, France via USA (OR)
Established	Yes
Abundance	Rare
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	No longer differentiated from population sourced via Canada. Impact unknown but likely negligible given that galls commonly eaten by stock.
Limiting Factors	Predation
Research Organization	MWLR
References	361, 761, 1064, 1578

ASTERACEAE
Cirsium arvense; Urophora cardui *(continued)*

RELEASE	
Country	United States of America
Year	1977
Source	Ex. Austria, France
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Attacked plants may be stunted and produce fewer seeds; however overall impact largely limited. Restricted to shaded infestations, close to riparian areas. Larvae in galls preyed on by birds, rodents, ants, and unidentified mite.
Limiting Factors	Habitat; Predation
Research Organization	USDA (1,7,10), State (1,6,7,9,13,14,15,21)
References	332, 334, 335, 361, 1182, 1501, 1504, 1506, 1578, 1731

RELEASE	
Country	United States of America
Year	1985
Source	Ex. Austria, France, Germany via Canada
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Galls recovered at two sites in 1987, but none recovered since then. If established, impact likely minor (similar to efficacy of this agent elsewhere).
Limiting Factors	Habitat; Predation
Research Organization	USDA (1), State (1)
References	361, 1008, 1182, 1506, 1578

TABLE 1

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Cirsium palustre* (L.) Scop.
Origin	Eurasia
Common Name	marsh thistle

AGENT

Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE

Country	Canada
Year	1997
Source	Ex. France (Rhine Valley)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Redistributed from *Carduus nutans* in field, *Cirsium palustre* lab colonies, and *Cirsium arvense* in field to field *Ci. palustre*. *Carduus* spp. (especially *nutans*) are more preferred and receive higher attack, though still insufficient to reduce weed stands in absence of competition. Impact on *Ci. palustre* has not been formally studied but is believe to be negligible. Though field survival in BC has been achieved in limited regions, populations remain low. Sustained survival has been difficult in other regions of BC. Establishment trials currently underway to determine limiting factors.

(continued at top of next column)

ASTERACEAE
Cirsium palustre; Rhinocyllus conicus (continued)

Country	Canada (continued)
Other Species Attacked	Also feeds on native *Cirsium* spp.
Research Organization	AAFC
References	117, 432, 729, 1185, 1186, 1841, 2080

RELEASE

Country	New Zealand
Year	1973
Source	Ex. France (Rhine Valley) via Canada
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially released on *Carduus nutans* subsp. *nutans* but also found feeding on *Cirsium palustre*. Impact to *Ci. palustre* not studied formally; however, impact on preferred host (*Ca. nutans* subsp. *nutans*) insufficient to control the weed population.
Other Species Attacked	Also feeds on the exotic hybrid of *Carduus nutans* L. subsp. *nutans* and *Ca. acanthoides* L. as well as the exotic *Cirsium vulgare* (Savi) Ten.
Research Organization	DSIR
References	688, 761, 914, 915, 916, 1064, 1650

ASTERACEAE
Cirsium palustre *(continued)*

AGENT

Species	*Trichosirocalus horridus* (Panzer)
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The authors of this revision stated "it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n." However because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently underway to determine if the species complex is truly a complex, and to (continued at top of next column)

ASTERACEAE
Cirsium palustre *(continued)*

Species	*Trichosirocalus horridus* (Panzer)
Notes (continued)	what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.
References	27, 689

RELEASE

Country	Canada
Year	2007
Source	Ex. Germany
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Redistributed from *Carduus* spp. to *Cirsium palustre*.
Research Organization	AAFC
References	117, 729

TABLE 1

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Cirsium vulgare* (Savi) Ten.
Origin	Eurasia, northern Africa
Common Name	spear thistle, bull thistle, Scotch thistle, common thistle, Fuller's thistle

AGENT	
Species	*Cheilosia grossa* (Fallén)
Past Names/Synonyms	*Cheilosia corydon* (Harris)
Classification	(Diptera: Syrphidae)

RELEASE	
Country	United States of America
Year	2001
Source	Ex. Italy
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Intentionally released on *Carduus* spp. but occasionally found attacking large rosettes of *Cirsium vulgare*, decreasing plant function and seed production. However, *Carduus* species are preferred over *Cirsium*.
Other Species Attacked	Damage similar to that caused by this agent has been observed in several native thistles species (*Cirsium edule* group), thus caution should be used when considering introduction of this fly into new areas. Also rarely found attacking *Carduus acanthoides* L., especially plants with large diameter stems (>10 mm).
Research Organization	State (15)
References	332, 334, 1506, 2002

ASTERACEAE
Cirsium vulgare (continued)

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	Australia
Year	1990
Source	Ex. France
Established	No
Research Organization	VIC State
References	186, 1602

RELEASE	
Country	Australia
Year	1994
Source	Ex. France
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Isolated populations are established in VIC, some of which have spread up to 22 km from release sites. Formal evaluation is lacking. Next generation recoveries made in TAS though still too early to claim establishment.
Research Organization	VIC State, TAS State
References	186, 883, 1602

ASTERACEAE
Cirsium vulgare; Rhinocyllus conicus *(continued)*

RELEASE	
Country	Canada
Year	1968
Source	Ex. France (Rhine Valley)
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Naturally spread from releases and/or redistributions made on *Carduus acanthoides* and *Ca. nutans*. *Carduus* spp. (especially *nutans*) are more preferred and receive higher attack, though still insufficient to reduce weed stands in absence of competition. Impact on *Cirsium vulgare* has not been formally studied but is likely to be low.
Other Species Attacked	Also feeds on native *Cirsium* spp.
Research Organization	AAFC
References	117, 729, 742, 1186, 1628, 2080

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. France (western)
Established	No
General Impact	Compromised
Notes	*Cirsium vulgare* plants in area destroyed with herbicides soon after the release.
Limiting Factors	Other control methods
Research Organization	ARC-PPRI
References	821, 2073

ASTERACEAE
Cirsium vulgare; Rhinocyllus conicus *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Italy via USA (CA)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Release made on *Silybum marianum* in 1985, which was subsequently considered failed due to herbicidal control. However, weevils successfully established at this site on *Cirsium vulgare*. Infected seed heads have significantly fewer seeds compared to uninfected seed heads. However weevils have been slow to disperse and numbers remain low overall; only 12.6% of seed heads attacked at release site, and damage decreases as the season progresses.
Research Organization	ARC-PPRI
References	637, 821, 992, 2073

RELEASE	
Country	Republic of South Africa
Year	1986
Source	Ex. France (western)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

TABLE 1

ASTERACEAE
Cirsium vulgare; Rhinocyllus conicus *(continued)*

Country Republic of South Africa (continued)

Notes Population not distinguished from 1985 release in the literature. Infected seed heads have significantly fewer seeds compared to uninfected seed heads. However weevils have been slow to disperse and numbers remain low overall; only 41.5% of seed heads attacked at release site, and damage decreases as the season progresses.

Research Organization ARC-PPRI

References 821, 992, 2073

RELEASE

Country United States of America

Year 1973

Source Ex. Italy, France (Rhine Valley)

Established Yes

Abundance Limited

General Impact Slight

Geographical Scale of Impact Localized

Notes Agents sourced from *Carduus nutans* (Ex. France) and *Ca. pycnocephalus* (Ex. Italy) found attacking *Cirsium vulgare* secondarily. Because *Ci. vulgare* flowers much later than the primary hosts, impact to this species is minimal.

Other Species Attacked Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.

Research Organization State (15)

References 332, 335, 1457, 1506

ASTERACEAE
Cirsium vulgare *(continued)*

AGENT

Species *Trichosirocalus horridus* (Panzer)

Classification (Coleoptera: Curculionidae)

Notes A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The authors of this revision stated “it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n.” However because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently underway to determine if the species complex is truly a complex, and to

(continued on next page)

ASTERACEAE
Cirsium vulgare *(continued)*

Species	*Trichosirocalus horridus* (Panzer)
Notes (continued)	what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.
References	27, 689

RELEASE	
Country	Australia
Year	1996
Source	Ex. Germany via Canada via New Zealand
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Redistributed from *Carduus nutans* subsp. *nutans* to *Cirsium vulgare*. Individuals now established on *Ca. nutans* considered to be *Trichosirocalus horridus* while these on *Ci. vulgare* are *T. horridus*. Confirmed established at one site each in VIC and TAS though formal evaluation of dispersal and impact lacking.
Research Organization	CSIRO, VIC State, NSW State
References	186, 886, 1602

ASTERACEAE
Cirsium vulgare; Trichosirocalus horridus *(continued)*

RELEASE	
Country	United States of America
Year	1974
Source	Ex. Italy
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Following initial releases on *Carduus acanthoides* in VA, some 20% of *Cirsium vulgare* plants within release areas exploited by this agent. Also redistributed intentionally to *Ca. acanthoides*. Few plant roots found infested with this agent in WY. Status in KS unknown.
Other Species Attacked	Also found feeding on five native *Cirsium* spp. in the USA. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders. Observed on the exotic *Cirsium arvense* (L.) Scop., though impact likely minimal.
Research Organization	State (7,13)
References	47, 335, 710, 1010, 1578, 1778

TABLE 1

TABLE 1

ASTERACEAE
Cirsium vulgare *(continued)*

AGENT

Species	*Urophora stylata* (Fabricius)
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	1993
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Evidence of insect presence in VIC varies by site and year. Where established, seed reduction up to 32% per capitulum has been recorded; capitula attack has varied 1 to 83%. Large amounts of seed still produced so control is not likely, though formal studies addressing impact are lacking. Establishment unconfirmed in NSW but confirmed for 2010 TAS release.
Research Organization	CSIRO, VIC State, NSW State
References	186, 883, 886, 1602

RELEASE

Country	Canada
Year	1973
Source	Ex. Germany, Switzerland
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Cirsium vulgare; Urophora stylata *(continued)*

Country	Canada (continued)
Notes	Naturally dispersed from all release sites and now abundant. *Cirsium vulgare* has decreased at most sites, likely due to combination of land use and attack by *Urophora stylata* and *Rhinocyllus conicus*.
Research Organization	AAFC, MU
References	117, 432, 437, 735, 744, 1469, 1628

RELEASE

Country	Canada
Year	1976
Source	Ex. France, Austria
Established	No
General Impact	Compromised
Notes	Release site mowed one year after release and colony disappeared.
Limiting Factors	Land use
Research Organization	AAFC, MU
References	744, 1469, 1628

RELEASE

Country	New Zealand
Year	1998
Source	Ex. France via Australia
Established	Yes
Abundance	Variable
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Impact has not been evaluated in New Zealand.
Research Organization	MWLR
References	749, 761, 1051, 1064, 1602

ASTERACEAE
Cirsium vulgare; Urophora stylata *(continued)*

RELEASE	
Country	New Zealand
Year	1999
Source	Ex. Germany, Switzerland via Canada via USA
Established	Yes
Abundance	Variable
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Intermixed with and no longer differentiated from earlier release via Australia. Impact has not been evaluated in New Zealand.
Research Organization	MWLR
References	744, 761, 1051, 1064, 1506

RELEASE	
Country	Republic of South Africa
Year	1983
Source	Ex. Germany (western)
Established	No
Notes	Main population accidentally destroyed by herbicidal application. Secondary release site failed as well for unknown reasons.
Limiting Factors	Other control methods
Research Organization	ARC-PPRI
References	992, 2073

ASTERACEAE
Cirsium vulgare; Urophora stylata *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1987
Source	Ex. Germany (western), France (western)
Established	No
Research Organization	ARC-PPRI
References	992, 2073

RELEASE	
Country	Republic of South Africa
Year	1989
Source	Ex. Germany (Rhine Valley)
Established	No
Research Organization	ARC-PPRI
References	992, 2073

RELEASE	
Country	United States of America
Year	1983
Source	Ex. Germany, Switzerland via Canada
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations cyclical in OR, limited in CA, CO and WA. From 60 to 90% of seed heads attacked in some areas, which has reduced seed production by up to 60%. However, in general, difficult to maintain high fly populations on this short-lived weed.
Research Organization	USDA (1,7), State (9,14,15)
References	332, 334, 335, 926, 927, 1501, 1506, 1578, 1799, 1902

TABLE 1

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Elephantopus mollis* Kunth
Incorrect Past Names/Synonyms	*Elephantopus scaber* L.
Notes	In the 4th edition of this catalogue, *Elephantopus scaber* L. was listed as a synonym for *Elephantopus mollis* Kunth. Though some release records indicate releases were made on both species in various regions, it is unclear if two species were truly present, or if both names were used for the same species. More recent references indicate the species are indeed separate and that the weed targeted for biological control is *E. mollis*. Consequently, the editors of this version of the catalogue refer to *E. mollis* alone, and list *E. scaber* as a name that has been incorrectly applied to *E. mollis*.
Origin	Central America, Caribbean
Common Name	elephant's foot, tobacco weed, lata hina, tobacco weed, tavoko ni veikau
References	817, 846

AGENT

Species	*Tetraeuaresta obscuriventris* (Loew)
Classification	(Diptera: Tephritidae)

ASTERACEAE
Elephantopus mollis; Tetraeuaresta obscuriventris (continued)

RELEASE

Country	Fiji
Year	1957
Source	Ex. Trinidad
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Though parasitized, agent is widely established with vast numbers. Control value documented as substantial, though formal evaluation of impact lacking.
Limiting Factors	Parasitism
Research Organization	DAF
References	288, 635, 961, 1376, 1547, 1940

RELEASE

Country	Hawaii USA
Year	1961
Source	Ex. Trinidad via Fiji
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Widespread and abundant following release. Partial control on KA initially, but more recently appears to be ineffective agent.
Research Organization	HDOA
References	30, 44, 407, 408, 409, 1149, 1349, 1940

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Gutierrezia* spp.
Notes	Encompasses numerous species in the genus *Gutierrezia*, including the most problematic *Gutierrezia sarothrae* (Pursh) Britton & Rusby and *G. microcephala* (DC.) A. Gray
Origin	North America, South America
Common Name	snakeweeds

AGENT

Species	*Heilipodus ventralis* (Hustache)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1988
Source	Ex. Argentina
Established	No
Notes	The target weed species are native to the USA.
Research Organization	USDA (3,13), State (35,40)
References	346, 460, 464

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Jacobaea vulgaris* Gaertn.
Past Names/Synonyms	*Senecio jacobaea* L.
Origin	Eurasia, northern Africa
Common Name	ragwort, tansy ragwort
References	434, 891, 1064, 1450, 1777

AGENT

Species	*Botanophila jacobaeae* (Hardy)
Past Names/Synonyms	*Hylemyia jacobaeae* (Hardy), *Pegohylemyia jacobaeae* (Hardy)
Incorrect Past Names/Synonyms	*Hylemyia seneciella* (Meade)
Classification	(Diptera: Anthomyiidae)
Notes	The introduction from New Zealand to Australia contained flies that were incorrectly identified as both *Hylemyia seneciella* (Meade) and *H. jacobaeae* (Hardy). However a closer inspection showed they were all *H. jacobaeae*.

RELEASE

Country	Australia
Year	1959
Source	Ex. England via New Zealand
Established	No
Research Organization	CSIRO
References	305, 456, 564, 886, 891

TABLE 1

ASTERACEAE
Jacobaea vulgaris; Botanophila jacobaeae (continued)

RELEASE	
Country	New Zealand
Year	1936
Source	Ex. England
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Can destroy large number of seeds in attacked heads, however most seed heads bloom later in season and escape herbivory.
Limiting Factors	Agent-host synchronization
Research Organization	DSIR
References	527, 720, 761, 835, 1064, 1246, 1769

AGENT	
Species	*Botanophila seneciella* (Meade)
Past Names/Synonyms	*Pegohylemyia seneciella* (Meade), *Hylemyia seneciella* (Meade)
Incorrect Past Names/Synonyms	*Hylemya seneciella* (Meade)
Classification	(Diptera: Anthomyiidae)

RELEASE	
Country	Canada
Year	1968
Source	Ex. France via USA (CA)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Jacobaea vulgaris; Botanophila seneciella (continued)

Country	Canada (continued)
Notes	Though widely distributed throughout BC, abundance is low. Populations often restricted to small relic populations of weed less desired by other biocontrol agents. Unable to control weed alone but contributes to partial control in combination with *Longitarsus* spp. and *Cochylis atricapitana*.
Limiting Factors	Interspecific competition
Research Organization	AAFC
References	117, 432, 434, 437, 594, 745, 746, 1469

RELEASE	
Country	New Zealand
Year	1936
Source	Ex. England
Established	No
Research Organization	DSIR
References	527, 720, 835, 1064, 1246, 1769

RELEASE	
Country	United States of America
Year	1966
Source	Ex. France
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Least effective of the three tansy ragwort biological control agents established in the USA. Only early seed heads are utilized; later-developing capitula generally escape attack. Best used as a complement to the other two.
Research Organization	USDA (7,12), State (8,9,15)
References	332, 335, 338, 594, 1202, 1501, 1578, 1836, 2003

ASTERACEAE
Jacobaea vulgaris *(continued)*

AGENT	
Species	*Cochylis atricapitana* (Stephens)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Australia
Year	1987
Source	Ex. Spain
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Causes significant damage in VIC and TAS by reducing plant size and survival.
Limiting Factors	Possibly Predation
Research Organization	VIC State, TAS State
References	564, 886, 890, 891, 1228, 1229

RELEASE	
Country	Canada
Year	1990
Source	Ex. Spain via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Established readily in NS where controlled weed within 5 years and dispersed widely. In BC populations smaller and restricted to coastal regions; introductions into interior climates failed. Though likely contributes to partial control with *Longitarsus* spp., formal evaluation of impact lacking.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 432, 434, 2003

ASTERACEAE
Jacobaea vulgaris; Cochylis atricapitana *(continued)*

RELEASE	
Country	New Zealand
Year	2006
Source	Ex. Spain via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	No evidence yet the agent has established.
Research Organization	MWLR
References	761, 891, 1064

AGENT	
Species	*Longitarsus flavicornis* (Stephens)
Incorrect Past Names/Synonyms	*Longitarsus jacobaeae* (Waterhouse)
Classification	(Coleoptera: Chrysomelidae)
Notes	The first release of *Longitarsus flavicornis* (Stephens) was originally misidentified as *Longitarsus jacobaeae* (Waterhouse) and released under that name in Australia in 1979. The true *L. jacobaeae* was subsequently released in Australia in 1987.

RELEASE	
Country	Australia
Year	1979
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Variable

(continued on next page)

TABLE 1

TABLE 1

ASTERACEAE
Jacobaea vulgaris; Longitarsus flavicornis *(continued)*

Country	Australia (continued)
Notes	Substantial to complete control in TAS. Less effective where there is winter flooding or water logging. In VIC effective above 500m at high rainfall sites, but failed to establish in warm, drier, coastal areas.
Limiting Factors	Climate; Habitat
Research Organization	VIC State
References	383, 564, 886, 887, 890, 891, 1229, 1523

RELEASE

Country	Australia
Year	1985
Source	Ex. Spain
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	This second introduction intermixed with earlier release and no longer differentiated. Substantial to complete control in TAS. Less effective where there is winter flooding or water logging. In VIC effective above 500m at high rainfall sites, but failed to establish in warm, drier, coastal areas.
Limiting Factors	Climate; Habitat
Research Organization	VIC State
References	564, 886, 891, 1229, 1523

ASTERACEAE
Jacobaea vulgaris *(continued)*

AGENT

Species	*Longitarsus jacobaeae* (Waterhouse)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1987
Source	Ex. Italy via USA (OR) via New Zealand
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Establishment, spread and impact minimal in VIC. In TAS, populations established, however they overlap with the very similar *Longitarsus flavicornis*, and the species are no longer differentiated.
Research Organization	VIC State
References	564, 886, 890, 891, 1229

RELEASE

Country	Canada
Year	1971
Source	Ex. Italy via USA (CA)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations from numerous sources released in 1970s and not differentiated. Abundant in cool coastal climates but establishment failed or very limited in interior. Where populations large, controls weed well in conjunction with other biocontrol agents.
Limiting Factors	Climate
Research Organization	AAFC
References	25, 434, 437, 735, 745

ASTERACEAE
Jacobaea vulgaris; Longitarsus jacobaeae *(continued)*

RELEASE	
Country	Canada
Year	1972
Source	Ex. England
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations from numerous sources released in 1970s and not differentiated. Abundant in cool coastal climates but establishment failed or very limited in interior. Where populations large, controls weed well in conjunction with other biocontrol agents.
Limiting Factors	Climate
Research Organization	AAFC
References	25, 434, 437, 735, 745

RELEASE	
Country	Canada
Year	1973
Source	Ex. Switzerland
Established	No
Notes	Though originally recorded as established, subsequent establishment results and beetle phenology indicated the original Swiss biotype failed.
Limiting Factors	Climate
Research Organization	AAFC
References	25, 434, 437, 735, 745

ASTERACEAE
Jacobaea vulgaris; Longitarsus jacobaeae *(continued)*

RELEASE	
Country	Canada
Year	1976
Source	Ex. Italy via USA (OR)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations from numerous sources released in 1970s and not differentiated. Abundant in cool coastal climates but establishment failed or very limited in interior. Where populations large, controls weed well in conjunction with other biocontrol agents.
Limiting Factors	Climate
Research Organization	AAFC
References	25, 434, 437, 735, 745

RELEASE	
Country	Canada
Year	2011
Source	Ex. Switzerland via USA (MT)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Additional population from Switzerland released beginning to increase efficacy in cold habitats. Releases of this strain ongoing.
Limiting Factors	Climate
Research Organization	AAFC
References	434, 437, 745, 1538

TABLE 1

ASTERACEAE
Jacobaea vulgaris; Longitarsus jacobaeae *(continued)*

RELEASE	
Country	New Zealand
Year	1983
Source	Ex. Italy via USA (OR)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Weed density declined dramatically at most sites soon after agent introduction. Sites with high rainfall less successful as these conditions favor the weed and hinder the agent.
Limiting Factors	Climate
Research Organization	DSIR
References	720, 761, 1064, 1769

RELEASE	
Country	United States of America
Year	1968
Source	Ex. Italy
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Most effective of established *Jacobaea vulgaris* agents. Has reduced *J. vulgaris* populations densities by 90% at some coastal or mild-climate locations. Works well in conjunction with *Tyria jacobaeae*.
Research Organization	USDA (7,12), State (8,9,15)
References	332, 338, 756, 1202, 1461, 1501, 1777, 1836, 2003

ASTERACEAE
Jacobaea vulgaris; Longitarsus jacobaeae *(continued)*

RELEASE	
Country	United States of America
Year	1969
Source	Ex. Switzerland
Established	No
Research Organization	USDA (7,12), State (8,9,15)
References	1777, 1836

RELEASE	
Country	United States of America
Year	2002
Source	Ex. Switzerland
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Better suited to climate where the Italian strain did poorly (inland, colder regions). Rapidly increasing at release sites in ID and MT, though populations still limited.
Research Organization	State (6,7), USDA (10)
References	334, 338, 1538, 1776, 1777, 2003

ASTERACEAE
Jacobaea vulgaris *(continued)*

AGENT	
Species	*Platyptilia isodactyla* (Zeller)
Classification	(Lepidoptera: Pterophoridae)

RELEASE	
Country	Australia
Year	1999
Source	Ex. Spain
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Well established in VIC and TAS with capitulum production 48-67% less in attacked plants in VIC.
Research Organization	TAS State, VIC State
References	886, 891, 1275, 1418

RELEASE	
Country	New Zealand
Year	2006
Source	Ex. Spain via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Established readily and beginning to decrease weed population where released. Showing promising results complementing effects of *Longitarsus jacobaeae*.
Research Organization	MWLR
References	761, 891, 1064, 1084

ASTERACEAE
Jacobaea vulgaris *(continued)*

AGENT	
Species	*Tyria jacobaeae* (L.)
Incorrect Past Names/Synonyms	*Callimorpha jacobaeae* (L.)
Classification	(Lepidoptera: Erebidae)

RELEASE	
Country	Australia
Year	1930
Source	Ex. England via New Zealand
Established	No
Research Organization	CSIR*
References	387, 564

RELEASE	
Country	Australia
Year	1936
Source	Ex. England
Established	No
Notes	Establishment failure due to heavy predation by *Harpobittacus nigriceps* (Selys) and other insects as well as disease outbreaks during laboratory rearing.
Limiting Factors	Predation; Disease
Research Organization	CSIR*
References	387, 564

TABLE 1

ASTERACEAE
Jacobaea vulgaris; Tyria jacobaeae *(continued)*

RELEASE

Country	Australia
Year	1955
Source	Ex. England
Established	No
Notes	Though some colonies initially survived in field, eventually disappeared due to heavy predation by *Harpobittacus nigriceps* (Selys) and other insects, parasitism, and disease outbreaks. Laboratory rearing severely impacted by disease outbreaks.
Limiting Factors	Predation; Disease; Parasitism
Research Organization	VIC State, CSIRO
References	140, 456, 564, 1622

RELEASE

Country	Australia
Year	1955
Source	Ex. Italy
Established	No
Notes	Imported stock ill-adapted to Australian conditions; no progeny survived to achieve successful pupation.
Limiting Factors	Agent-host synchronization
Research Organization	VIC State
References	140, 456, 564, 1622

RELEASE

Country	Australia
Year	1962
Source	Ex. Switzerland, Austria
Established	No

(continued at top of next column)

ASTERACEAE
Jacobaea vulgaris; Tyria jacobaeae *(continued)*

Country	Australia (continued)
Notes	Each release established for up to 3 seasons but eventually disappeared due to build-up of predation by insects and birds, parasitism, and disease.
Limiting Factors	Predation; Disease; Parasitism
Research Organization	VIC State
References	456, 564, 1621

RELEASE

Country	Australia
Year	1978
Source	Ex. Switzerland via Canada; Ex. France via USA (CA) via Canada
Established	No
Notes	One population persisted for 4 years, but all eventually disappeared. Predation, disease and environmental factors (poor climate matching) likely factors in disappearance.
Limiting Factors	Predation; Disease; Climate
Research Organization	VIC State
References	456, 564, 746, 755, 1622

RELEASE

Country	Australia
Year	1993
Source	Ex. England via New Zealand
Established	Yes
Abundance	Rare
General Impact	None

(continued on next page)

ASTERACEAE
Jacobaea vulgaris; Tyria jacobaeae *(continued)*

Country	Australia (continued)
Notes	Though some colonies survived initially in TAS, eventually disappeared due to predation, parasitism, and lack of suitable pupation sites. One population established in VIC since 1994, however not spreading and impact expected to be negligible.
Limiting Factors	Predation; Parasitism; Habitat
Research Organization	TAS State, VIC State
References	883, 886, 890, 891, 1229

RELEASE

Country	Canada
Year	1961
Source	Ex. Sweden
Established	No
Limiting Factors	Predation; Parasitism
Research Organization	AAFC
References	746

RELEASE

Country	Canada
Year	1962
Source	Ex. Switzerland
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Jacobaea vulgaris; Tyria jacobaeae *(continued)*

Country	Canada (continued)
Notes	Can cause complete defoliation of *Jacobaea vulgaris* which can lead to decreased winter survivorship and decreased seed production in some locations at some times. However, *J. vulgaris* populations persist in all major infested areas despite even high cases of defoliation. Weather-induced fluctuations of weed control insect populations rather than vice versa.
Limiting Factors	Climate
Research Organization	AAFC
References	434, 743, 745, 746, 747, 1469

RELEASE

Country	Canada
Year	1966
Source	Ex. France via USA (CA)
Established	No
Research Organization	AAFC
References	117, 437, 746, 755

RELEASE

Country	New Zealand
Year	1929
Source	Ex. England
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations vary by year and location. At high densities, severe defoliation has been observed killing plants, though most New Zealand populations are able to regrow. Rarely sufficient to markedly impact the weed.

(continued on next page)

ASTERACEAE
Jacobaea vulgaris; Tyria jacobaeae *(continued)*

Country	New Zealand (continued)
Other Species Attacked	Occasionally found causing spillover attack on the native *Senecio minimus* Poir. and *S. biserratus* Belcher
Research Organization	CI
References	720, 761, 1064, 1246, 1768, 1769

RELEASE

Country	United States of America
Year	1959
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations fluctuate; high densities often completely defoliate plants. In mild regions of CA, OR, WA the weed often re-grows and recovers sufficiently to successfully overwinter and reproduce. In the colder, harsher Intermountain West, frosts usually kill regrowth before plants fully recover so moth is more effective at reducing weed populations. Complements effect of *Longitarsus jacobaeae*. Due to observed nontarget attack, interstate transport not permitted, and some states have prohibited its redistribution within their borders.

(continued at top of next column)

ASTERACEAE
Jacobaea vulgaris; Tyria jacobaeae *(continued)*

Country	United States of America (continued)
Limiting Factors	Predation; Parasitism; Disease
Other Species Attacked	Documented attacking the introduced *Senecio vulgaris* L. and *S. seneca*, the ornamental *Senecio bicolor* (Willd.) Tod. (whose name has since been changed to *Jacobaea maritima* [L.] Pelser & Meijden) and the native *S. integerrimus* Nutt., *S. triangularis* Hook. and *Packera pseudaurea* (Rydb.) W.A. Weber & Á. Löve. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders.
Research Organization	USDA (7,12), State (8,9,15)
References	332, 334, 338, 755, 756, 758, 1202, 1457, 1461, 1501, 1836, 2003

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Mikania micrantha* Kunth
Origin	Central America, South America
Common Name	mile-a-minute weed, mikania vine, wa bosucu, wa butako
AGENT	
Species	*Actinote anteas* (Doubleday)
Classification	(Lepidoptera: Nymphalidae)
RELEASE	
Country	Indonesia
Year	1999
Source	Ex. Costa Rica
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Released intentionally against *Chromolaena odorata*, but quickly spread and established on *Mikania micrantha* as well. Along with *Actinote thalia pyrrha*, helps control weed in some lowland areas. Populations somewhat limited by predation.
Limiting Factors	Predation
Research Organization	IOPRI
References	416, 486, 2054

ASTERACEAE
Mikania micrantha *(continued)*

AGENT	
Species	*Actinote thalia pyrrha* Fabricius
Classification	(Lepidoptera: Nymphalidae)
RELEASE	
Country	Indonesia
Year	1999
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Released intentionally against *Chromolaena odorata*, but quickly spread and established on *Mikania micrantha* as well. Along with *Actinote anteas*, helps control weed in some lowland areas.
Other Species Attacked	Also feeds on the exotic *Austroeupatorium inulaefolium* (Kunth) R.M. King & H. Rob.
Research Organization	IOPRI
References	416, 486, 2054

TABLE 1

ASTERACEAE
Mikania micrantha *(continued)*

AGENT

Species	*Liothrips mikaniae* (Priesner)
Classification	(Thysanoptera: Phlaeothripidae)

RELEASE

Country	Malaysia
Year	1990
Source	Ex. Trinidad
Established	No
Notes	Establishment failure due to predation.
Limiting Factors	Predation
Research Organization	IIBC, PLANTI
References	55, 290, 416, 878, 879, 1096

RELEASE

Country	Solomon Islands
Year	1988
Source	Ex. Trinidad
Established	No
Notes	Initially believed to have established from the 1989 release as subsequent redistributions made. However believed to have died out by 1990.
Research Organization	MAL, IIBC
References	290, 416, 1438, 1864

ASTERACEAE
Mikania micrantha *(continued)*

AGENT

Species	*Puccinia spegazzinii* De Toni
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Fiji
Year	2009
Source	Ex. Ecuador
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Isolate IMI 393075. Establishment higher in wetter regions. Having impact at several sites locally and continuing to spread, though it is too soon to determine overall abundance and impact.
Limiting Factors	Climate
Research Organization	KRS, SPC
References	416, 418, 424, 537

RELEASE

Country	India
Year	2005
Source	Ex. Trinidad
Established	No
Notes	Isolate IMI 393067. Failed to establish in Assam where biotype of weed resistant to this pathotype, and where dry season is long. Initially believed to thrive in Kerala where dry season short. Subsequent observations show it failed to establish persistent populations in the field.
Limiting Factors	Specificity; Climate
Research Organization	CABI-United Kingdom, KFRI
References	114, 537, 539, 1606

ASTERACEAE
Mikania micrantha; Puccinia spegazzinii *(continued)*

RELEASE

Country	Papua New Guinea
Year	2008
Source	Ex. Ecuador
Established	Yes
Abundance	High
General Impact	Too early post release
Notes	Isolate IMI 393075. Established and spread rapidly, especially in wet regions. Already reducing growth rate and cover at some sites, but too soon post release to know overall impact.
Limiting Factors	Climate
Other Species Attacked	Found infecting the native species *Mikania cordata* (Burm. f.) B.L. Rob.
Research Organization	NARI
References	416, 418, 424, 537

RELEASE

Country	People's Republic of China
Year	2006
Source	Ex. Argentina
Established	No
Notes	Isolate IMI 393078. Though there was spread at the release site initially, currently believed to have failed. Does not establish or perform well at dry sites.
Limiting Factors	Climate
Research Organization	CABI-United Kingdom, CAAS-BCI, GEI
References	416, 537, 538

ASTERACEAE
Mikania micrantha; Puccinia spegazzinii *(continued)*

RELEASE

Country	People's Republic of China
Year	2011
Source	Ex. Ecuador via Papua New Guinea
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Isolate IMI 393075. Established at three sites.
Limiting Factors	Climate
Research Organization	CABI-United Kingdom, CAAS-BCI, GAF
References	418, 418, 424, 764

RELEASE

Country	Taiwan
Year	2008
Source	Ex. Ecuador
Established	Yes
Abundance	Variable
General Impact	Too early post release
Notes	Isolate IMI 393075. Though still too early post release to determine overall impact, rust spread already observed from southern to central Taiwan. Does not establish or perform well at dry sites; high disease severity corresponds with humid and shaded hillsides.
Limiting Factors	Climate
Research Organization	CABI-United Kingdom, TFB
References	416, 418, 537, 538, 1844

TABLE 1

ASTERACEAE
Mikania micrantha; Puccinia spegazzinii (continued)

RELEASE	
Country	Vanuatu
Year	2012
Source	Ex. Ecuador via Papua New Guinea
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Isolate IMI 393075. Established and spreading on Efate and Tanna but too soon to assess impact.
Limiting Factors	Climate
Research Organization	DLQS
References	204, 418, 424

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Onopordum acanthium* L.
Origin	Eurasia, northern Africa
Common Name	Scotch thistle

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	Canada
Year	1998
Source	Ex. France (Rhine Valley)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Redistributed from *Carduus nutans* to *Onopordum acanthium*. The single release site was monitored and an unknown larva recovered, however it was not confirmed to be *Rhinocyllus conicus*. Site status remains unknown.
Other Species Attacked	Also feeds on native *Cirsium* spp.
Research Organization	AAFC
References	117, 729, 1186

ASTERACEAE
Onopordum acanthium; Rhinocyllus conicus *(continued)*

RELEASE	
Country	United States of America
Year	1973
Source	Ex. France (Rhine Valley)
Established	No
Notes	Sourced from *Carduus nutans*. Redistributed from *Ca. nutans* to *Onopordum acanthium*. Failure to establish likely due to strain being collected from host species different from release target.
Limiting Factors	Specificity
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	State (15)
References	332, 1457, 1501, 1578

RELEASE	
Country	United States of America
Year	1973
Source	Ex. Italy
Established	No
Notes	Sourced from *Carduus pycnocephalus*. Failure to establish likely due to strain being collected from host species different to release target.
Limiting Factors	Specificity
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	USDA (1), State (15)
References	332, 335, 1457

ASTERACEAE
Onopordum acanthium; Rhinocyllus conicus *(continued)*

RELEASE	
Country	United States of America
Year	1976
Source	Ex. Unknown
Established	No
Notes	Though this release was likely a within-CA redistribution from other local sources, it remains unclear from which species and host plant it was originally sourced.
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	State (14)
References	231, 924, 1457, 1512

AGENT	
Species	*Trichosirocalus horridus* (Panzer)
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. The editors of this revision stated “it is highly likely that the introductions originally made into Canada from Germany to control *Carduus* spp., as well as those into

(continued on next page)

TABLE 1

ASTERACEAE
Onopordum acanthium *(continued)*

Species *Trichosirocalus horridus* (Panzer)

Notes (continued) the United States from Italy to control *Carduus* spp. and *Cirsium vulgare* are either *T. mortadelo* sp. n. or a mixture of *T. horridus* and *T. mortadelo* sp. n." However because specimens in North America have not been examined in greater detail utilizing the new keys, the editors of this catalogue must refer to them all with the only name under which they have appeared in North American literature, *T. horridus*. All three species are supposedly present in Australia. While it is believed Australia sourced their *T. mortadelo* from New Zealand, surveys in New Zealand yielded *T. horridus* only, regardless of whether the host surveyed was *Cirsium* or *Carduus*. Molecular studies are currently underway to determine if the species complex is truly a complex, and to what level, but until new results are published the editors of this catalogue follow the published conclusion that three distinct *Trichosirocalus* species have been utilized in thistle weed biological control.

References 27, 689

ASTERACEAE
Onopordum acanthium; Trichosirocalus horridus *(continued)*

RELEASE

Country Canada
Year 1991
Source Ex. Germany
Established Yes
Abundance Unknown
General Impact Unknown
Geographical Scale of Impact Unknown
Notes Naturally spread from releases and/or redistributions made on *Carduus* spp. and *Cirsium vulgare*. Also redistributed intentionally from *Ca. nutans* to *Onopordum acanthium*.
Research Organization AAFC
References 117, 729, 735

RELEASE

Country United States of America
Year 1994
Source Ex. Italy
Established No
Notes Redistributed from *Carduus nutans* to *Onopordum acanthium* but failed to establish.
Other Species Attacked Also found feeding on five native *Cirsium* spp. in the USA. Consequently, interstate transport not permitted, and some states have prohibited its redistribution within their borders. Also observed on the exotic *Cirsium arvense* (L.) Scop., though impact likely minimal.
Research Organization State (15)
References 47, 332, 335, 710, 1578, 1778

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Onopordum acaulon* L.
Origin	Eurasia, northern Africa
Common Name	stemless thistle
AGENT	
Species	*Eublemma amoena* (Hübner)
Classification	(Lepidoptera: Erebidae)
RELEASE	
Country	Australia
Year	2000
Source	Ex. France (southern)
Established	No
Notes	Redistributed from *Onopordum* spp. complex (*O. acanthium*, *O. illyricum*, and their hybrids) to *O. acaulon*. Establishment failure possibly due to poor weather condition at release time and prolonged drought post release.
Limiting Factors	Climate
Research Organization	CSIRO
References	1608

ASTERACEAE
Onopordum acaulon (continued)

AGENT	
Species	*Larinus latus* Herbst
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	Australia
Year	2001
Source	Ex. Greece
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Redistributed from *Onopordum* spp. complex (*O. acanthium*, *O. illyricum*, and their hybrids) to *O. acaulon*.
Research Organization	CSIRO
References	171, 1759

TABLE 1

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Onopordum* spp.
Notes	Comprises *Onopordum acanthium* L. (Scotch thistle) and *O. illyricum* L. (Illyrian thistle) as a complex of parent and hybrid forms in Australia
Origin	Eurasia, northern Africa
Common Name	Scotch thistle, Illyrian thistle

AGENT

Species	*Botanophila spinosa* Rondani
Classification	(Diptera: Anthomyiidae)

RELEASE

Country	Australia
Year	1999
Source	Ex. France (southern)
Established	No
Research Organization	CSIRO
References	171, 172, 175, 1418

AGENT

Species	*Eublemma amoena* (Hübner)
Classification	(Lepidoptera: Erebidae)

RELEASE

Country	Australia
Year	1998
Source	Ex. France (southern)
Established	Yes

(continued at top of next column)

ASTERACEAE
Onopordum spp.; *Eublemma amoena* *(continued)*

Country	Australia (continued)
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Observed reducing size of attacked plants. Currently the restricted range and low population sizes limit impact overall.
Research Organization	CSIRO
References	171, 172, 175

AGENT

Species	*Larinus latus* Herbst
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1992
Source	Ex. Greece
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Infests the majority of capitula in *Onopordum* patches on the mainland, significantly decreasing production/release of viable seed. In combination with other agents contributes to control, though impact decreased somewhat by large and long-lived seed bank. Establishment in TAS confirmed though too early (for recent releases) to determine impact.
Research Organization	CSIRO
References	171, 175, 883, 886, 1758, 2012

ASTERACEAE
***Onopordum* spp.** *(continued)*

AGENT

Species	*Lixus cardui* Olivier
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1993
Source	Ex. France (southern)
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Most widely established agent on mainland *Onopordum*. Significantly decreases plant stature and seed production. In combination with other agents contributes to control. Establishment in TAS confirmed though too early (for recent releases) to determine impact.
Research Organization	CSIRO
References	168, 171, 175, 176, 883, 886, 1762, 2012

ASTERACEAE
***Onopordum* spp.** *(continued)*

AGENT

Species	*Tephritis postica* Loew
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	1995
Source	Ex. France (southern)
Established	No
Notes	Establishment failure probably due to adult winter mortality and over-dispersal of survivors.
Limiting Factors	Climate
Research Organization	CSIRO
References	171, 172, 175, 2012

AGENT

Species	*Trichosirocalus briesei* Alonso-Zarazaga & Sanchez-Ruiz
Classification	(Coleoptera: Curculionidae)
Notes	A 2002 revision of *Trichosirocalus horridus* (Panzer) concluded that this species was in fact a complex of three species, with distinct host plant genus preferences: *T. horridus*, *T. mortadelo* Alonso-Zarazaga & Sánchez-Ruiz, and *T. briesei* Alonso-Zarazaga & Sánchez-Ruiz with preferences for *Cirsium*, *Carduus*, and *Onopordum* thistles, respectively. All three are supposedly present in Australia.

(continued on next page)

TABLE 1

TABLE 1

ASTERACEAE
***Onopordum* spp.** *(continued)*

Species	*Trichosirocalus briesei* Alonso-Zarazaga & Sanchez-Ruiz (continued)
Notes	Because there is a disagreement for the morphological parameters selected by taxonomists for this separation, molecular studies are currently underway to determine if the species complex is truly a complex, and to what level. Until new conclusions are reached, the editors of this catalogue follow the three published names of the separation.
References	27, 171, 175

RELEASE

Country	Australia
Year	1997
Source	Ex. Spain (northern)
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Observed reducing size of attacked plants and killing smaller rosettes. Currently the restricted range and low population sizes limit impact overall.
Research Organization	CSIRO
References	171, 175

ASTERACEAE
***Onopordum* spp.** *(continued)*

AGENT

Species	*Urophora terebrans* (Loew)
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	2000
Source	Ex. Italy (central)
Established	No
Notes	Difficult to rear and discarded after *Larinus latus* became widespread.
Research Organization	CSIRO
References	171, 172, 175, 1418

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Parthenium hysterophorus* L.
Origin	North America, Central America, South America
Common Name	parthenium weed, parthenium, congress grass

AGENT	
Species	*Bucculatrix parthenica* Bradley
Past Names/Synonyms	*Bucculatrix* sp. D
Classification	(Lepidoptera: Bucculatricidae)

RELEASE	
Country	Australia
Year	1984
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely established, populations vary by season and weather—increasing in summer/autumn with high rainfall and becoming scarce in dry times. In favorable conditions up to 50% of total leaf area is destroyed, but in general populations are low with no obvious impact on the weed.
Limiting Factors	Climate; Season
Research Organization	QLD State, IIBC
References	497, 1194, 1209, 1215

ASTERACEAE
Parthenium hysterophorus *(continued)*

TABLE 1

AGENT	
Species	*Carmenta* sp. nr *ithacae* (Beutenmüller)
Classification	(Lepidoptera: Sesiidae)
Notes	The population of *Carmenta ithacae* from *Parthenium hysterophorus* in Mexico may be a different species from the more polyphagous population from the USA, and hence is referred to as *Carmenta* sp. nr. *ithacae*.

RELEASE	
Country	Australia
Year	1998
Source	Ex. Mexico
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though initially believed to be of only limited abundance, in summer 2012 widespread establishment seen throughout central QLD; abundance and impact expected to continue to increase.
Research Organization	QLD State
References	493, 497, 1418

TABLE 1

ASTERACEAE
Parthenium hysterophorus *(continued)*

AGENT	
Species	*Conotrachelus albocinereus* Fiedler
Past Names/Synonyms	*Conotrachelus* sp.
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1995
Source	Ex. Argentina
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though established in central QLD is neither widespread nor abundant.
Research Organization	QLD State
References	497, 1222

AGENT	
Species	*Epiblema strenuana* (Walker)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Australia
Year	1982
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Parthenium hysterophorus; Epiblema strenuana *(continued)*

Country	Australia (continued)
Notes	Widely established throughout range of weed, reaching densities of 20 to 30 larvae per plant. Major contributor to substantial control, especially when young plants attacked and in presence of pasture competition. Heavy infestations reduce plant height and seed production. Insect populations decline after long dry periods.
Research Organization	QLD State, IIBC
References	496, 497, 1209, 1215

AGENT	
Species	*Listronotus setosipennis* (Hustache)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1982
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though populations widespread, typically low abundance and only seasonally present in large numbers causing significant damage locally. More effective in alluvial or black soil and in regions with prolonged dry seasons and erratic rainfall.
Limiting Factors	Climate; Soil
Research Organization	QLD State
References	496, 497, 1209, 1969

ASTERACEAE
Parthenium hysterophorus; Listronotus setosipennis (continued)

RELEASE

Country	Australia
Year	1991
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Collected from drier areas with hot summers and cool winters in attempt to improve agent's effectiveness under drier conditions. Subsequently not differentiated from Brazilian population. Though widespread, typically low abundance and only seasonally present in large numbers causing significant damage locally. More effective in alluvial or black soil and in regions with prolonged dry seasons and erratic rainfall.
Limiting Factors	Climate; Soil
Research Organization	QLD State
References	437

AGENT

Species	*Platphalonidia mystica* (Razowski & Becker)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Australia
Year	1992
Source	Ex. Argentina
Established	Yes

(continued at top of next column)

ASTERACEAE
Parthenium hysterophorus; Platphalonidia mystica (continued)

Country	Australia (continued)
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Confirmed established since reared from field-collected stems, though at low levels. Larvae difficult to distinguish from the widely established *Epiblema strenuana*.
Research Organization	QLD State
References	496, 497, 679

AGENT

Species	*Puccinia abrupta* Dietel & Holw. var. *partheniicola* (H.S. Jacks.) Parmelee
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Australia
Year	1991
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Established easily in southern QLD where impact only minor. Sporadic or absent in rest of state due to unsuitable dry conditions.
Limiting Factors	Climate
Research Organization	IIBC, QLD State
References	497, 561, 1431

TABLE 1

ASTERACEAE
Parthenium hysterophorus *(continued)*

AGENT

Species	*Puccinia xanthii* Schwein. var. *parthenii-hysterophorae* Seier, H.C. Evans & Á. Romero
Past Names/Synonyms	*Puccinia melampodii* Dietel & Holway
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Australia
Year	2000
Source	Ex. Mexico, USA (TX)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Established readily in northern QLD where dry summers caused low population levels and only minor impact. Sporadic or absent in rest of state due to unsuitable dry conditions.
Limiting Factors	Climate
Research Organization	QLD State
References	494, 495, 497

RELEASE

Country	Republic of South Africa
Year	2010
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Establishment hampered by destruction of release sites and host plant death due to dry conditions post-release. Spread recorded from MP release sites. Additional releases ongoing.

(continued at top of next column)

ASTERACEAE
Parthenium hysterophorus; Puccinia xanthii *(continued)*

Country	Republic of South Africa (continued)
Limiting Factors	Land use; Climate
Research Organization	ARC-PPRI, SASRI, WFW
References	992, 1737, 1738, 1739

AGENT

Species	*Smicronyx lutulentus* Dietz
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1981
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Originally believed to have failed field establishment; populations did not become abundant until 14 years following release. Though now widely established, incidence is sporadic. Impact varies from negligible during dry periods to significant seed reduction due to high insect populations after rain.
Limiting Factors	Climate
Research Organization	QLD State
References	496, 497, 1209, 1215, 1219

ASTERACEAE
Parthenium hysterophorus *(continued)*

AGENT

Species	*Stobaera concinna* (Stål)
Classification	(Hemiptera: Delphacidae)

RELEASE

Country	Australia
Year	1983
Source	Ex. Mexico
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established on *Parthenium hysterophorus* in north QLD and on *Ambrosia artemisiifolia* in southeast QLD.
Research Organization	QLD State
References	494, 497, 1209, 1215

AGENT

Species	*Zygogramma bicolorata* Pallister
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1980
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Variable

(continued at top of next column)

ASTERACEAE
Parthenium hysterophorus; Zygogramma bicolorata *(continued)*

Country	Australia (continued)
Notes	Though widespread and abundant on *Ambrosia artemisiifolia* two years following introduction, populations did not become abundant on *Parthenium hysterophorus* until 12 years following release. Outbreaks of *Zygogramma bicolorata* cause complete defoliation that reduces plant vigor, reproductive output, weed density and soil seed banks. Outbreaks occur with sufficient summer rain and in central QLD but not in north.
Limiting Factors	Climate
Research Organization	QLD State, IIBC
References	496, 497, 1209, 1215, 1219

RELEASE

Country	India
Year	1984
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Variable
Notes	In some regions causes 100% defoliation, reducing weed population. In other areas, high densities still insufficient to control weed alone. Failed to establish is hot, dry regions.
Limiting Factors	Climate
Other Species Attacked	Also feeds on the economically important *Helianthus annuus* L. (thus far with no evidence of economic loss to sunflower crops) and the exotic *Xanthium strumarium* L.
Research Organization	IIBC, IIHR, ICAR, KAU
References	499, 555, 905, 1034

TABLE 1

TABLE 1

ASTERACEAE
Parthenium hysterophorus; Zygogramma bicolorata *(continued)*

RELEASE	
Country	Sri Lanka
Year	2004
Source	Ex. Mexico via India
Established	No
Research Organization	DASL
References	82, 499, 778

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Pilosella aurantiaca* (L.) F. W. Schultz & Sch. Bip.
Past Names/Synonyms	*Hieracium aurantiacum* L.
Origin	Europe
Common Name	orange hawkweed

AGENT	
Species	*Aulacidea subterminalis* Niblett
Classification	(Hymenoptera: Cynipidae)

RELEASE	
Country	Canada
Year	2011
Source	Ex. Switzerland
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued at top of next column)

ASTERACEAE
Pilosella aurantiaca; Aulacidea subterminalis *(continued)*

Country	Canada (continued)
Notes	Few galls observed one year following release, though too early post release to confirm sustained establishment. *Pilosella aurantiaca* is not preferred host, so additional release efforts will focus on *P. flagellaris*.
Limiting Factors	Specificity
Research Organization	AAFC, CABI-Switzerland
References	427

RELEASE	
Country	United States of America
Year	2011
Source	Ex. Switzerland
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	State (7), CABI-Switzerland
References	1102, 1103

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Pilosella flagellaris* (Willd.) Arv.-Touv.
Past Names/Synonyms	*Hieracium flagellare* Willd.
Origin	Europe
Common Name	whiplash hawkweed
AGENT	
Species	*Aulacidea subterminalis* Niblett
Classification	(Hymenoptera: Cynipidae)
RELEASE	
Country	Canada
Year	2011
Source	Ex. Switzerland
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Few galls observed one year following initial release. Too early post release to confirm sustained establishment.
Research Organization	AAFC, CABI-Switzerland
References	437

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Pilosella officinarum* Vaill.
Past Names/Synonyms	*Hieracium pilosella* L.
Origin	Eurasia
Common Name	mouse-ear hawkweed
AGENT	
Species	*Aulacidea subterminalis* Niblett
Classification	(Hymenoptera: Cynipidae)
RELEASE	
Country	New Zealand
Year	1999
Source	Ex. Switzerland, Germany
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Field impact not formally evaluated but anecdotal evidence suggests will not be able to control weed alone. Drought limits survival.
Limiting Factors	Climate
Other Species Attacked	Also feeds on the introduced *Pilosella aurantiaca* (L.) F. W. Schultz & Sch. Bip.
Research Organization	MWLR
References	690, 761, 1056, 1064, 1696, 1702

TABLE 1

ASTERACEAE
Pilosella officinarum *(continued)*

AGENT	
Species	*Cheilosia psilophthalma* (Becker)
Classification	(Diptera: Syrphidae)

RELEASE	
Country	New Zealand
Year	2006
Source	Ex. Switzerland, Germany
Established	No
Notes	Rearing difficulties resulted in only limited release where establishment not confirmed.
Research Organization	MWLR
References	1052, 1056, 1064, 1702

AGENT	
Species	*Cheilosia urbana* (Meigen)
Classification	(Diptera: Syrphidae)

RELEASE	
Country	New Zealand
Year	2006
Source	Ex. Switzerland, Germany
Established	No
Notes	Rearing difficulties resulted in only limited release where establishment not confirmed.
Research Organization	MWLR
References	1052, 1056, 1064, 1702

ASTERACEAE
Pilosella officinarum *(continued)*

AGENT	
Species	*Macrolabis pilosellae* (Binnie)
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	New Zealand
Year	2002
Source	Ex. Switzerland, Germany
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Field impact not formally evaluated but anecdotal evidence suggests it will not be able to control weed alone. Drought limits survival.
Limiting Factors	Climate
Other Species Attacked	Also feeds on the introduced *Pilosella piloselloides* (Vill.) Sojak subsp. *praealta* and *P. caespitosa* (Dumort.) P. D. Sell & C. West
Research Organization	MWLR
References	690, 761, 1052, 1056, 1064, 1696, 1702

AGENT	
Species	*Oxyptilus pilosellae* Zeller
Classification	(Lepidoptera: Pterophoridae)

RELEASE	
Country	New Zealand
Year	1999
Source	Ex. Switzerland, Germany
Established	No

(continued on next page)

ASTERACEAE
Pilosella officinarum; Oxyptilus pilosellae (continued)

Country	New Zealand (continued)
Notes	Rearing difficulties resulted in release at only one site where it did not establish.
Research Organization	MWLR
References	1064, 1702

AGENT

Species	*Puccinia hieracii* var. *piloselloidarum* (Probst) Jørst.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	New Zealand
Year	1998
Source	Ex. Ireland
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Initially an unintentional introduction that was later redistributed, but many *Pilosella officinarum* populations were resistant. Consequently two additional strains were deliberately introduced from Ireland to aid in control. Widely distributed and suppresses growth by 10-20%. Infection highest under moist conditions, but impact greatest when infection followed by drought conditions.
Limiting Factors	Climate
Research Organization	ARNZ
References	761, 1064, 1702

ASTERACEAE *(continued)*

TABLE 1

WEED

Family	Asteraceae
Species	*Pluchea carolinensis* (Jacq.) G. Don
Past Names/Synonyms	*Pluchea odorata* (L.) Cass.
Incorrect Past Names/Synonyms	*Pluchea symphytifolia* (Mill.) Gillis
Notes	Though listed as the correct name for this weed in select references, *Pluchea symphytifolia* (Mill.) Gillis is not a true synonym of this weed and is now synonomized with a different taxon.
Origin	tropical Americas
Common Name	sour bush, hairy fleabane
References	326, 978

AGENT

Species	*Acinia picturata* (Snow)
Incorrect Past Names/Synonyms	*Acinia fucata* Fabricius
Classification	(Diptera: Tephritidae)

RELEASE

Country	Hawaii USA
Year	1959
Source	Ex. Guatemala
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though established throughout the state, populations never reached densities sufficient to suppress weed. Typical seed destruction as low as 5-6%.
Research Organization	HDOA, State (52)
References	29, 44, 399, 406, 612, 762, 1026

TABLE 1

ASTERACEAE
Pluchea carolinensis (continued)

AGENT

Species	*Dichomeris aenigmatica* (Clarke)
Past Names/Synonyms	*Trichotaphe aenigmatica* Clarke
Classification	(Lepidoptera: Gelechiidae)
References	326, 1605

RELEASE

Country	Hawaii USA
Year	1957
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	None
Notes	Ineffective control agent; parasitism may play role.
Limiting Factors	Parasitism
Research Organization	HDOA
References	44, 399, 406, 612, 762, 1026, 1349

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Rhaponticum repens* (L.) Hidalgo
Past Names/Synonyms	*Centaurea repens* L., *Acroptilon repens* (L.) DC.
Origin	Central Asia
Common Name	Russian knapweed
References	792

AGENT

Species	*Aulacidea acroptilonica* Tyurebaev
Classification	(Hymenoptera: Cynipidae)

RELEASE

Country	Canada
Year	2008
Source	Ex. Uzbekistan
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	AAFC, CABI-Switzerland
References	1613, 1614

RELEASE

Country	United States of America
Year	2009
Source	Ex. Uzbekistan
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Too early post release to determine overall abundance and impact, though populations have significantly increased at one MT site. Parasitism becoming apparent.
Research Organization	State (7), CABI-Switzerland
References	1103, 1613, 1614

ASTERACEAE
Rhaponticum repens *(continued)*

AGENT	
Species	*Jaapiella ivannikovi* Fedotova
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	Canada
Year	2009
Source	Ex. Uzbekistan
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	AAFC, CABI-Switzerland
References	1613, 1614

RELEASE	
Country	United States of America
Year	2009
Source	Ex. Uzbekistan
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Establishment also likely for CA but confirmation only tentative. Though too early post release to determine overall abundance and impact, initial results from first WY release site indicate attack reduces seed output per shoot by 91% and above-ground biomass by 34%. Established at several sites in MT, but populations have not significantly increased.
Research Organization	State (7), USDA (19), CABI-Switzerland
References	334, 1103, 1613, 1614

ASTERACEAE
Rhaponticum repens *(continued)*

AGENT	
Species	*Subanguina picridis* (Kirjanova) Brzeski
Past Names/Synonyms	*Paranguina picridis* (Kirjanova) Kirjanova & Ivanova, *Mesoanguina picridis* (Kirjanova) Chizhov & Subbotin
Classification	(Tylenchida: Anguinidae)

RELEASE	
Country	Canada
Year	1977
Source	Ex. Kazakhstan
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though initially established in BC and SK, many release sites lost due to subsequent land use. No evaluations conducted since 2002 to confirm current establishment, abundance and impact. If still present, likely limited in establishment and impact, but most promising for spring-moist and irrigated sites.
Limiting Factors	Land use
Research Organization	AAFC, MU
References	117, 152, 742, 1944

RELEASE	
Country	United States of America
Year	1984
Source	Ex. Kazakhstan via Canada
Established	No
Research Organization	USDA (7,10), State (9,13,15,21)
References	1469, 1501, 1596, 1597, 1944

TABLE 1

TABLE 1

ASTERACEAE
Rhaponticum repens; Subanguina picridis (continued)

RELEASE	
Country	United States of America
Year	1990
Source	Ex. Turkey, Uzbekistan
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Reduces plant biomass and flowering, though infections not consistent from year to year due to varying moisture conditions. Lack of moisture limits survival. Does not move readily; needs to be propagated and redistributed on large scale. Not cost-effective.
Limiting Factors	Climate
Other Species Attacked	Also attacks to a lesser extent the native *Centaurea rothrockii* Greenman (whose name has since been changed to *Plectocephalus rothrockii* (Greenm.) D. J. N. Hind), the cultivated *Cynara scolymus* L. (whose name has since been changed to *Cynara cardunculus* L. subsp. *cardunculus*), and maybe also attacks the exotic *Centaurea diffusa* Lam.
Research Organization	USDA (7,10), State (9,13,15,21)
References	39, 74, 334, 335, 1101, 1596, 1597, 1735

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Silybum marianum* (L.) Gaertn.
Origin	Mediterranean, southwest Europe, northern Africa
Common Name	milk thistle, variegated thistle

AGENT	
Species	*Rhinocyllus conicus* (Frölich)
Classification	(Coleoptera: Curculionidae)
Notes	In the USA, interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
References	1457

RELEASE	
Country	Australia
Year	1988
Source	Ex. France
Established	Yes
Abundance	Limited
General Impact	None
Notes	Established at a few sites and some dispersal has occurred, but no impact detected on the weed.
Research Organization	VIC State
References	186, 1274

ASTERACEAE
Silybum marianum; Rhinocyllus conicus *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Italy via USA (CA)
Established	No
General Impact	Compromised
Notes	Soon after release, the plants were destroyed with herbicides and weevils never became established on *Silybum marianum*, though they did establish at this site on *Cirsium vulgare*.
Limiting Factors	Other control methods
Research Organization	ARC-PPRI
References	637, 821, 992, 2073

RELEASE	
Country	United States of America
Year	1969
Source	Ex. France (Rhine Valley) via Canada
Established	No
Notes	Sourced from *Carduus nutans*. Failure to establish likely due to strain being collected from host species different to release target. In CA, newly hatched larvae failed to exit from the large, outer bracts of milk thistle capitula upon which eggs hatched.
Limiting Factors	Specificity
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	USDA (7,9), State (5,14,15)
References	637, 645, 1457, 1830

ASTERACEAE
Silybum marianum; Rhinocyllus conicus *(continued)*

RELEASE	
Country	United States of America
Year	1971
Source	Ex. Italy
Established	Yes
Abundance	Moderate
General Impact	None
Notes	Sourced from *Silybum marianum*. Capable of causing significant amount of damage to capitula but often feed below seeds; all seeds rarely killed in any attacked seed head. Oviposition typically ends before all capitula produced. In TX, only infestations in moist, shady conditions attacked.
Limiting Factors	Habitat
Other Species Attacked	Attacks 22 of 90 *Cirsium* spp. native to the USA. Interstate shipment permits revoked in 2000, and not recommended for redistribution within each state.
Research Organization	USDA (7,9), State (5,14,15)
References	38, 137, 332, 335, 637, 645, 1457, 1506, 1578, 1830, 1837

TABLE 1

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Sonchus arvensis* L.
Origin	Eurasia
Common Name	perennial sow-thistle
AGENT	
Species	*Cystiphora sonchi* (Bremi)
Classification	(Diptera: Cecidomyiidae)
RELEASE	
Country	Canada
Year	1981
Source	Ex. Austria
Established	Yes
Abundance	Variable
General Impact	None
Notes	Populations widespread in SK and initially high in AB but since decreased due to parasitism. Populations fluctuate in many locations; extremely dry or moist soils reduce number of emerging adults. Reduction of *Sonchus arvensis* in NS needs further study to determine whether this agent is responsible. No noticeable impact in other parts of range.
Limiting Factors	Parasitism; Habitat
Other Species Attacked	Also found attacking the exotic *Sonchus oleraceus* L.
Research Organization	AAFC
References	432, 1185, 1196, 1472, 1475, 1480

ASTERACEAE
Sonchus arvensis *(continued)*

AGENT	
Species	*Liriomyza sonchi* Hendel
Classification	(Diptera: Agromyzidae)
RELEASE	
Country	Canada
Year	1987
Source	Ex. Austria
Established	No
Research Organization	AAFC
References	1196, 1475

AGENT	
Species	*Tephritis dilacerata* (Loew)
Classification	(Diptera: Tephritidae)
RELEASE	
Country	Canada
Year	1979
Source	Ex. Austria
Established	No
Research Organization	AAFC
References	742, 1196, 1470, 1472, 1475

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Tripleurospermum inodorum* (L.) Sch. Bip.
Past Names/Synonyms	*Tripleurospermum maritimum* (L.) W. D. J. Koch subsp. *inodorum* (L.) Appleq., *Matricaria perforata* Mérat
Notes	Diploid and tetraploid forms occur in both Europe and North America.
Origin	Eurasia
Common Name	scentless chamomile
References	60, 1195

AGENT

Species	*Microplontus edentulus* (Schultze)
Past Names/Synonyms	*Ceutorhynchus edentulus* Schultze
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Canada
Year	1997
Source	Ex. Austria
Established	Yes
Abundance	Rare
General Impact	None
Notes	Established only at one site. No evidence of impact in field. Larval mining in stems occurs too late to impact plant fitness, and mining in receptacles does not destroy seeds. Parasitism may play role in low population levels.
Limiting Factors	Parasitism
Research Organization	ARC
References	432, 1185, 1195, 1197

ASTERACEAE
Tripleurospermum inodorum (continued)

AGENT

Species	*Omphalapion hookerorum* (Kirby)
Past Names/Synonyms	*Apion hookeri* Kirby
Incorrect Past Names/Synonyms	*Omphalapion hookeri* (Kirby)
Classification	(Coleoptera: Brentidae)
References	1195, 1286, 1934

RELEASE

Country	Canada
Year	1992
Source	Ex. Germany
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Releases of this population were intermixed in populations of those already present adventively and subsequently not distinguished. Up to 78% seed heads attacked by *Omphalapion hookerorum* and up to 32% by *Rhopalomyia tripleurospermi*. Estimated seed production reduced up to 19% by combination of both species. Up to 17 *O. hookerorum* adults found per seed head (mean 3.9); dispersing up to 2.8 km/yr.
Research Organization	ARC, AAFC
References	117, 432, 1139, 1185, 1188, 1195, 1197, 1481

TABLE 1

ASTERACEAE
Tripleurospermum inodorum (continued)

AGENT

Species	*Rhopalomyia tripleurospermi* Skuhravá & Hinz
Past Names/Synonyms	*Rhopalomyia* n. sp.
Classification	(Diptera: Cecidomyiidae)

RELEASE

Country	Canada
Year	1999
Source	Ex. Austria
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Up to 78% seed heads attacked by *Omphalapion hookerorum* and up to 32% by *Rhopalomyia tripleurospermi*. Estimated seed production reduced up to 19% by combination of both species. Plants often stunted by heavy galling and have decreased and/or delayed flower production. Anecdotal reports suggest weed populations declining in areas with heavy attack. Dispersing up to 5.2 km/yr.
Research Organization	ARC
References	117, 432, 1185, 1195, 1197

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Xanthium strumarium* L.
Past Names/Synonyms	*Xanthium pungens* Wallroth, *Xanthium occidentale* Bertol., *Xanthium italicum* Moretti, *Xanthium canadense* Mill.
Notes	A dozen or more taxa (treated as species, subspecies, varieties, and/or forms) are often referred to as *Xanthium strumarium* sens. lat. in Europe and America and are lumped as well by the editors of this catalogue/database. Four of these species are recognized in Australia within the Noogoora burr complex (*Xanthium occidentale* Bertol., *X. italicum* Moretti, *X. orientale* L., and *X. cavanillesii* Schouw). All Australian entries under this complex pertain to releases made against what Australian biological control workers referred to as *X. occidentale*. The *Euaresta aequalis* Loew entry in Fiji pertains to observations on *X. strumarium* L. and *X. canadensis* Mill. The *Ophraella communa* LeSage entry in Japan pertains to observations on *X. strumarium* L., *X. canadensis* Mill., and *X. italicum* Moretti.
Origin	North America, South America, Central America
Common Name	noogoora burr, cocklebur

ASTERACEAE
Xanthium strumarium *(continued)*

AGENT

Species	*Epiblema strenuana* (Walker)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Australia
Year	1984
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established but generally at low densities. Not impacting the weed at current population levels. Limiting factor possibly lack of hosts when adults emerge from winter diapause.
Limiting Factors	Agent-host synchronization
Research Organization	QLD State
References	1215, 1874, 1880, 1881

RELEASE

Country	Papua New Guinea
Year	2002
Source	Ex. Mexico via Australia
Established	No
Notes	Two releases were made; both cultures died out before establishment could be confirmed, likely due to release sizes being too small.
Limiting Factors	Small release size
Research Organization	NARI
References	418, 427, 1881

ASTERACEAE
Xanthium strumarium *(continued)*

AGENT

Species	*Euaresta aequalis* Loew
Classification	(Diptera: Tephritidae)

RELEASE

Country	Australia
Year	1932
Source	Ex. USA (CA, KS, TX)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Distribution limited and established at low levels. When burs attacked, usually only one seed fed upon leading to no significant impact.
Research Organization	CSIR*, CPPB*, QLD State
References	1880, 1881, 1989

RELEASE

Country	Fiji
Year	1951
Source	Ex. USA via Australia
Established	No
Notes	Severe flooding following release may have led to the establishment failure.
Limiting Factors	Flooding
Research Organization	KRS
References	1374, 1376, 1547

TABLE 1

ASTERACEAE
Xanthium strumarium (continued)

AGENT

Species	*Mecas cana* subsp. *saturnina* (LeConte)
Past Names/Synonyms	*Mecas saturnina* LeConte
Classification	(Coleoptera: Cerambycidae)
References	1099, 1252

RELEASE

Country	Australia
Year	1963
Source	Ex. USA (TX)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Previously established at one site. No recent recoveries; possibly died out.
Research Organization	QLD State, CSIRO
References	753, 1880, 1881, 1936

AGENT

Species	*Nupserha vexator* (Pascoe)
Incorrect Past Names/Synonyms	*Nupserha antennata* Gahan
Classification	(Coleoptera: Cerambycidae)

RELEASE

Country	Australia
Year	1964
Source	Ex. India
Established	Yes

(continued at top of next column)

ASTERACEAE
Xanthium strumarium; Nupserha vexator (continued)

Country	Australia (continued)
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely established and frequently found at high densities, has provided little control.
Research Organization	QLD State, CSIRO
References	753, 1880, 1881, 1936

RELEASE

Country	Fiji
Year	1971
Source	Ex. India
Established	No
Research Organization	KRS
References	960

RELEASE

Country	Fiji
Year	1971
Source	Ex. India via Australia
Established	No
Research Organization	KRS
References	960

AZOLLACEAE

WEED	
Family	Azollaceae
Species	*Azolla filiculoides* Lam.
Origin	North America, Central America, South America
Common Name	Azolla, water fern, red water fern, fairy fern
AGENT	
Species	*Stenopelmus rufinasus* Gyllenhal
Classification	(Coleoptera: Erirhinidae)

RELEASE	
Country	Republic of South Africa
Year	1997
Source	Ex. USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Has not failed to control a single site where released, typically in <10 months. *Azolla filiculoides* no longer a significant problem in South Africa.
Other Species Attacked	Also found in very low numbers on what was originally believed to be the indigenous *Azolla pinnata* R. Br. subsp. *africana* (Desv.) R. M. K. Saunders & K. Fowler, but which has since been identified as *Azolla microphylla* Kaulf.
Research Organization	ARC-PPRI
References	297, 800, 805, 992, 1199

RELEASE	
Country	Zimbabwe
Year	1999
Source	Ex. USA (FL) via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Took ~11 months to control the weed 100% at three sites in Zimbabwe. The weed no longer poses a threat to aquatic ecosystems in southern Africa.
Research Organization	ARC-PPRI
References	418, 797, 804, 1199

TABLE 1

BASELLACEAE

WEED	
Family	Basellaceae
Species	*Anredera cordifolia* (Ten.) Steenis
Origin	South America
Common Name	Madeira vine, potato vine, mignonette vine, jalap vine
AGENT	
Species	*Plectonycha correntina* Lacordaire
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	Australia
Year	2011
Source	Ex. Argentina
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Release program ongoing. Initial results promising, but too early to assess overall impact and establishment at many sites.
Research Organization	QLD State, NSW State
References	118, 841, 1413, 1423, 1704

BIGNONIACEAE

WEED	
Family	Bignoniaceae
Species	*Dolichandra unguis-cati* (L.) L. G. Lohmann
Past Names/Synonyms	*Macfadyena unguis-cati* (L.) A.H.Gentry
Origin	tropical Americas
Common Name	cat's claw creeper
AGENT	
Species	*Carvalhotingis hollandi* Drake
Classification	(Hemiptera: Tingidae)
RELEASE	
Country	Republic of South Africa
Year	2007
Source	Ex. Brazil, Argentina
Established	Yes
Abundance	Too early post release
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though confirmed established, impact unknown. Population build-up hindered by dry and hot climatic conditions and exposed sites.
Limiting Factors	Climate; Habitat
Research Organization	ARC-PPRI
References	982, 984, 992

BIGNONIACEAE
Dolichandra unguis-cati *(continued)*

AGENT

Species	*Carvalhotingis visenda* Drake & Hambleton
Classification	(Hemiptera: Tingidae)

RELEASE

Country	Australia
Year	2007
Source	Ex. Paraguay; Ex. Brazil, Argentina via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Too early post release
Notes	Rate of spread from release sites slow. Under evaluation.
Research Organization	QLD State
References	492, 494, 500, 501

RELEASE

Country	Republic of South Africa
Year	2007
Source	Ex. Brazil, Argentina
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Populations increasing; abundant at a local scale but not at all sites. Where large, causes die-back at points of growth on stems and widespread leaf defoliation. Establishment and population build-up hindered by dry and hot climatic conditions and exposed sites.
Limiting Factors	Climate; Habitat
Research Organization	ARC-PPRI
References	982, 984, 992

BIGNONIACEAE
Dolichandra unguis-cati *(continued)*

AGENT

Species	*Charidotis auroguttata* Boheman
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Republic of South Africa
Year	1999
Source	Ex. Venezuela
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Minimal population build-up and no signs of spread. Predation and parasitism tentatively assigned as factors limiting establishment and population growth.
Limiting Factors	Predation; Parasitism
Research Organization	ARC-PPRI
References	984, 992, 1713, 1971, 1972

AGENT

Species	*Hylaeogena jureceki* Obenberger
Classification	(Coleoptera: Buprestidae)

RELEASE

Country	Australia
Year	2012
Source	Ex. Brazil, Argentina via Republic of South Africa
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued on next page)

TABLE 1

BIGNONIACEAE
Dolichandra unguis-cati; Hylaeogena jureceki *(continued)*

RELEASE	
Country	Australia (continued)
Notes	Larvae and adults recovered from many release sites in QLD, but it is too early to confirm field establishment.
Research Organization	QLD State
References	494, 500

RELEASE	
Country	Republic of South Africa
Year	2007
Source	Ex. Brazil, Argentina, Paraguay
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though still too early to determine, establishment and population build-up not as successful as for *Carvalhotingis visenda*; both are hindered by dry and hot climatic conditions and exposed sites. Where established, foliar damage is minimal and no measurable impact on plant growth or biomass has been recorded.
Limiting Factors	Climate; Habitat
Research Organization	ARC-PPRI
References	982, 984, 992

BIGNONIACEAE
Dolichandra unguis-cati *(continued)*

AGENT	
Species	*Hypocosmia pyrochroma* Jones
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	2008
Source	Ex. Brazil, Argentina via Republic of South Africa
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Larvae initially recovered from some release sites, but field establishment still not yet confirmed.
Research Organization	QLD State
References	492, 500, 1418

RELEASE	
Country	Republic of South Africa
Year	2010
Source	Ex. Brazil, Argentina, Paraguay
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Establishment not yet confirmed. Under evaluation.
Research Organization	ARC-PPRI
References	498, 982, 984, 992

BIGNONIACEAE *(continued)*

WEED	
Family	Bignoniaceae
Species	*Tecoma stans* (L.) Juss. ex Kunth var. *stans*
Origin	tropical Americas
Common Name	yellow bells

AGENT	
Species	*Prospodium transformans* (Ellis & Everh.) Cummins
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Republic of South Africa
Year	2010
Source	Ex. Mexico
Established	No
Notes	Establishment failure due possibly to combination of incomplete compatibility and very high temperatures post inoculation that appear to kill off infections. Evaluation underway.
Limiting Factors	Possibly host plant incompatibility; possibly climate
Research Organization	ARC-PPRI
References	1131, 2006

BORAGINACEAE

WEED	
Family	Boraginaceae
Species	*Cordia curassavica* (Jacq.) Roem. & Schult.
Past Names/Synonyms	*Cordia macrostachya* (Jacq.) Roem. & Schult., *Cordia cylindrostachya* (Ruiz & Pav.) Roem. & Schult.
Origin	South and Central America, Caribbean
Common Name	black sage

AGENT	
Species	*Eurytoma attiva* Burks
Past Names/Synonyms	*Eurytoma* sp. nr *howardii* D.T.
Classification	(Hymenoptera: Eurytomidae)

RELEASE	
Country	Malaysia
Year	1977
Source	Ex. Trinidad via Mauritius
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Rapidly spread throughout country. Helped limit spread and dispersal by seed. Heavily parasitized, though populations recovered. With *Metrogaleruca obscura* reduced dominance of this weed such that it is no longer a problem.
Limiting Factors	Parasitism
Research Organization	DAMA
References	55, 71, 288, 318, 1396, 1678, 1845

TABLE 1

BORAGINACEAE
Cordia curassavica; Eurytoma attiva *(continued)*

RELEASE	
Country	Mauritius
Year	1949
Source	Ex. Trinidad
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Destroys large proportion of fruit, severely limiting dispersal of plant. In conjunction with *Metrogaleruca obscura*, has led to complete control of plant such that it is no longer considered a weed on Mauritius.
Research Organization	IIBC
References	288, 586, 668, 1973

RELEASE	
Country	Sri Lanka
Year	1978
Source	Ex. Trinidad via Mauritius via Malaysia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Spread quickly. Locally, damage observed to be severe with up to 80% of seed destroyed. Overall impact not recently evaluated, but along with *Metrogaleruca obscura*, successful control had been predicted to be likely soon after original releases.
Research Organization	IIBC, DASL
References	288, 1679

BORAGINACEAE
Cordia curassavica *(continued)*

AGENT	
Species	*Metrogaleruca obscura* (Degeer)
Past Names/Synonyms	*Schematiza cordiae* Barber
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Malaysia
Year	1977
Source	Ex. Trinidad
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Spread throughout peninsular Malaysia. Caused extensive defoliation and reduced plant size. Heavily predated, though populations recovered. With *Eurytoma attiva* reduced dominance of this weed such that it is no longer a problem.
Limiting Factors	Predation
Research Organization	DAMA
References	55, 71, 288, 318, 1678, 1845

RELEASE	
Country	Mauritius
Year	1948
Source	Ex. Trinidad
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

BORAGINACEAE
Cordia curassavica; Metrogaleruca obscura (continued)

RELEASE

Country	Mauritius (continued)
Notes	Causes complete defoliation and suppression of flowering over large areas. In conjunction with *Eurytoma attiva*, has led to complete control of plant such that it is no longer considered a weed on Mauritius.
Research Organization	IIBC
References	288, 586, 668, 1675, 1973

RELEASE

Country	Sri Lanka
Year	1978
Source	Ex. Trinidad via Malaysia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Established, spreading and causing extensive defoliation at local level. Overall impact not recently evaluated, but along with *Eurytoma attiva*, successful control had been predicted to be likely soon after original releases.
Research Organization	IIBC, DASL
References	288, 1679

BORAGINACEAE
Cordia curassavica (continued)

AGENT

Species	*Physonota alutacea* Boheman
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Mauritius
Year	1947
Source	Ex. Trinidad
Established	No
Notes	Not established, apparently due to ant predation.
Limiting Factors	Predation
Research Organization	IIBC
References	288, 586, 668, 1675

TABLE 1

BORAGINACEAE *(continued)*

WEED	
Family	Boraginaceae
Species	*Cynoglossum officinale* L.
Origin	Eurasia
Common Name	houndstongue

AGENT	
Species	*Longitarsus quadriguttatus* (Pontoppidan)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1998
Source	Ex. Austria
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Last confirmed present in AB in 2009, but *Mogulones crucifer* subsequently destroyed all known individuals of *Cynoglossum officinale* and *Longitarsus quadriguttatus* has not been found since. No formal evaluations conducted where still present in BC. Recent qualitative observations on decreases in agent populations may suggest that overall impact is limited. Given high success of *M. crucifer*, continued use of *L. quadriguttatus* not recommended.
Research Organization	AAFC
References	117, 432, 436, 437, 440, 1629

BORAGINACEAE
Cynoglossum officinale *(continued)*

AGENT	
Species	*Mogulones crucifer* (Pallas)
Past Names/Synonyms	*Mogulones cruciger* Herbst, *Ceutorhynchus cruciger* Herbst
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Canada
Year	1997
Source	Ex. Hungary, Serbia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Readily established, rapidly reduced weed populations throughout release area and beyond
Other Species Attacked	Also feeds on native and other introduced species in the Boraginaceae, but sporadically and to a lesser amount than on its preferred host *Cynoglossum officinale* L.
Research Organization	AAFC
References	40, 117, 432, 435, 436, 440, 442

BORAGINACEAE *(continued)*

WEED

Family	Boraginaceae
Species	*Echium plantagineum* L.
Origin	Spain, Portugal, northern Africa
Common Name	Paterson's curse, salvation Jane

AGENT

Species	*Dialectica scalariella* (Zeller)
Classification	(Lepidoptera: Gracillariidae)

RELEASE

Country	Australia
Year	1980
Source	Ex. France, Portugal
Established	No
Notes	Loss of plants due to drought and grasshoppers contributed to failure at some sites. Further releases prevented by High Court injunction.
Limiting Factors	Climate; Predation
Research Organization	CSIRO
References	454, 458, 1661

RELEASE

Country	Australia
Year	1988
Source	Ex. France, Portugal
Established	Yes
Abundance	Moderate
General Impact	Variable

(continued at top of next column)

BORAGINACEAE
Echium plantagineum; Dialectica scalariella (continued)

Country	Australia (continued)
Notes	Releases resumed in 1988 following the lifting of High Court injunction after government inquiries found that control of the weed would be in the national interest. Spread throughout temperate range of weed but failed in upland areas of VIC and likely all TAS due to high mortality in winter. Lack of host over summer second factor implicated limiting population growth. Occasional heavy damage, particularly to drought-stressed plants, but in general not contributing to control.
Limiting Factors	Agent-host synchronization; Climate
Other Species Attacked	Commonly attacks other temperate herbaceous native and introduced Boraginaceae.
Research Organization	VIC State, QLD State, NSW State, SA State, WA State
References	121, 458, 886, 1335, 1500, 1574, 1656, 1661, 1929

TABLE 1

BORAGINACEAE
Echium plantagineum *(continued)*

AGENT	
Species	*Longitarsus aeneus* Kutschera
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1993
Source	Ex. France, Spain
Established	No
Notes	Could not rear in quarantine and direct field release of larvae-infested plants failed to establish due to poor seasonal synchrony of release and synchronization with host plant.
Limiting Factors	Agent-host synchronization
Research Organization	CSIRO, VIC State
References	1500, 1655, 1656, 1661

AGENT	
Species	*Longitarsus echii* (Koch)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1996
Source	Ex. France, Spain
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

BORAGINACEAE
Echium plantagineum; Longitarsus echii *(continued)*

Country	Australia (continued)
Notes	Establishment rates of 84%. Kills plants before flowering, causes economically significant reductions in plant density. Abundance and impact typically high on mainland, but can be variable as most effective agent in drier Mediterranean climate areas. Early TAS releases failed due to site management issues, but establishment confirmed following 2008 releases.
Limiting Factors	Climate; Land use
Research Organization	CSIRO, VIC State
References	121, 366, 883, 886, 1277, 1574, 1655, 1656, 1661

AGENT	
Species	*Meligethes planiusculus* (Heer)
Classification	(Coleoptera: Nitidulidae)

RELEASE	
Country	Australia
Year	1996
Source	Ex. France, Portugal
Established	Yes
Abundance	Moderate
General Impact	None
Notes	Spread rapidly and currently established widely but not at high enough densities to limit seeding. Overall impacts negligible.
Research Organization	CSIRO
References	121, 366, 1335, 1574, 1655, 1656, 1661, 1760

TABLE 1

BORAGINACEAE
Echium plantagineum *(continued)*

AGENT	
Species	*Mogulones geographicus* (Goeze)
Past Names/Synonyms	*Ceutorhynchus geographicus* (Goeze)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1993
Source	Ex. France, Portugal
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread. Initially observed dispersing prior to population build-up; more recently populations increasing greatly at several locations around Australia. Attack more frequent on larger plants. While significant damage observed locally, contribution to control difficult to measure overall.
Research Organization	CSIRO, VIC State
References	121, 366, 886, 1335, 1500, 1574, 1655, 1656, 1661, 1761

BORAGINACEAE
Echium plantagineum *(continued)*

AGENT	
Species	*Mogulones larvatus* (Schultze)
Past Names/Synonyms	*Ceutorhynchus larvatus* Schultze
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1990
Source	Ex. France
Established	No
Notes	Establishment failure due to low release numbers and being out of synchrony with the Australian season.
Limiting Factors	Agent-host synchronization; Small release size
Research Organization	CSIRO
References	366, 1651, 1655, 1656, 1661

RELEASE	
Country	Australia
Year	1992
Source	Ex. France, Portugal
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Established widely building up to very high densities locally on mainland. Causes pre-flowering plant mortality 50-80%. Negatively affected by drought and late autumn rains that limit aestivation survival. Major contributor to control of this weed in high rainfall areas. Early TAS releases failed due to site management issues, but establishment confirmed following 2008 releases.

(continued on next page)

TABLE 1

BORAGINACEAE
Echium plantagineum; Mogulones larvatus (continued)

Country	Australia (continued)
Limiting Factors	Climate; Land use
Other Species Attacked	Also attacks the exotic *Echium vulgare* L.
Research Organization	CSIRO, VIC State, WA State, SA State, NSW State
References	121, 366, 883, 886, 1276, 1500, 1655, 1656, 1661, 1662

AGENT

Species	*Opsilia coerulescens* (Scopoli)
Incorrect Past Names/Synonyms	*Phytoecia coerulescens* (Scopoli)
Classification	(Coleoptera: Cerambycidae)
References	293, 1108

RELEASE

Country	Australia
Year	1995
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	None
Notes	Only present in low numbers in NSW but widespread in northern VIC. Ineffective; no difference found in plant performance between attacked and unattacked plants.
Other Species Attacked	Also attacks the exotic *Echium vulgare* L. and the native *Cynoglossum australe* R.Br. Damage on the latter was very low and the larvae were small, restricted by the size of the flowering stem.
Research Organization	CSIRO, VIC State
References	1107, 1335, 1574, 1656, 1661

BORAGINACEAE *(continued)*

WEED

Family	Boraginaceae
Species	*Heliotropium amplexicaule* Vahl
Origin	South America
Common Name	blue heliotrope

AGENT

Species	*Deuterocampta quadrijuga* (Stäl)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	2001
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Observed causing severe localized damage though formal evaluation of overall impact lacking.
Research Organization	CSIRO
References	170, 177, 178, 1418

BORAGINACEAE *(continued)*

WEED

Family	Boraginaceae
Species	*Heliotropium europaeum* L.
Origin	Mediterranean Europe, northern Africa
Common Name	common heliotrope

AGENT

Species	*Longitarsus albineus* (Foudras)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1979
Source	Ex. Greece
Established	No
Notes	Though small numbers found season following release, subsequent drought conditions limited host availability and insects died out.
Research Organization	CSIRO
References	453, 456, 457, 1659

RELEASE

Country	Australia
Year	1981
Source	Ex. France, Greece
Established	No
Notes	Though small numbers found season following release, subsequent drought conditions limited host availability and insects died out.
Research Organization	CSIRO
References	456, 457, 1659

BORAGINACEAE
Heliotropium europaeum; Longitarsus albineus (continued)

RELEASE

Country	Australia
Year	1987
Source	Ex. Unknown
Established	No
Notes	Thousands of mass-reared adults released though establishment failed. Small numbers found few seasons following releases but never again after 1992 despite presence of host.
Research Organization	CSIRO
References	457, 1656, 1659

AGENT

Species	*Uromyces heliotropii* Sred.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Australia
Year	1991
Source	Ex. Turkey
Established	Yes
Abundance	Rare
General Impact	None
Notes	Occasional sightings but no apparent impact. Poor establishment due to climate (too dry at some release sites) and inability of overwintering teliospores to synchronize germination with reappearance of target in spring; target annual and ephemeral.
Limiting Factors	Climate; Agent-host synchronization
Research Organization	CSIRO
References	457, 752, 1656, 1658, 1659

TABLE 1

CACTACEAE

WEED	
Family	Cactaceae
Species	*Acanthocereus tetragonus* (L.) Hummelinck
Past Names/Synonyms	*Acanthocereus pentagonus* (L.) Britton & Rose
Origin	southern North America to northern South America
Common Name	sword pear
References	1112, 1224

AGENT	
Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae,

(continued at top of next column)

CACTACEAE
Acanthocereus tetragonus *(continued)*

Species	*Hypogeococcus festerianus* (Lizer y Trelles) (continued)
Notes (continued)	and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

RELEASE	
Country	Australia
Year	1980
Source	Ex. Argentina
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	This cactus species slower growing and has fewer spine clusters than others, leaving *Hypogeococcus festerianus* more vulnerable to predation and limiting population size. Weed only occurs in limited areas in central QLD where *H. festerianus* causes deformed growth. No evaluation undertaken on this cactus, but main infestation has greatly reduced in extent and control is regarded as adequate.
Limiting Factors	Predation
Research Organization	QLD State
References	847, 1224

CACTACEAE; *Acanthocereus tetragonus*
Hypogeococcus festerianus *(continued)*

RELEASE

Country	New Caledonia
Year	2003
Source	Ex. Argentina via Australia
Established	No
Notes	Establishment failure likely due to too small of release number, a result of difficulties in quarantine rearing.
Limiting Factors	Small release size
Research Organization	QLD State, DDR
References	179, 1224

RELEASE

Country	New Caledonia
Year	2007
Source	Ex. Argentina via Australia
Established	No
Notes	Establishment failure due to difficulties in rearing and observations that *Acanthocereus tetragonus* might be unsuitable host.
Limiting Factors	Specificity
Research Organization	QLD State, DDR
References	623, 1216, 1224

CACTACEAE
Acanthocereus tetragonus *(continued)*

AGENT

Species	*Nealcidion cereicola* (Fisher)
Past Names/Synonyms	*Alcidion cereicola* Fisher
Classification	(Coleoptera: Cerambycidae)
References	992, 1252, 1437

RELEASE

Country	Australia
Year	1979
Source	Ex. Argentina
Established	No
Research Organization	QLD State
References	1216, 1217, 1220, 1224

CACTACEAE *(continued)*

TABLE 1

WEED

Family	Cactaceae
Species	*Cereus jamacaru* DC. subsp. *jamacaru*
Past Names/Synonyms	*Cereus jamacaru* DC.
Incorrect Past Names/Synonyms	*Cereus peruvianus* (L.) Miller
Notes	For many years the South African populations have been referred to by the misapplied name *C. peruvianus* (L.) Miller, and more recently to *C. jamacaru* DC. In the present work, South African populations have largely been assigned to two taxa: *Cereus hildmannianus* K. Schum. subsp. *uruguayanus* (R. Kiesling) N. P. Taylor is cultivated in South Africa and should be treated at least as potentially invasive while *C. jamacaru* DC. subsp. *jamacaru* is widely naturalized and invasive in South Africa. Biological control efforts of *Cereus* spp. have largely been reported for *C. jamacaru* subsp. *jamacaru*, but could also apply to *C. hildmannianus* subsp. *uruguayanus*.
Origin	South America
Common Name	queen of the night, bobbejaanpaal, môrester, nagblom
References	1930

CACTACEAE
Cereus jamacaru *(continued)*

AGENT

Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

CACTACEAE
Cereus jamacaru; Hypogeococcus festerianus *(continued)*

RELEASE

Country	Republic of South Africa
Year	1983
Source	Ex. Argentina via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released onto *Harrisia martinii* but also attacked *Cereus jamacaru* subsp. *jamacaru* on which it reduces fruit production and leads to death of both seedlings and large plants. Biocontrol program against this weed is now considered complete.
Research Organization	ARC-PPRI
References	991, 992, 993, 1340, 1437

CACTACEAE
Cereus jamacaru *(continued)*

AGENT

Species	*Nealcidion cereicola* (Fisher)
Past Names/Synonyms	*Alcidion cereicola* Fisher
Classification	(Coleoptera: Cerambycidae)
References	992, 1252, 1437

RELEASE

Country	Republic of South Africa
Year	1990
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Released onto mixed cacti stand containing both *Harrisia martinii* and *Cereus jamacaru* subsp. *jamacaru* in 1990. Redistributed from *C. jamacaru* subsp. *jamacaru* to another mixed stand with *H. martinii* and *C. jamacaru* subsp. *jamacaru* in 1997. Only established at a few sites but does extensive damage where populations reach high levels, causing large stem sections to break off, or entire plant to collapse. Biocontrol program against this weed now considered complete, though throughout much of South Africa this is largely due to *Hypogeococcus festerianus*.
Research Organization	ARC-PPRI
References	991, 992, 993, 1258, 1437

TABLE 1

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida*
Incorrect Past Names/Synonyms	*Cylindropuntia rosea* (DC.) Backeb.
Notes	In South Africa, *Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida* was known for many years incorrectly as *C. rosea* (DC.) Backeb., which is similar and closely related.
Origin	Mexico, southern USA
Common Name	chain-fruit cholla

AGENT

Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

RELEASE

Country	Republic of South Africa
Year	1970
Source	Ex. USA (TX) via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

CACTACEAE; *Cylindropuntia fulgida* var. *fulgida* *Dactylopius tomentosus* (continued)

Country	Republic of South Africa (continued)
Notes	Imbricata biotype, redistributed from *Cylindropuntia imbricata* to *C. fulgida* var. *fulgida*. Following release, not as effective as on *C. imbricata* and *C. leptocaulis*. This was later shown to be due to existence of different biotypes, with this “Imbricata” biotype not preferring *C. fulgida* var. *fulgida*. Presently kills some small plants, but largely ineffective against large plants. Overall impact minimal.
Limiting Factors	Specificity
Research Organization	ARC-PPRI
References	840, 992, 993, 1165, 1167, 1258, 1437

RELEASE

Country	Republic of South Africa
Year	2003
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Cholla biotype. Established rapidly and colonized entire infestations at most sites of release. Pugnacious ants preventing establishment at some sites in NC. Now redistributed in lieu of herbicide applications. Particularly effective against small plants but also defoliates large plants which, following hand felling, then succumb without reproducing. Despite additional predation by coccinellids, *Cylindropuntia fulgida* var. *fulgida* is now considered under complete control.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	992, 993, 1166, 1167, 1258, 1437

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *mamillata* (A. Schott ex Engelm.) Backeb.
Origin	Mexico, southern USA
Common Name	boxing glove cactus (applied only to the crested morphotype, forma *monstrosa*), coral cactus
AGENT	
Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167
RELEASE	
Country	Republic of South Africa
Year	2011
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized

(continued at top of next column)

CACTACEAE; *Cylindropuntia fulgida* var. *mamillata* *Dactylopius tomentosus* (continued)

Country	Republic of South Africa (continued)
Notes	Cholla biotype, redistributed from *Cylindropuntia fulgida* var. *fulgida* to *C. fulgida* var. *mamillata*. Has nearly wiped out the plants at first release site. Though releases have been limited thus far, establishment has occurred at most sites. Pugnacious ants preventing establishment at some locations, and some populations limited by coccinelid predation.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	993, 1437

TABLE 1

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Cylindropuntia imbricata* (Haw.) F.M. Knuth
Past Names/Synonyms	*Opuntia imbricata* (Haw.) DC.
Origin	Mexico, southern USA
Common Name	imbricate prickly pear, kabelturksvy, devil's rope, rope pear

AGENT	
Species	*Dactylopius tomentosus* (Lamark)
Incorrect Past Names/Synonyms	*Dactylopius newsteadi*
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

RELEASE	
Country	Australia
Year	1925
Source	Ex. USA (TX)
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Rapid establishment and very effective on small or re-growing plants, but less so on larger plants. Populations initially high but decreased once small target weeds largely eradicated. Populations also somewhat limited by predation. Still controls the weed to a very low distribution, killing any seedlings around established plants.

(continued at top of next column)

CACTACEAE
Cylindropuntia imbricata; Dactylopius tomentosus (continued)

Country	Australia (continued)
Limiting Factors	Predation
Other Species Attacked	Also established on the introduced *Cylindropuntia leptocaulis* (DC.) F.M. Knuth and *C. tunicata* (Lehm.) F.M. Knuth on which it has significant impact and on the introduced *C. rosea* (DC.) Backeb. on which it is ineffective.
Research Organization	CPPB*
References	509, 753, 840, 847, 1989

RELEASE	
Country	Republic of South Africa
Year	1970
Source	Ex. USA (TX) via Australia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Imbricata biotype. Particularly effective against small plants but also defoliates large plants which, following hand felling, then succumb without reproducing. Chemical or mechanical control needed occasionally to supplement the agents, but overall impacts of biological control are significant.
Research Organization	ARC-PPRI
References	840, 992, 993, 1165, 1167, 1258, 1342, 1437

CACTACEAE
Cylindropuntia imbricata (continued)

AGENT	
Species	*Metamasius spinolae* (Gyllenhal)
Classification	(Coleoptera: Dryophthoridae)

RELEASE	
Country	Republic of South Africa
Year	1974
Source	Ex. Mexico
Established	No
Notes	Redistributed from *Opuntia ficus-indica* to *Cylindropuntia imbricata*.
Research Organization	ARC-PPRI
References	50, 992, 1258

CACTACEAE (continued)

WEED	
Family	Cactaceae
Species	*Cylindropuntia leptocaulis* (DC.) F.M. Knuth
Origin	Mexico, southern USA
Common Name	pencil cactus, desert Christmas cactus, desert Christmas cholla, potloodkaktus

AGENT	
Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

RELEASE	
Country	Republic of South Africa
Year	1977
Source	Ex. USA (TX) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Imbricata biotype, redistributed from *Cylindropuntia imbricata* to *C. leptocaulis*. Successfully controlled practically all known infestations. Isolated plants are still found, but no additional control measures are necessary.
Research Organization	ARC-PPRI
References	840, 992, 993, 1258, 1437, 1930

TABLE 1

TABLE 1

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Harrisia balansae* (K. Schum.) N. P. Taylor & Zappi
Incorrect Past Names/Synonyms	*Harrisia bonplandii* (Pfeiff.) Britton & Rose
Origin	South America

AGENT	
Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

CACTACEAE
Harrisia balansae; Hypogeococcus festerianus (continued)

RELEASE	
Country	Republic of South Africa
Year	2006
Source	Ex. Argentina via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Though initially introduced for control of *Harrisia martinii*, causing extensive damage to *H. balansae* as well.
Research Organization	ARC-PPRI
References	992, 1224

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Harrisia martinii* (Labour.) Britton
Past Names/Synonyms	*Eriocereus martinii* (Labour.) Riccob.
Origin	Argentina, Paraguay
Common Name	Harrisia cactus, moon cactus, toukaktus
AGENT	
Species	*Cactoblastis* sp. nr *doddi*
Past Names/Synonyms	*Cactoblastis* sp.
Classification	(Lepidoptera: Pyralidae)
RELEASE	
Country	Australia
Year	1978
Source	Ex. Argentina
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially believed to have failed establishment. Small population possibly found on *Cylindropuntia tunicata* in central QLD in 2013. As *C. tunicata* is not the normal field host, small population may be persistent on *Harrisia* spp. Confirmation in 2013/2014 required.
Research Organization	QLD State
References	847, 1214, 1216, 1220, 1224

CACTACEAE
Harrisia martinii *(continued)*

AGENT	
Species	*Eriocereophaga humeridens* O'Brien
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	Australia
Year	1976
Source	Ex. Brazil
Established	No
Notes	Establishment occurred at some sites but colonies died out as host plant was destroyed by *Hypogeococcus festerianus*. Not established.
Limiting Factors	Interspecific competition
Research Organization	QLD State
References	847, 1220, 1224

TABLE 1

CACTACEAE
Harrisia martinii *(continued)*

AGENT	
Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

CACTACEAE
Harrisia martinii; Hypogeococcus festerianus *(continued)*

RELEASE	
Country	Australia
Year	1975
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established rapidly and developed large populations. Within 3 years large plants killed, by 1979 chemical treatment was ended in favor of biological control using this insect.
Research Organization	QLD State
References	847, 1220, 1224, 1816

RELEASE	
Country	Republic of South Africa
Year	1983
Source	Ex. Argentina via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Despite heavy predation in the field, has been a very effective biocontrol agent and has killed off large infestations of the weed in South Africa. Biocontrol program against this weed now considered complete.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	991, 992, 1224, 1258, 1437

CACTACEAE
Harrisia martinii (continued)

AGENT

Species	*Nealcidion cereicola* (Fisher)
Past Names/Synonyms	*Alcidion cereicola* Fisher
Classification	(Coleoptera: Cerambycidae)
References	992, 1252, 1437

RELEASE

Country	Australia
Year	1974
Source	Ex. Argentina
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially widely established and very effective in killing top growth of large *Harrisia* plants. Spread slow. Small plants and regrowth not suitable for larval development; progressively out-competed by *Hypogeococcus festerianus*. Not surveyed specifically since 1990s so unknown if still present. If established, populations likely rare and with negligible impact.
Limiting Factors	Interspecific competition
Research Organization	QLD State
References	1216, 1217, 1220, 1224, 1816

CACTACEAE
Harrisia martinii; Nealcidion cereicola (continued)

RELEASE

Country	Republic of South Africa
Year	1990
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	First released onto mixed cacti stand containing both *Harrisia martinii* and *Cereus jamacaru* subsp. *jamacaru*. Redistributed from *C. jamacaru* subsp. *jamacaru* to another mixed stand with *H. martinii* and *C. jamacaru* subsp. *jamacaru*. Only limited establishment. Where populations reach high densities, can cause large stem sections to break off. Plants can re-grow following attack. Biocontrol program against this weed now considered complete, though throughout much of South Africa this is largely due to *Hypogeococcus festerianus*.
Research Organization	ARC-PPRI
References	991, 992, 993, 1258

TABLE 1

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Harrisia regelii* (Weing.) Borg
Past Names/Synonyms	*Eriocereus regelii* (Weing.) Backeb.
Incorrect Past Names/Synonyms	*Harrisia pomanensis* (F. A. C. Weber ex K. Schum.) Britton & Rose, *Harrisia bonplandii* (Parmentier) Britton & Rose, *Eriocereus ?bonplandii* (Parm. ex Pfeiff.) Riccob.
Notes	Initially identified as *Eriocereus regelii* (Weing.) Backeb. in Australia. This was subsequently believed to have been a misidentification so the name was later reported as *Eriocereus ?bonplandii* (Parm. ex Pfeiff.) Riccob.; *E. bonplandii* was later synonomized with *Harrisia pomanensis* (F. A. C. Weber ex K. Schum.) Britton & Rose. A recent re-examination of Australian material indicated the species in question is *H. regelii* (Weing.) Borg (the new name for *E. regelii*).
Origin	Argentina
Common Name	Harrisia cactus
References	35, 588, 1092

AGENT

Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)

(continued at top of next column)

CACTACEAE
Harrisia regelii *(continued)*

Species	*Hypogeococcus festerianus* (Lizer y Trelles) (continued)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

RELEASE

Country	Australia
Year	1982
Source	Ex. Argentina
Established	Yes

(continued on next page)

CACTACEAE
Harrisia regelii; Hypogeococcus festerianus (continued)

Country	Australia (continued)
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Provides effective control.
Research Organization	QLD State
References	847, 1216, 1224

AGENT	
Species	*Nealcidion cereicola* (Fisher)
Past Names/Synonyms	*Alcidion cereicola* Fisher
Classification	(Coleoptera: Cerambycidae)
References	992, 1252, 1437

RELEASE	
Country	Australia
Year	1974
Source	Ex. Argentina
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially widely established and very effective in killing top growth of large *Harrisia* plants. Spread slow. Small plants and regrowth not suitable for larval development; progressively out-competed by *Hypogeococcus festerianus*. Not surveyed specifically since 1990s so unknown if still present. If established, populations likely rare and with negligible impact.
Limiting Factors	Interspecific competition
Research Organization	QLD State
References	1216, 1217, 1224

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Harrisia tortuosa* (J. Forbes ex Otto & A. Dietr.) Britton & Rose
Past Names/Synonyms	*Eriocereus tortuosus* (J. Forbes ex Otto & A. Dietr.) Riccob.
Incorrect Past Names/Synonyms	*Harrisia tortuosus* (Forbes) Britton & Rose
Origin	Argentina, Bolivia, Paraguay, Uruguay
Common Name	Millmerran Harrisia cactus

AGENT	
Species	*Cactoblastis* sp. nr *doddi*
Past Names/Synonyms	*Cactoblastis* sp.
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	1980
Source	Ex. Argentina
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially believed to have established while causing very little damage; later recorded as not established. Small population possibly found on *Cylindropuntia tunicata* in central QLD in 2013. As *C. tunicata* is not the normal field host, small population may be persistent on *Harrisia* spp. Confirmation in 2013/2014 required.
Research Organization	QLD State
References	847, 1214, 1216, 1224

TABLE 1

CACTACEAE
Harrisia tortuosa *(continued)*

AGENT	
Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

CACTACEAE
Harrisia tortuosa; Hypogeococcus festerianus *(continued)*

RELEASE	
Country	Australia
Year	1976
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established rapidly and developed large populations. Within 3 years large plants killed, by 1979 chemical treatment was ended in favor of biological control using this insect.
Research Organization	QLD State
References	847, 1216, 1220, 1224

AGENT	
Species	*Nealcidion cereicola* (Fisher)
Past Names/Synonyms	*Alcidion cereicola* Fisher
Classification	(Coleoptera: Cerambycidae)
References	992, 1252, 1437

RELEASE	
Country	Australia
Year	1976
Source	Ex. Argentina
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued on next page)

CACTACEAE
Harrisia tortuosa; Nealcidion cereicola *(continued)*

Country	Australia (continued)
Notes	Initially widely established and very effective in killing top growth of large *Harrisia* plants. Spread slow. Small plants and regrowth not suitable for larval development; progressively out-competed by *Hypogeococcus festerianus*. Not surveyed specifically since 1990s so unknown if still present. If established, populations likely rare and with negligible impact.
Research Organization	QLD State
References	847, 1216, 1217, 1224

WEED

Family	Cactaceae
Species	*Opuntia aurantiaca* Lindl.
Origin	Argentina, Uruguay
Common Name	jointed cactus, tiger pear, katjie

AGENT

Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Australia
Year	1926
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Variable

(continued at top of next column)

CACTACEAE
Opuntia aurantiaca; Cactoblastis cactorum *(continued)*

Country	Australia (continued)
Notes	Initially released against *Opuntia stricta*, but naturally spread and attacks this species as well. Contributes to control in some areas by killing small stems and young growth; in most regions plant recovers quickly and not killed by attack.
Other Species Attacked	Also attacks the exotic *Opuntia elata* Link & Otto ex Salm-Dyck, *O. elatior* Mill., and *O. humifusa* (Raf.) Raf. Spillover attack found on melons and tomatoes.
Research Organization	CPPB*
References	130, 509, 510, 511, 753, 844, 845, 847, 1989

RELEASE

Country	Republic of South Africa
Year	1933
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Released intentionally and redistributed on *Opuntia ficus-indica*, but naturally spread to *O. aurantiaca* growing in the vicinity of release sites. Causes temporary destruction of above ground surface parts of weed, though the plant recovers rapidly. Small plants which have not formed tuberous underground growth, however, often completely killed. Overall not effective in the control of this cactus.

(continued on next page)

TABLE 1

CACTACEAE
Opuntia aurantiaca; Cactoblastis cactorum *(continued)*

Country	Republic of South Africa (continued)
Other Species Attacked	Occasionally found providing incomplete control on the exotic *Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida*, *C. imbricata* (Haw.) F.M. Knuth., *Opuntia monacantha* (Willd.) Haw., *O. spinulifera* Salm-Dyck, *O. salmiana* J. Parm. ex Pfeiff., and *Austrocylindropuntia subulata* (Muehlenpf.) Backeb.
Research Organization	ARC-PPRI
References	992, 1258, 1259, 1490, 2071

AGENT

Species	*Dactylopius austrinus* De Lotto
Past Names/Synonyms	*Dactylopius* sp. nr *confusus*
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	Australia
Year	1933
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Increased rapidly following introduction. Provides successful control in all areas. Most damaging in hot dry times and less so in hot wet seasons.
Limiting Factors	Climate
Research Organization	CPPB*
References	511, 844, 845, 847, 1989

CACTACEAE
Opuntia aurantiaca; Dactylopius austrinus *(continued)*

RELEASE

Country	Republic of South Africa
Year	1935
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	High populations can decimate *Opuntia aurantiaca* populations, however populations of *Dactylopius austrinus* are variable. *O. aurantiaca* infestations increase in density during wet years, which favor the plant but not *D. austrinus*, and decrease during dry years. The insect has successful wave of attack then deteriorates due to extensive regrowth from underground tubers and loose lying joints. Predation significant in the past, but rarely problematic in mature colonies at present.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	992, 993, 1256, 1259, 1342, 1490

CACTACEAE
Opuntia aurantiaca *(continued)*

AGENT

Species	*Dactylopius ceylonicus* (Green)
Past Names/Synonyms	*Dactylopius indicus* Green
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	Australia
Year	1935
Source	Ex. Argentina
Established	No
Research Organization	CPPB*
References	511, 1989

AGENT

Species	*Melitara prodenialis* Walker
Past Names/Synonyms	*Zophodia prodenialis* Walker, *Melitara bollii* (Zeller)
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Australia
Year	1928
Source	Ex. USA (TX)
Established	No
Research Organization	CPPB*
References	509, 511, 635, 944, 1989

CACTACEAE
Opuntia aurantiaca *(continued)*

AGENT

Species	*Mimorista pulchellalis* Dyar
Classification	(Lepidoptera: Crambidae)

RELEASE

Country	Republic of South Africa
Year	1979
Source	Ex. Argentina
Established	No
Notes	Initially established at low levels. Subsequently assumed to have died out.
Research Organization	ARC-PPRI
References	992, 1259, 1348

AGENT

Species	*Nanaia* sp.
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Republic of South Africa
Year	1983
Source	Ex. Peru
Established	No
Research Organization	ARC-PPRI
References	834, 992, 1259, 2074

TABLE 1

CACTACEAE
Opuntia aurantiaca (continued)

AGENT	
Species	*Tucumania tapiacola* Dyar
Past Names/Synonyms	*Zophodia tapiacola* (Dyar)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	1935
Source	Ex. Argentina
Established	Yes
Abundance	Rare
General Impact	Variable
Notes	Can be locally damaging in some areas at some times but generally rare in field.
Other Species Attacked	Also attacks (albeit mildly) the exotic *Opuntia humifusa* (Raf.) Raf., *O. stricta* (Haw.) Haw. and *Harrisia martinii* (Labour.) Britton
Research Organization	CPPB*
References	844, 845, 847, 1989

RELEASE	
Country	Republic of South Africa
Year	1976
Source	Ex. Argentina
Established	No
Notes	Initially believed to have established, but has since died out. Predation and host-plant incompatibility limited populations.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	992, 1256, 1259

CACTACEAE
Opuntia aurantiaca; Tucumania tapiacola (continued)

RELEASE	
Country	Republic of South Africa
Year	1982
Source	Ex. Argentina
Established	No
Notes	Predation limited populations.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	992, 1259

WEED	
Family	Cactaceae
Species	*Opuntia elatior* Mill.
Origin	Caribbean, Central America, Colombia, Venezuela
Common Name	prickly pear

AGENT	
Species	*Dactylopius ceylonicus* (Green)
Past Names/Synonyms	*Dactylopius indicus* Green
Classification	(Hemiptera: Dactylopiidae)

RELEASE	
Country	India
Year	post 1863
Source	Ex. Brazil, Mexico
Established	No
Notes	Redistributions from *Opuntia monacantha* to *O. elatior* failed as this species is specific to *O. monacantha*.
Limiting Factors	Specificity
References	1548, 1831

CACTACEAE
Opuntia elatior (continued)

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	India
Year	1926
Source	Ex. USA (AZ, CA, TX) via Australia via Sri Lanka
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established giving complete control.
References	635, 1542, 1548

RELEASE	
Country	Indonesia
Year	1935
Source	Ex. USA (AZ, CA, TX) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established rapidly throughout Sulawesi Island, providing complete control by 1939.
Research Organization	DAI
References	635, 1548

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia engelmannii* Salm-Dyck ex Engelm.
Past Names/Synonyms	*Opuntia lindheimeri* Engelm., *Opuntia tardospina* Griffiths, *Opuntia* aff. *lindheimeri* Engelm.
Notes	This species was not found during a recent survey of Cactaceae on Nevis. It is unclear if this is because other control measures successfully eradicated the plant, or if the original species identification was incorrect.
Origin	North America
Common Name	Texas prickly pear, small round-leaved prickly pear, kleinrondeblaarturksvy

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Antigua
Year	1960
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially released on *Opuntia triacantha* but spread to *O. engelmannii* var. *lindheimeri*. Isolated clumps that previously escaped attack were heavily infested and collapsing by 1970.

(continued on next page)

TABLE 1

TABLE 1

CACTACEAE
Opuntia engelmannii; Cactoblastis cactorum *(continued)*

Country	Antigua (continued)
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
Research Organization	DAA
References	99, 288, 1680, 2071, 2079

RELEASE

Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. Argentina via Australia via Republic of South Africa
Established	No
Notes	Initial reports claimed *Cactoblastis cactorum* rapidly provided control of this species in pastures. However, *Opuntia engelmannii* var. *lindheimeri* was not found during a recent survey of Cactaceae on Nevis. It is unclear if this is because control measures successfully eradicated the plant, or if the original species identification was incorrect.
Research Organization	IIBC
References	99, 288, 1459, 1680, 2071

RELEASE

Country	Republic of South Africa
Year	1938
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Limited
General Impact	None

(continued at top of next column)

CACTACEAE
Opuntia engelmannii; Cactoblastis cactorum *(continued)*

Country	Republic of South Africa (continued)
Notes	Redistributed from *Opuntia ficus-indica* to *O. engelmannii*. Heavy mortality occurs among larvae because of the very excessive excretions of highly mucilaginous sap where they attempt entrance. Does not thrive in or accomplish as much destruction on this species as *O. ficus-indica*, and often serves as a trap by attracting (mortally) many individuals away from *O. ficus-indica* when the two weed species grow together.
Other Species Attacked	Occasionally found providing incomplete control on the exotic *Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida*, *C. imbricata* (Haw.) F.M. Knuth., *Opuntia monacantha* (Willd.) Haw., *O. spinulifera* Salm-Dyck, *O. salmiana* J. Parm. ex Pfeiff., and *Austrocylindropuntia subulata* (Muehlenpf.) Backeb.
Research Organization	ARC-PPRI
References	992, 993, 1258, 1342, 1490, 2071

CACTACEAE
Opuntia engelmannii *(continued)*

AGENT

Species	*Dactylopius austrinus* De Lotto
Past Names/Synonyms	*Dactylopius* sp. nr *confusus*
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. Argentina via Republic of South Africa
Established	No
Research Organization	IIBC
References	99, 288, 446, 1459, 1680

AGENT

Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE

Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. USA via Australia via Republic of South Africa
Established	No
Research Organization	IIBC
References	99, 288, 1459, 1490, 1680

CACTACEAE
Opuntia engelmannii; Dactylopius opuntiae *(continued)*

RELEASE

Country	Republic of South Africa
Year	1938
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Ficus biotype, redistributed from *Opuntia ficus-indica* to *O. engelmannii*. Successful control when its predators can be kept at a negligible level. Re-inoculations frequently necessary to keep target plants in check.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	635, 833, 992, 993, 1258, 1342, 1490

TABLE 1

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia ficus-indica* (L.) Mill.
Past Names/Synonyms	*Opuntia cordobensis* Spegazzini, *Opuntia megacantha* Salm-Dyck
Notes	Previous literature referred to this release as occurring on *Opuntia cordobensis* Spegazzini which has since been synonymized with *O. ficus-indica* (L.) Mill. While some authors consider *O. ficus-indica* to be a spineless cultivar derived from *O. megacantha*, many other authors consider *O. megacantha* to also be a cultivated taxon or a name applied to multiple ruderal reversions to spininess from the escaped, cultivated *O. ficus-indica* and they treat *O. megacantha* as a later synonym. The editors of this catalogue are in the latter group.
Origin	Mexico
Common Name	Indian fig, mission prickly pear, grootdoringturksvy

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

CACTACEAE
Opuntia ficus-indica; Cactoblastis cactorum (continued)

RELEASE	
Country	Hawaii USA
Year	1950
Source	Ex. Argentina via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Overall, weed under substantial levels of control. Together with *Dactylopius opuntiae* provides excellent control in lowland and coastal regions. Following initial control there is indication of resurgence at certain mid range elevations. Infestations at elevations higher than 914m remain unaffected.
Limiting Factors	Elevation
Research Organization	HDOA
References	325, 326, 413, 601, 612, 762, 1452, 1453, 1948

RELEASE	
Country	Republic of South Africa
Year	1933
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

CACTACEAE
Opuntia ficus-indica; Cactoblastis cactorum *(continued)*

Country	Republic of South Africa (continued)
Notes	Helpful in checking regrowth as it attacks mainly young plants on the outskirts of infestations. Nearly 90% of the originally infested area of 900,000 ha was reclaimed by the action of mainly *Dactylopius opuntiae* and, to a lesser extent, *Cactoblastis cactorum*. Populations limited by predation, and the inability of larvae to penetrate thick cuticles of older stems or to survive thick mucilaginous exudate.
Limiting Factors	Predation
Other Species Attacked	Occasionally found providing incomplete control on the exotic *Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida*, *C. imbricata* (Haw.) F.M. Knuth., *Opuntia monacantha* (Willd.) Haw., *O. spinulifera* Salm-Dyck, *O. salmiana* J. Parm. ex Pfeiff., and *Austrocylindropuntia subulata* (Muehlenpf.) Backeb.
Research Organization	ARC-PPRI
References	50, 51, 668, 992, 993, 1258, 1342, 1490, 2071, 2075

CACTACEAE
Opuntia ficus-indica *(continued)*

TABLE 1

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Past Names/Synonyms	*Dactylopius* sp.
Incorrect Past Names/Synonyms	*Dactylopius confusus* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Hawaii USA
Year	1949
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Overall, weed under substantial levels of control. More effective in areas of low rainfall. Together with *Cactoblastis cactorum* provides excellent control in lowland and coastal regions. Following initial control there is indication of resurgence at certain mid range elevations. Infestations at elevations higher than 914m remain unaffected.
Limiting Factors	Elevation; Climate
Research Organization	HDOA
References	325, 326, 413, 601, 612, 1452, 1453, 1948

TABLE 1

CACTACEAE
Opuntia ficus-indica; Dactylopius opuntiae *(continued)*

RELEASE	
Country	Hawaii USA
Year	1949
Source	Ex. USA (CA)
Established	No
Notes	Originally tested on *Opuntia ficus-indica* but did not survive. Released on HA on what was believed to be *O. cordobensis*, a plant found near the shore of north-west side of island of HA but not seen or reported thereafter. *O. cordobensis* has since been synonomized with *O. ficus-indica*. Insect established initially but was quickly exterminated by predaceous ants.
Limiting Factors	Predation
Research Organization	BAF
References	35, 413, 601, 635, 762, 1948

RELEASE	
Country	Republic of South Africa
Year	1938
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

CACTACEAE
Opuntia ficus-indica; Dactylopius opuntiae *(continued)*

Country	Republic of South Africa (continued)
Notes	Ficus biotype. Aided by hand-felling, contributed most to the spectacular clearance of nearly 90% of the originally infested area. About 900,000 ha reclaimed by the action of mainly *Dactylopius opuntiae* and, to lesser extent, *Cactoblastis cactorum*. Subsequently redistributed throughout South Africa. Though widespread, still many plants in most provinces free of this agent. Populations largest and most effective when predators chemically controlled and in areas of lower rainfall.
Limiting Factors	Predation; Climate
Research Organization	ARC-PPRI
References	50, 51, 635, 833, 992, 993, 1258, 1342, 1490, 2075

CACTACEAE
Opuntia ficus-indica *(continued)*

AGENT	
Species	*Lagocheirus funestus* Thomson
Past Names/Synonyms	*Archlagocheirus funestus* (Thomson)
Classification	(Coleoptera: Cerambycidae)
References	992, 1252

RELEASE	
Country	Hawaii USA
Year	1951
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Can cause total destruction of plants, however distribution very limited. Replaced *Dactylopius opuntiae* and *Cactoblastis cactorum* at higher altitudes in some areas.
Research Organization	HDOA
References	399, 413, 601, 612, 1452, 1453

RELEASE	
Country	Republic of South Africa
Year	1943
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Still localized around original release sites, but rare and has played only minor role in biological control of *Opuntia ficus-indica.*
Research Organization	ARC-PPRI
References	50, 51, 992, 1342

CACTACEAE
Opuntia ficus-indica *(continued)*

AGENT	
Species	*Melitara dentata* (Grote)
Past Names/Synonyms	*Melitara doddalis* Dyar
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Hawaii USA
Year	1949
Source	Ex. USA (TX)
Established	No
Research Organization	HDOA
References	413, 601, 635, 1948

AGENT	
Species	*Melitara prodenialis* Walker
Past Names/Synonyms	*Melitara bollii* (Zeller)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Hawaii USA
Year	1949
Source	Ex. USA (TX)
Established	No
Research Organization	HDOA
References	413, 601, 635, 1948

TABLE 1

TABLE 1

CACTACEAE
Opuntia ficus-indica (continued)

AGENT	
Species	*Metamasius spinolae* (Gyllenhal)
Past Names/Synonyms	*Cactophagous spinolae* (Gyllenhal)
Classification	(Coleoptera: Dryophthoridae)

RELEASE	
Country	Republic of South Africa
Year	1948
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Very local distribution. Abundant and destructive at two localities only. Dispersal extremely slow.
Research Organization	ARC-PPRI
References	50, 51, 992, 1342

AGENT	
Species	*Moneilema armatum* LeConte
Past Names/Synonyms	*Monilema crassum* LeConte, *Moneilema crassum* Melsheimer
Classification	(Coleoptera: Cerambycidae)
References	326, 1099

RELEASE	
Country	Hawaii USA
Year	1950
Source	Ex. USA (TX)
Established	No
Research Organization	HDOA
References	413, 601, 635, 1948

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia humifusa* (Raf.) Raf.
Origin	North America
Common Name	creeping prickly pear, large-flowered prickly pear

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Republic of South Africa
Year	2000
Source	Ex. North America via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Stricta biotype. Redistributed from *Opuntia stricta* to *O. humifusa*.
Research Organization	ARC-PPRI
References	833, 993, 1258

TABLE 1

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Opuntia littoralis* (Engelm.) Cockerell
Origin	southwestern coastal USA including Santa Cruz Island and Baja California, Mexico
Common Name	prickly pear, coastal prickly pear

AGENT

Species	*Dactylopius opuntiae* (Cockerell)
Past Names/Synonyms	*Dactylopius* sp.
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE

Country	United States of America
Year	1951
Source	Ex. Mexico via Australia via Hawaii USA
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Main agent for control on Santa Cruz Island; reduced cactus by 75% by 1979. *Opuntia oricola* is less susceptible than *O. littoralis*; high initial attack rates on *O. littoralis* and hybrids have replaced many stands with less attacked *O. oricola*. This and predation have slowed rate of destruction in more recent times. Target weed considered native.
Limiting Factors	Predation
Research Organization	State (4,5)
References	635, 638, 639, 643

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Opuntia monacantha* (Willd.) Haw.
Incorrect Past Names/Synonyms	*Opuntia vulgaris* Mill., *Opuntia monocantha* (Willd.) Haw.
Origin	Argentina, Brazil, Paraguay, Uruguay
Common Name	prickly pear, drooping prickly pear, smooth tree pear, suurturksvy
References	35, 845, 1091, 1930

AGENT

Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Mauritius
Year	1950
Source	Ex. Argentina via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Weed initially controlled by *Dactylopius*, however subsequent predation led to increase in *Opuntia* spp. *Cactoblastis cactorum* established immediately and restored control to weed population. Wild *Opuntia* spp. now rare on Mauritius and always attacked by *C. cactorum*.
Research Organization	MAM
References	586, 668, 2071

CACTACEAE
Opuntia monacantha *(continued)*

AGENT

Species	*Dactylopius ceylonicus* (Green)
Past Names/Synonyms	*Dactylopius indicus* Green
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	Australia
Year	1914
Source	Ex. Brazil via India via Sri Lanka
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established rapidly and readily controlled the weed in all areas.
Other Species Attacked	Also attacks the exotic *Opuntia elata* Link & Otto ex Salm-Dyck
Research Organization	PPTC, QLD State
References	509, 845, 847, 1989

RELEASE

Country	India
Year	1795
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

CACTACEAE
Opuntia monacantha; Dactylopius ceylonicus *(continued)*

Country	India (continued)
Notes	Introduced for commercial purposes in the mistaken belief it was *Dactylopius coccus* Costa. Established and provided complete control. Populations now variable because weed infestations typically decimated locally. Redistribution of insects to southern India in 1836 and Sri Lanka in 1865 mark the first attempt at biological control of a weed.
References	635, 636, 1542, 1548, 1831, 2077

RELEASE

Country	India
Year	1821
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	This release again made for commercial purposes in the mistaken belief it was *Dactylopius coccus* Costa. Was found to be identical to the agents already common in India from the 1795 release; the populations were subsequently not differentiated. Established and provided complete control. Populations now variable because weed infestations typically decimated locally.
References	635, 1542, 1831, 2077

CACTACEAE
Opuntia monacantha; Dactylopius ceylonicus *(continued)*

RELEASE	
Country	Mauritius
Year	1914
Source	Ex. Brazil via India via Sri Lanka via Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	By 1928 had almost completely cleared the island of *Opuntia monacantha*. Subsequently, introduction of a predator reduced effectiveness. *Cactoblastis cactorum* then introduced and controlled weed. *Dactylopius* spp. not seen in recent surveys so may be extinct from Mauritius, though because *Opuntia* spp. now restricted to inaccessible sites, may still be present.
Limiting Factors	Predation
Research Organization	MAM
References	586, 635, 668, 1293

RELEASE	
Country	Republic of South Africa
Year	1913
Source	Ex. Brazil via India via Sri Lanka
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Within a few years brought *Opuntia monacantha* under control. Populations of the weed still flare, though no additional control measures needed, aside from utilizing this biocontrol agent.
Research Organization	ARC-PPRI
References	51, 635, 992, 1258, 1342

CACTACEAE
Opuntia monacantha; Dactylopius ceylonicus *(continued)*

RELEASE	
Country	Sri Lanka
Year	1865
Source	Ex. Brazil via India
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established and providing complete control of the weed over vast areas. Populations now variable because weed infestations typically decimated locally.
References	635, 636, 1542, 1548, 2077

AGENT	
Species	*Dactylopius confusus* (Cockerell)
Past Names/Synonyms	*Dactylopius greenii* Cockerell
Classification	(Hemiptera: Dactylopiidae)

RELEASE	
Country	Australia
Year	1915
Source	Ex. South America via Germany via Republic of South Africa
Established	No
Research Organization	PPTC, QLD State
References	635, 1989

TABLE 1

CACTACEAE
Opuntia monacantha; Dactylopius confusus *(continued)*

RELEASE	
Country	Australia
Year	1926
Source	Ex. South America via Germany via Republic of South Africa
Established	No
Notes	Initially established but failed to survive when food source destroyed by *Dactylopius ceylonicus*.
Limiting Factors	Interspecific competition
Research Organization	CPPB*
References	635, 1989

RELEASE	
Country	India
Year	1836
Source	Ex. South America via Germany via Republic of South Africa
Established	No
References	446, 635, 1831

RELEASE	
Country	India
Year	1838
Source	Ex. South America via Germany via Republic of South Africa
Established	No
References	446, 635, 1831

CACTACEAE
Opuntia monacantha; Dactylopius confusus *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1832
Source	Ex. South America via Germany
Established	No
Notes	Intentionally introduced in an attempt to collect dye, though the misidentification of this species led to it causing some of the first (though inadvertent) effects of biological control of weeds. Not recorded recently, probably as a result of the destruction of the weed by *Dactylopius ceylonicus*.
Research Organization	Private
References	51, 446, 635

CACTACEAE
Opuntia monacantha (continued)

AGENT

Species	*Dactylopius opuntiae* (Cockerell)
Incorrect Past Names/Synonyms	*Dactylopius tomentosus* (Lam.)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE

Country	Mauritius
Year	1928
Source	Ex. USA (AZ, CA, TX) via Australia via Sri Lanka
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially effective control, followed by slow increase in weed, probably as a result of predation by deliberately introduced biocontrol agent. *Cactoblastis cactorum* then introduced and controlled weed. *Dactylopius* spp. not seen in recent surveys so may be extinct from Mauritius, though because *Opuntia* spp. now restricted to inaccessible sites, may still be present.
Limiting Factors	Predation
Research Organization	MAM
References	586, 635, 668, 1293

CACTACEAE (continued)

WEED

Family	Cactaceae
Species	*Opuntia oricola* Philbrick
Origin	southwestern coastal USA including Santa Cruz Island and Baja California, Mexico
Common Name	prickly pear, chaparral prickly pear

AGENT

Species	*Dactylopius opuntiae* (Cockerell)
Past Names/Synonyms	*Dactylopius* sp.
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE

Country	United States of America
Year	1951
Source	Ex. Mexico via Australia via Hawaii USA
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	*Opuntia oricola* less susceptible than *O. littoralis*. This and predation have slowed the rate of destruction in recent times. Target weed considered native.
Limiting Factors	Predation
Research Organization	State (4,5)
References	635, 638, 639, 643

TABLE 1

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Opuntia* spp.
Notes	A few releases now attributed to this group were listed under *Opuntia vulgaris* in previous versions of this catalogue (a species now referred to as *Opuntia monacantha*). However, all references cited then and now do not differentiate which *Opuntia* species it was that received this release. Consequently, the entries have been changed to *Opuntia* spp.
Origin	North and South America adjacent to Caribbean Islands, Caribbean Islands
Common Name	prickly pear, raketa, Malagasy cactus
References	446, 668

AGENT

Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Ascension Island
Year	1973
Source	Ex. Argentina via Australia via Republic of South Africa via Antigua and Nevis via St Helena
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Now in a state of controlled equilibrium; *Opuntia* spp. no longer a problem.
Research Organization	IIBC
References	582, 584, 2071

CACTACEAE
Opuntia spp.; *Cactoblastis cactorum* *(continued)*

RELEASE

Country	Cayman Islands
Year	1970
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis and Antigua
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Initially released on *Opuntia stricta* but spread to other *Opuntia* species. Nursery plants so heavily attacked that cultivation proving difficult. Still not present on Cayman Brac.
Research Organization	IIBC
References	288, 312, 2071, 2079

RELEASE

Country	Israel
Year	pre 1970
Source	Ex. Argentina via Republic of South Africa via Nevis via Antigua
Established	No

(continued on next page)

CACTACEAE
Opuntia* spp.; *Cactoblastis cactorum *(continued)*

Country Israel (continued)
Notes Reference Bennett 1970 indicates *Cactoblastis cactorum* from Trinidad was shipped to both Kenya and Israel pre 1970 for release against *Opuntia* spp. This biological control agent originated in Argentina, not Trinidad. Other references confirm the material sent to Kenya originated in Argentina, and was sent through a variety of countries prior to shipment to Kenya. It is assumed by the editors of this catalogue that the cultures utilized in Trinidad laboratories before shipment to Israel originated from Argentina. Because the only reference available documenting the release in Israel lumped this release along with that of Kenya, the "via" nations listed for Kenya are also listed for Israel.
Research Organization IIBC
References 98, 2071

RELEASE
Country Kenya
Year 1966
Source Ex. Argentina via Republic of South Africa via Nevis via Antigua
Established No
Notes One egg stick found following release, but since believed to have died out.
Research Organization IIBC
References 308, 668, 2071

CACTACEAE
Opuntia* spp.; *Cactoblastis cactorum *(continued)*

RELEASE
Country Kenya
Year 1971
Source Ex. Argentina via Republic of South Africa via Nevis via Antigua
Established No
General Impact Compromised
Notes Passed through two generations at one site near Nairobi, but subsequently may have died out as release area was cleared.
Limiting Factors Land use
Research Organization IIBC
References 312, 670, 2071

RELEASE
Country Pakistan
Year 1994
Source Ex. Argentina via Australia
Established No
Notes Larval feeding observed soon after release, but establishment later deemed unsuccessful.
Research Organization IIBC, VIC State
References 880, 1134, 1989, 2076

TABLE 1

CACTACEAE
Opuntia* spp.; *Cactoblastis cactorum *(continued)*

RELEASE	
Country	St Helena
Year	1971
Source	Ex. Argentina via Australia via Republic of South Africa via Antigua and Nevis
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Although no quantitative data are available, agent appears to have reduced abundance of *Opuntia* spp. substantially. Impact somewhat controversial as some residents preferred cactus covered slopes to bare rock, and used the fruit for wine.
Research Organization	IIBC
References	312, 582, 2071, 2077

AGENT	
Species	*Dactylopius ceylonicus* (Green)
Past Names/Synonyms	*Dactylopius indicus* Green
Classification	(Hemiptera: Dactylopiidae)

RELEASE	
Country	Kenya
Year	1958
Source	Ex. Brazil via India via Sri Lanka via Republic of South Africa via Tanzania
Established	Yes
Abundance	Unknown
General Impact	Variable

(continued at top of next column)

CACTACEAE
Opuntia* spp.; *Dactylopius ceylonicus *(continued)*

Country	Kenya (continued)
Notes	Some control in coastal region (Coast) and Lake Victoria areas (Nyanza) but not satisfactory as additional agents sought.
Research Organization	DAK
References	635, 668

RELEASE	
Country	Tanzania
Year	1957
Source	Ex. Brazil via India via Sri Lanka via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Substantial control in the Lake Victoria area.
Research Organization	DAT
References	635, 668

CACTACEAE
***Opuntia* spp.** *(continued)*

AGENT

Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE

Country	Kenya
Year	post 1958
Source	Ex. Mexico via Australia via Republic of South Africa via Tanzania
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional

(continued at top of next column)

CACTACEAE
Opuntia* spp.; *Dactylopius opuntiae *(continued)*

Country	Kenya (continued)
Notes	Ficus biotype. Abundant and effective; near one community in Rift Valley has largely wiped out most plants. [Reported in previous edition of this catalogue as an accidental introduction probably from the USA via South Africa via Tanzania in 1958 when *Dactylopius ceylonicus* was intentionally introduced. References cited at the time do not confirm the introduction, so the source of this information remains unknown. An alternative reference (Goeden 1978) indicates the species was introduced intentionally. Because current researchers are unsure of the avenue of introduction, it is possible the species was introduced via both channels. Consequently two entries are given for this species, and the editors of this new version of the catalogue assume the different source populations (if more than one) have since intermixed and are no longer differentiated.]
Research Organization	DAK
References	446, 635, 944, 970, 2005

RELEASE

Country	Tanzania
Year	1958
Source	Ex. Mexico via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Ficus biotype. Providing excellent control.
Research Organization	DAT
References	635, 2005

TABLE 1

TABLE 1

CACTACEAE
***Opuntia* spp.** *(continued)*

AGENT

Species	*Dactylopius* sp.
Past Names/Synonyms	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Though a key reference in previous versions of the catalogue (Greathead 1971) refers to this species on Madagascar as *Dactylopius opuntiae*, the same reference states elsewhere the agent was introduced to Madagascar from La Réunion, where the identity of the *Dactylopius* sp. remains unclear. More recent references indicate the identity of the agent on Madagascar remains unclear, so the editors of this version of the catalogue are following suit.
References	668

RELEASE

Country	Madagascar
Year	1923
Source	Ex. Unknown
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Led to complete control of previously widespread *Opuntia* spp. within 5 years.
Research Organization	MAMA
References	668, 1076, 1240

CACTACEAE
***Opuntia* spp.** *(continued)*

AGENT

Species	*Dactylopius* sp. nr *confusus* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	New Caledonia
Year	1962
Source	Ex. Argentina via Hawaii USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Well established and providing very good control.
Research Organization	NCC
References	286, 635, 1548, 1775

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia streptacantha* Lem.
Origin	Mexico
Common Name	Westwood pear, white spine prickly pear

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	1926
Source	Ex. Argentina
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially released against *Opuntia stricta*, but naturally spread and attacks this species as well. Larvae develop in young plants, frequently destroying them. Old stems too woody for larval development. The weed serves as a reservoir for the moth in central QLD.
Other Species Attacked	Also attacks the exotic *Opuntia elata* Link & Otto ex Salm-Dyck, *O. elatior* Mill., and *O. humifusa* (Raf.) Raf. Spillover attack found on melons and tomatoes.
Research Organization	CPPB*
References	130, 509, 510, 511, 753, 845, 847, 1989

CACTACEAE
Opuntia streptacantha *(continued)*

AGENT	
Species	*Chelinidea tabulata* (Burmeister)
Classification	(Hemiptera: Coreidae)

RELEASE	
Country	Australia
Year	1922
Source	Ex. USA (TX)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Populations initially high on *Opuntia stricta* so spread naturally to this species where it never provided any degree of control. Destruction of main host *O. stricta* by *Cactoblastis cactorum* dramatically decreased populations of this insect. *O. streptacantha* remains an important host.
Other Species Attacked	Found feeding on nectarines, dates, peaches, ripe grapes, rock melons, watermelons, and tomatoes when dense populations were suddenly deprived of their host by the collapse of the prickly pear stands. There have been no reports of damage since 1931.
Research Organization	CPPB*
References	509, 511, 635, 733, 944, 1989

TABLE 1

CACTACEAE
Opuntia streptacantha *(continued)*

AGENT	
Species	*Chelinidea vittiger* Uhler
Classification	(Hemiptera: Coreidae)

RELEASE	
Country	Australia
Year	1925
Source	Ex. USA (FL, TX)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established with difficulty on primary host *Opuntia stricta*, increased, then declined following widespread destruction of *O. stricta* by *Cactoblastis cactorum*. Not recorded on *O. streptacantha* since 1934.
Research Organization	CPPB*
References	509, 511, 635, 1989

CACTACEAE
Opuntia streptacantha *(continued)*

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Australia
Year	1928
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established readily giving useful control in heavy weed infestations by destroying young plants. After mechanical clearing regrowth effectively controlled by this agent. Remains a significant factor in control of this weed.
Research Organization	CPPB*
References	511, 635, 847, 1989

TABLE 1

CACTACEAE
Opuntia streptacantha *(continued)*

AGENT	
Species	*Lagocheirus funestus* Thomson
Past Names/Synonyms	*Archlagocheirus funestus* (Thomson)
Classification	(Coleoptera: Cerambycidae)
References	992, 1252

RELEASE	
Country	Australia
Year	1936
Source	Ex. Mexico
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established readily and initially had significant impact; gregarious larvae feeding in heavy woody stems caused collapse of even very large plants. Populations more recently declined and now uncommon in field. Larvae and pupae are subject to predation by crows, rodents and lizards.
Limiting Factors	Predation
Research Organization	CPPB*
References	635, 753, 944, 1989

CACTACEAE
Opuntia streptacantha *(continued)*

AGENT	
Species	*Moneilema blapsides* (Newman) subsp. *ulkei* Horn
Past Names/Synonyms	*Moneilema ulkei*
Classification	(Coleoptera: Cerambycidae)
References	1099, 1252

RELEASE	
Country	Australia
Year	1926
Source	Ex. USA (TX)
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially destroyed large plants but due to small isolated populations did not provide effective control. Has not been recovered for many years.
Research Organization	CPPB*
References	635, 753, 1989

CACTACEAE *(continued)*

TABLE 1

WEED

Family	Cactaceae
Species	*Opuntia stricta* (Haw.) Haw.
Past Names/Synonyms	*Opuntia dillenii* (Ker Gawler) Haw., *Opuntia stricta* (Haw.) Haw. var. *dillenii* (Ker Gawl.) L. D. Benson, *Opuntia inermis* DC., *Opuntia stricta* (Haw.) Haw. var. *stricta*
Notes	This species is sometimes split in various ways by different taxonomists and is currently under debate. The editors of this version of the catalogue currently support the idea it is all one highly variable *Opuntia stricta* (Haw.) Haw.
Origin	North and South America adjacent to Caribbean Islands, Caribbean Islands
Common Name	spiny pest pear, common prickly pear, prickly pear, sweet prickly pear, Australian pest pear, prickly pear
References	135, 845, 846, 1459

AGENT

Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Antigua
Year	1960
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

CACTACEAE
Opuntia stricta; Cactoblastis cactorum *(continued)*

Country	Antigua (continued)
Notes	Initially released on *Opuntia triacantha* but spread to *O. stricta* which is considered native to Antigua. Few individual cactus plants remain from historically large populations. The moth is still present; remaining plants persist despite attack.
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
Research Organization	DAA
References	35, 99, 288, 1680, 2071, 2077, 2079

RELEASE

Country	Australia
Year	1926
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Variable
Notes	Rapid establishment and destruction of the weed by 1934 and of regrowth by 1935, especially in scrub country. Not able to control the weed in cooler areas where cannot complete two generations each year, nor in places where always hot and the plant segments dehydrated.
Limiting Factors	Climate
Other Species Attacked	Also attacks the exotic *Opuntia elata* Link & Otto ex Salm-Dyck, *O. elatior* Mill., and *O. humifusa* (Raf.) Raf. Spillover attack found on melons and tomatoes.
Research Organization	CPPB*
References	130, 509, 510, 511, 845, 847, 1989

CACTACEAE
Opuntia stricta; Cactoblastis cactorum *(continued)*

RELEASE	
Country	Cayman Islands
Year	1970
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis and Antigua
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Few individual cactus plants remain from historically large populations. Moth is still present; remaining plants persist despite high attack. Target weed considered native.
Research Organization	IIBC
References	35, 98, 99, 288, 312, 2071, 2077, 2079

RELEASE	
Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. Argentina via Australia via Republic of South Africa
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Released on Nevis, spread naturally to St Kitts. Initially very abundant and effective, significantly reducing the cactus population. Recent surveys indicate current moth populations lower than previously, which enables some cactus individuals to escape attack. The plant (considered native) continues to thrive in small scattered populations on both islands.

(continued at top of next column)

CACTACEAE
Opuntia stricta; Cactoblastis cactorum *(continued)*

Country	Federation of St Kitts and Nevis (continued)
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck (previously referred to as *Opuntia cochenillifera* (L.) Mill.).
Research Organization	IIBC
References	99, 288, 610, 1459, 1680, 2071, 2077, 2079

RELEASE	
Country	Montserrat
Year	1960
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released on *Opuntia triacantha* but spread to *O. stricta* (considered native). Few individual cactus plants remain from historically large populations. Moth is still present; remaining plants persist despite high attack.
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
Research Organization	DAM
References	35, 99, 288, 610, 1680, 2071, 2077, 2079

TABLE 1

CACTACEAE
Opuntia stricta; Cactoblastis cactorum (continued)

RELEASE	
Country	New Caledonia
Year	1932
Source	Ex. Argentina via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Well established in the release location within a year of release. Highly beneficial control.
Research Organization	NCC
References	635, 1548, 1754

RELEASE	
Country	Republic of South Africa
Year	1980s
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Redistributed from *Opuntia ficus-indica* to *O. stricta* and met with limited success throughout much of South Africa. In Kruger National Park, initially very abundant and dispersed rapidly, prior to decreasing again (likely due to predation). Though heavy attack results in larger plants collapsing and delayed maturity in larger plants, many smaller plants begin to grow from the fragmented portions. Unable to provide sufficient control alone.
Limiting Factors	Predation

(continued at top of next column)

CACTACEAE
Opuntia stricta; Cactoblastis cactorum (continued)

Country	Republic of South Africa (continued)
Other Species Attacked	Occasionally found providing incomplete control on the exotic *Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida*, *C. imbricata* (Haw.) F.M. Knuth., *Opuntia monacantha* (Willd.) Haw., *O. spinulifera* Salm-Dyck, *O. salmiana* J. Parm. ex Pfeiff., and *Austrocylindropuntia subulata* (Muehlenpf.) Backeb.
Research Organization	ARC-PPRI
References	832, 833, 992, 993, 1258, 2071

AGENT	
Species	*Chelinidea tabulata* (Burmeister)
Classification	(Hemiptera: Coreidae)

RELEASE	
Country	Australia
Year	1922
Source	Ex. USA (TX)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Initially rapid establishment, increase and dispersal causing heavy destruction of fruit and new shoots. Exerted significant control prior to extensive destruction by *Cactoblastis cactorum*. Now numbers limited and ineffective in controlling the weed.
Limiting Factors	Interspecific competition

(continued on next page)

CACTACEAE
Opuntia stricta; Chelinidea tabulata (continued)

Country	Australia (continued)
Other Species Attacked	Found feeding on nectarines, dates, peaches, ripe grapes, rock melons, watermelons, and tomatoes when dense populations were suddenly deprived of their host by the collapse of the prickly pear stands. There have been no reports of damage since 1931.
Research Organization	CPPB*
References	509, 510, 511, 635, 733, 753, 1989

AGENT

Species	*Chelinidea vittiger* Uhler
Classification	(Hemiptera: Coreidae)

RELEASE

Country	Australia
Year	1925
Source	Ex. USA (FL, TX)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Slow establishment then began increasing rapidly. Subsequently declined following destruction of *Opuntia stricta* by *Cactoblastis cactorum*; none have been seen since 1940.
Limiting Factors	Interspecific competition
Research Organization	CPPB*
References	509, 511, 635, 1989

CACTACEAE
Opuntia stricta (continued)

TABLE 1

AGENT

Species	*Dactylopius austrinus* De Lotto
Past Names/Synonyms	*Dactylopius* sp. nr *confusus*
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. Argentina via Republic of South Africa
Established	No
Notes	Target plant is considered native.
Research Organization	IIBC
References	288, 446, 1459, 1680

AGENT

Species	*Dactylopius ceylonicus* (Green)
Past Names/Synonyms	*Dactylopius indicus* Green
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	India
Year	post 1863
Source	Ex. Brazil, Mexico
Established	No
Notes	Redistributions from *Opuntia monacantha* to *O. stricta* failed as this species is specific to *O. monacantha*.
Limiting Factors	Specificity
References	1548, 1607, 1831

TABLE 1

CACTACEAE
Opuntia stricta (continued)

AGENT	
Species	*Dactylopius confusus* (Cockerell)
Past Names/Synonyms	*Dactylopius greenii* Cockerell
Classification	(Hemiptera: Dactylopiidae)

RELEASE	
Country	Australia
Year	1933
Source	Ex. USA (FL)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Initial establishment rapid but population declined and was thought to have become extinct. Rediscovered in central QLD in 1967. Provides no appreciable control.
Research Organization	CPPB*
References	511, 515, 1989

CACTACEAE
Opuntia stricta (continued)

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Incorrect Past Names/Synonyms	*Dactylopius tomentosus* (Lam.)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Australia
Year	1921
Source	Ex. USA (AZ, CA, TX)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Rapidly established. Provided excellent control of dense infestations in brigalow stands. Following heavy die-off of host species from attack by *Cactoblastis cactorum*, this agent now useful in cooler areas where *C. cactorum* cannot complete two generations in a year, and in hot dry areas where the plant segments are often dehydrated.
Limiting Factors	Interspecific competition
Other Species Attacked	Also damages the introduced *Opuntia elatior* Mill. and *Opuntia elata* Link & Otto ex Salm-Dyck.
Research Organization	CPPB*
References	509, 511, 635, 845, 847, 850, 1989

CACTACEAE
Opuntia stricta; Dactylopius opuntiae (continued)

RELEASE	
Country	Australia
Year	1933
Source	Ex. USA (TX)
Established	No
Notes	Released in attempt to control regrowth of *Opuntia stricta*. All colonies disappeared following destruction of host plants by resurgent populations of *Cactoblastis cactorum*.
Limiting Factors	Interspecific competition
Research Organization	CPPB*
References	635, 1989

RELEASE	
Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. USA (AZ, TX) via Australia via Republic of South Africa
Established	No
Notes	Target plant is considered native.
Research Organization	IIBC
References	288, 1258, 1459, 1490, 1680

RELEASE	
Country	India
Year	1926
Source	Ex. USA (AZ, CA, TX) via Australia via Sri Lanka
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

CACTACEAE
Opuntia stricta; Dactylopius opuntiae (continued)

Country	India (continued)
Notes	Widely established giving complete control. Heavily infested areas became fit for cultivation within five or six years. Attacked by predaceous coccinellids, but apparently with limited impact to the agent's population.
Limiting Factors	Predation
Other Species Attacked	Also found attacking the widely cultivated *Nopalea cochenillifera* (L.) Salm-Dyck
References	635, 1542, 1548

RELEASE	
Country	Republic of South Africa
Year	1997
Source	Ex. North America via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Stricta biotype. Biomass of *Opuntia stricta* declined by 90% 6 years following release of this new biotype. Fruit production was halted, decreasing the long-range dispersal of this weed. *Dactylopius opuntiae* populations best suited to low rainfall areas and seasons. Low natural dispersal abilities have required continued manual redistribution.
Research Organization	ARC-PPRI
References	833, 992, 993, 1258, 1437

TABLE 1

CACTACEAE
Opuntia stricta; Dactylopius opuntiae *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1980s
Source	Ex. USA (AZ, TX) via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Ficus biotype, redistributed from *Opuntia ficus-indica* to *O. stricta*. Despite multiple redistribution attempts, majority of releases failed. This biotype of *Dactylopius opuntiae* is better suited to *O. ficus-indica* and only occurs as spillover on *O. stricta* growing in the vicinity of *O. ficus-indica*.
Limiting Factors	Specificity
Research Organization	ARC-PPRI
References	833, 993, 1258

RELEASE	
Country	Sri Lanka
Year	1925
Source	Ex. USA (AZ, CA, TX) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established, giving very good control.
Research Organization	DASL
References	635, 1548

CACTACEAE
Opuntia stricta *(continued)*

AGENT	
Species	*Loxomorpha flavidissimalis* (Grote)
Past Names/Synonyms	*Mimorista flavidissimalis* (Grote)
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	Australia
Year	1925
Source	Ex. USA (TX)
Established	No
Research Organization	CPPB*
References	509, 1989

AGENT	
Species	*Melitara dentata* (Grote)
Past Names/Synonyms	*Melitara doddalis* Dyar
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	1926
Source	Ex. USA (AZ, CO, TX)
Established	No
Research Organization	CPPB*
References	635, 1989

CACTACEAE
Opuntia stricta *(continued)*

AGENT	
Species	*Melitara prodenialis* Walker
Past Names/Synonyms	*Zophodia prodenialis* Walker, *Melitara bollii* (Zeller)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	1926
Source	Ex. USA (FL, TX)
Established	No
Research Organization	CPPB*
References	509, 511, 635

AGENT	
Species	*Melitara* sp.
Past Names/Synonyms	*Zophodia prodenialis* Walker, *Melitara bollii* (Zeller)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Australia
Year	1925
Source	Ex. USA (TX)
Established	No
Research Organization	CPPB*
References	1989

CACTACEAE
Opuntia stricta *(continued)*

TABLE 1

AGENT	
Species	*Moneilema blapsides* (Newman) subsp. *ulkei* Horn
Past Names/Synonyms	*Moneilema ulkei*
Classification	(Coleoptera: Cerambycidae)
References	1099, 1252

RELEASE	
Country	Australia
Year	1926
Source	Ex. USA (TX)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially well established and damaging. Many release sites since lost to destruction by *Cactoblastis cactorum*. Though occasionally killed larger plants, did not give control and populations currently limited.
Limiting Factors	Interspecific competition
Research Organization	CPPB*
References	635, 1989

TABLE 1

CACTACEAE
Opuntia stricta (continued)

AGENT	
Species	*Moneilema variolare* Thomson
Classification	(Coleoptera: Cerambycidae)
RELEASE	
Country	Australia
Year	1932
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	None
Notes	Established, but population too small to provide control.
Research Organization	CPPB*
References	511, 635, 1989

AGENT	
Species	*Olycella junctolineella* (Hulst)
Past Names/Synonyms	*Olyca junctolineella* (Hulst)
Classification	(Lepidoptera: Pyralidae)
RELEASE	
Country	Australia
Year	1924
Source	Ex. USA (TX)
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established readily but never became factor in control of the weed and may no longer occur on it in Australia.
Research Organization	CPPB*
References	509, 511, 1989

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia tomentosa* Salm-Dyck
Origin	Mexico, Guatemala
Common Name	velvet opuntia, velvet tree pear
AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)
RELEASE	
Country	Australia
Year	1926
Source	Ex. Argentina
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially released against *Opuntia stricta*, but naturally spread and attacks this species as well. Larvae develop in young plants, frequently destroying them, but only occurs when weed growing among *O. stricta*. Old stems too woody for larval development/oviposition.
Other Species Attacked	Also attacks the exotic *Opuntia elata* Link & Otto ex Salm-Dyck, *O. elatior* Mill., and *O. humifusa* (Raf.) Raf. Spillover attack found on melons and tomatoes.
Research Organization	CPPB*
References	130, 509, 510, 511, 753, 845, 847, 1989

CACTACEAE
Opuntia tomentosa *(continued)*

AGENT

Species	*Cactoblastis doddi* Heinrich
Classification	(Lepidoptera: Pyralidae)

RELEASE

Country	Australia
Year	1935
Source	Ex. Argentina
Established	No
Research Organization	CPPB*
References	1839

AGENT

Species	*Chelinidea tabulata* (Burmeister)
Classification	(Hemiptera: Coreidae)

RELEASE

Country	Australia
Year	1922
Source	Ex. USA (TX)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Populations initially high on *Opuntia stricta* so spread naturally to this species where it never provided any degree of control. Destruction of main host *O. stricta* by *Cactoblastis cactorum* dramatically decreased populations of this insect.

(continued at top of next column)

CACTACEAE
Opuntia tomentosa; Chelinidea tabulata *(continued)*

Country	Australia (continued)
Other Species Attacked	Found feeding on nectarines, dates, peaches, ripe grapes, rock melons, watermelons, and tomatoes when dense populations were suddenly deprived of their host by the collapse of the prickly pear stands. There have been no reports of damage since 1931.
Research Organization	CPPB*
References	509, 511, 635, 733, 1989

AGENT

Species	*Dactylopius coccus* Costa
Classification	(Hemiptera: Dactylopiidae)

RELEASE

Country	Australia
Year	1926
Source	Ex. Central America via Republic of South Africa
Established	No
Research Organization	CPPB*
References	446, 1989

TABLE 1

CACTACEAE
Opuntia tomentosa *(continued)*

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Australia
Year	1922
Source	Ex. USA (AZ, TX)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Established readily. Effective in killing young seedlings, small older plants, and large plants in dense stands in scrubs. Less effective on large plants in the open unless they have been felled prior to introduction of insects. Efficacy limited by inefficient dispersal.
Limiting Factors	Habitat
Other Species Attacked	Also damages the exotic *Opuntia elata* Link & Otto ex Salm-Dyck.
Research Organization	CPPB*
References	511, 635, 847, 1989

CACTACEAE
Opuntia tomentosa *(continued)*

AGENT	
Species	*Lagocheirus funestus* Thomson
Past Names/Synonyms	*Archlagocheirus funestus* (Thomson)
Classification	(Coleoptera: Cerambycidae)
References	992, 1252

RELEASE	
Country	Australia
Year	1936
Source	Ex. Mexico
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Rapid establishment and initially good control, but later declined and now considered nearly extinct. Larvae and pupae subject to predation by crows, rodents and lizards.
Limiting Factors	Predation
Research Organization	CPPB*
References	635, 753, 847, 944, 1989

CACTACEAE
Opuntia tomentosa (continued)

AGENT	
Species	*Moneilema blapsides* (Newman) subsp. *ulkei* Horn
Past Names/Synonyms	*Moneilema ulkei*
Classification	(Coleoptera: Cerambycidae)
References	1099, 1252

RELEASE	
Country	Australia
Year	1926
Source	Ex. USA (TX)
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Capable of causing collapse of large plants but this rarely occurs. Populations small and isolated. Has not been recovered for many years.
Research Organization	CPPB*
References	635, 753, 1989

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia triacantha* (Willd.) Sweet
Origin	Puerto Rico, Lesser Antilles
Common Name	suckers

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Antigua
Year	1960
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Isolated clumps that previously escaped attack were heavily infested and collapsing by 1970. This target weed considered native to Antigua.
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
Research Organization	DAA
References	2046

TABLE 1

CACTACEAE
Opuntia triacantha; Cactoblastis cactorum *(continued)*

RELEASE	
Country	Cayman Islands
Year	1970
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis and Antigua
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Initially released on *Opuntia stricta* but spread to *O. triacantha* (considered native). Nursery plants so heavily attacked that cultivation proving difficult. Still not present on Cayman Brac.
Research Organization	IIBC
References	35, 288, 312, 2071, 2079

RELEASE	
Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. Argentina via Australia via Republic of South Africa
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

CACTACEAE
Opuntia triacantha; Cactoblastis cactorum *(continued)*

Country	Federation of St Kitts and Nevis (continued)
Notes	Released on Nevis, spread naturally to St Kitts. Initially very abundant and effective, significantly reducing the cactus population. Recent surveys indicate current moth populations lower than previously, which enables some cactus individuals to escape attack. The plant (considered native) continues to thrive in small scattered populations on both islands.
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
Research Organization	IIBC
References	99, 288, 610, 1459, 1680, 2071, 2077, 2079

RELEASE	
Country	Montserrat
Year	1960
Source	Ex. Argentina via Australia via Republic of South Africa via Nevis
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Well established and provided very good control. Due to lack of pasture management, the land became overgrown by *Acacia* spp. as the cactus was destroyed. Target weed considered native.
Other Species Attacked	Also found attacking the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
Research Organization	DAM
References	35, 99, 288, 610, 1680, 2071, 2079

CACTACEAE
Opuntia triacantha *(continued)*

AGENT	
Species	*Dactylopius austrinus* De Lotto
Past Names/Synonyms	*Dactylopius* sp. nr *confusus*
Classification	(Hemiptera: Dactylopiidae)

RELEASE	
Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. Argentina via Republic of South Africa
Established	No
Notes	Target plant is considered native.
Research Organization	IIBC
References	288, 446, 1459, 1680

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Federation of St Kitts and Nevis
Year	1957
Source	Ex. USA via Australia via Republic of South Africa
Established	No
Notes	Target plant is considered native.
Research Organization	IIBC
References	288, 1459, 1490, 1680

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia tuna* (L.) Mill.
Origin	Caribbean
Common Name	prickly pear, barbary fig, elephantear prickly pear

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Mauritius
Year	1950
Source	Ex. Argentina via Australia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Weed initially controlled by *Dactylopius*, however subsequent predation led to increase in *Opuntia* spp. *Cactoblastis cactorum* established immediately and restored control to weed population. Wild *Opuntia* spp. now rare on Mauritius and always attacked by *C. cactorum*.
Research Organization	MAM
References	586, 668, 2071

TABLE 1

TABLE 1

CACTACEAE
Opuntia tuna *(continued)*

AGENT	
Species	*Dactylopius ceylonicus* (Green)
Past Names/Synonyms	*Dactylopius indicus* Green
Classification	(Hemiptera: Dactylopiidae)

RELEASE	
Country	Mauritius
Year	1914
Source	Ex. Brazil via India via Sri Lanka via Republic of South Africa
Established	No
Notes	Unable to live on *Opuntia tuna*.
Limiting Factors	Specificity
Research Organization	MAM
References	586, 635, 668, 1293

CACTACEAE
Opuntia tuna *(continued)*

AGENT	
Species	*Dactylopius opuntiae* (Cockerell)
Incorrect Past Names/Synonyms	*Dactylopius tomentosus* (Lam.)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

RELEASE	
Country	Mauritius
Year	1928
Source	Ex. USA (AZ, CA, TX) via Australia via Sri Lanka
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially effective control, followed by slow increase in weed, probably as a result of predation by deliberately introduced biocontrol agent. *Cactoblastis cactorum* then introduced and controlled weed. *Dactylopius* spp. not seen in recent surveys so may be extinct from Mauritius, though because *Opuntia* spp. now restricted to inaccessible sites, may still be present.
Limiting Factors	Predation
Research Organization	MAM
References	586, 635, 668, 1293

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Pereskia aculeata* Mill.
Origin	tropical America, Caribbean
Common Name	Barbados gooseberry, pereskia
AGENT	
Species	*Phenrica guerini* Bechyné
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	Republic of South Africa
Year	1991
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Populations limited and ineffective at two sites; high densities observed at additional site where damage is significant. Reasons for varying success not yet understood.
Research Organization	ARC-PPRI
References	991, 1437

CARYOPHYLLACEAE

WEED	
Family	Caryophyllaceae
Species	*Silene vulgaris* (Moench) Garcke
Origin	Eurasia
Common Name	bladder campion
AGENT	
Species	*Cassida azurea* Fabricius
Incorrect Past Names/Synonyms	*Cassida hemisphaerica* Herbst
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	Canada
Year	1989
Source	Ex. Europe
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	*Cassida azurea* populations at most sites too small to have impact on weed density. One AB site had heavy feeding on all plants and little of the weed was left, but unclear if due to *C. azurea*, plant competition, or mowing.
Research Organization	AAFC
References	432, 1479

TABLE 1

TABLE 1

CHENOPODIACEAE

WEED

Family	Chenopodiaceae
Species	*Halogeton glomeratus* (M. Bieb.) C. A. Mey.
Origin	Central Asia
Common Name	halogeton

AGENT

Species	*Coleophora parthenica* Meyrick
Classification	(Lepidoptera: Coleophoridae)

RELEASE

Country	United States of America
Year	1974
Source	Ex. Pakistan
Established	No
Notes	Redistributed from *Salsola tragus* to *Halogeton glomeratus* but failed to establish.
Research Organization	USDA (7)
References	231, 335, 1454, 1511, 1512

RELEASE

Country	United States of America
Year	1976
Source	Ex. Pakistan
Established	No
Notes	Collected from and released on *Halogeton glomeratus*.
Research Organization	USDA (7)
References	231, 1512

CHENOPODIACEAE *(continued)*

WEED

Family	Chenopodiaceae
Species	*Salsola tragus* L.
Incorrect Past Names/Synonyms	*Salsola australis* R. Br., *Salsola iberica* (Sennen & Pau) Botsch., *Salsola kali* L. subsp. *ruthenica* (Iljin) Soó, *Salsola kali* var. *tenuifolia* Tausch, *Salsola pestifer* A. Nelson, *Salsola ruthenica* Iljin
Notes	"Russian thistle" comprises seven distinct species in North America of which *Salsola tragus* is probably the most widespread. The correct name for the single species naturalized in the Hawaiian Islands is *Salsola tragus* L. Other names that have been associated with this widely naturalized species of *Salsola* have been misapplied in this region.
Origin	Eurasia
Common Name	Russian thistle, tumbleweed
References	858, 1699, 1721, 1925

AGENT

Species	*Coleophora klimeschiella* Toll
Classification	(Lepidoptera: Coleophoridae)

RELEASE

Country	Canada
Year	1977
Source	Ex. Pakistan via USA (CA)
Established	No
General Impact	Compromised
Notes	Initially survived but population destroyed during flooding in 1979.
Limiting Factors	Natural disaster
Research Organization	AAFC
References	732

CHENOPODIACEAE
Salsola tragus; Coleophora klimeschiella *(continued)*

RELEASE	
Country	Hawaii USA
Year	1980
Source	Ex. Pakistan via USA (CA)
Established	No
Research Organization	HDOA
References	641, 759, 1046, 1047

RELEASE	
Country	United States of America
Year	1977
Source	Ex. Pakistan
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	May kill young plants; attacked older plants presumably produce less seed. Heavily parasitized and preyed upon which prevents populations from building sufficiently to have significant impact. Ineffective agent.
Limiting Factors	Predation; Parasitism
Research Organization	USDA (7), State (5,9)
References	334, 335, 641, 646, 759, 1511, 1578

CHENOPODIACEAE
Salsola tragus *(continued)*

AGENT	
Species	*Coleophora parthenica* Meyrick
Classification	(Lepidoptera: Coleophoridae)

RELEASE	
Country	Canada
Year	1975
Source	Ex. Pakistan via USA (CA)
Established	No
Notes	Not established in SK where summer too cool for breeding.
Limiting Factors	Climate
Research Organization	AAFC
References	641, 732, 757

RELEASE	
Country	Hawaii USA
Year	1980
Source	Ex. Pakistan via USA (CA)
Established	No
Research Organization	HDOA
References	641, 757, 1047

RELEASE	
Country	United States of America
Year	1973
Source	Ex. Egypt
Established	No
Research Organization	USDA (7), State (5)
References	641, 757

TABLE 1

CHENOPODIACEAE
Salsola tragus; Coleophora parthenica *(continued)*

RELEASE	
Country	United States of America
Year	1973
Source	Ex. Pakistan
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	1974 releases onto southern CA *Salsola tragus* were Pakistan population intermixed with population from Turkey and subsequently not differentiated in the literature. Note: *S. tragus* redistributions made from CA stock originated in central CA and were sourced from Pakistani material. Feeding inside plant stems does not cause acute damage to vital plant tissues; however, plant may be chronically impacted gradually over summer as it becomes weakened hollow shell. Overall, feeding damage appears to have minimal impact, hindered greatly by parasitism, predation, poor host-plant synchronization.
Limiting Factors	Predation; Parasitism; Agent-host synchronization
Research Organization	USDA (7,9), State (5)
References	334, 335, 641, 759, 1297, 1298, 1511, 1578

CHENOPODIACEAE
Salsola tragus; Coleophora parthenica *(continued)*

RELEASE	
Country	United States of America
Year	1974
Source	Ex. Turkey
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	1974 releases onto southern CA *Salsola tragus* were Pakistan population intermixed with population from Turkey and subsequently not differentiated in the literature. Note: *S. tragus* redistributions made from CA stock originated in central CA and were sourced from Pakistani material. Feeding inside plant stems does not cause acute damage to vital plant tissues; however, plant may be chronically impacted gradually over summer as it becomes weakened hollow shell. Overall, feeding damage appears to have minimal impact, hindered greatly by parasitism, predation, poor host-plant synchronization.
Limiting Factors	Predation; Parasitism; Agent-host synchronization
Research Organization	USDA (7), State (5)
References	641, 757, 759, 1297, 1298, 1511

COMMELINACEAE

WEED

Family	Commelinaceae
Species	*Tradescantia fluminensis* Vell.
Origin	South America
Common Name	tradescantia, wandering Jew

AGENT

Species	*Lema basicostata* Monros
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	New Zealand
Year	2012
Source	Ex. Brazil
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	MWLR
References	735

COMMELINACEAE
Tradescantia fluminensis *(continued)*

AGENT

Species	*Neolema ogloblini* (Monros)
Incorrect Past Names/Synonyms	*Lema obscura*
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	New Zealand
Year	2011
Source	Ex. Brazil
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	MWLR
References	761, 1064

TABLE 1

CONVOLVULACEAE

WEED

Family	Convolvulaceae
Species	*Calystegia sepium* (L.) R. Br.
Past Names/Synonyms	*Convolvulus sepium* L.
Origin	North America
Common Name	hedge bindweed, hedge false bindweed

AGENT

Species	*Aceria malherbae* Nuzzaci
Incorrect Past Names/Synonyms	*Aceria convolvuli* (Nalepa), *Eriophyes convolvuli* Nalepa, *Aceria malherbe* (Nalepa)
Classification	(Acari: Eriophyidae)

RELEASE

Country	United States of America
Year	1993
Source	Ex. Greece
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	State (20)
References	335, 1104, 1799

CONVOLVULACEAE
Calystegia sepium *(continued)*

AGENT

Species	*Tyta luctuosa* (Denis & Schiffermüller)
Classification	(Lepidoptera: Noctuidae)

RELEASE

Country	United States of America
Year	1991
Source	Ex. Italy
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Overwintered in field cage, but establishment unknown.
Research Organization	State (20)
References	83, 335, 1104, 1799

CONVOLVULACEAE *(continued)*

WEED	
Family	Convolvulaceae
Species	*Convolvulus arvensis* L.
Origin	Eurasia
Common Name	field bindweed

AGENT	
Species	*Aceria malherbae* Nuzzaci
Incorrect Past Names/Synonyms	*Aceria convolvuli* (Nalepa), *Eriophyes convolvuli* Nalepa, *Aceria malherbe* (Nalepa)
Classification	(Acari: Eriophyidae)

RELEASE	
Country	Canada
Year	1989
Source	Ex. Greece
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Locally abundant but established at only three sites in AB. Establishment appears to be better in moister microclimates. Galling damage found up to 1.4 km from one site. Some plants heavily galled and stunted though impact has not been evaluated quantitatively. *Convolvulus arvensis* continues to be a problematic weed in many parts of Canada.
Limiting Factors	Climate
Research Organization	AAFC, ARC
References	1189, 1191, 1698

CONVOLVULACEAE
Convolvulus arvensis; Aceria malherbae *(continued)*

RELEASE	
Country	Mexico
Year	2004
Source	Ex. Greece via USA (NM)
Established	No
Research Organization	UAMX, CNR
References	138, 1582, 1583, 1584

RELEASE	
Country	Republic of South Africa
Year	1994
Source	Ex. Greece
Established	No
General Impact	Compromised
Notes	Establishment failure due to release sites subsequently being destroyed or converted to grazing land.
Limiting Factors	Land use
Research Organization	ARC-PPRI
References	354, 355, 992, 993, 1341, 2070

RELEASE	
Country	United States of America
Year	1989
Source	Ex. Greece
Established	Yes
Abundance	Variable
General Impact	Variable

(continued on next page)

TABLE 1

TABLE 1

CONVOLVULACEAE
Convolvulus arvensis; Aceria malherbae *(continued)*

Country	United States of America (continued)
Notes	Abundance, attack levels and impact vary dramatically across and within states where established. No impact at some sites, >90% decrease in aboveground plant biomass at others. Reasons for variability not studied explicitly, but populations known to be impacted by climate and possibly host plant resistance.
Limiting Factors	Climate
Research Organization	USDA (7,10,12), State (9), USDA-APHIS
References	39, 138, 334, 335, 1104, 1105, 1595, 1598, 1698, 1799

AGENT

Species	*Tyta luctuosa* (Denis & Schiffermüller)
Classification	(Lepidoptera: Noctuidae)

RELEASE

Country	Canada
Year	1989
Source	Ex. Italy
Established	No
Notes	Adults found one year after release in AB. Possible they still remain, but permanent establishment not confirmed.
Research Organization	AAFC, ARC
References	1185, 1189, 1191

CONVOLVULACEAE
Convolvulus arvensis; Tyta luctuosa *(continued)*

RELEASE

Country	United States of America
Year	1987
Source	Ex. Italy
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Establishment so limited to date that impact of larval feeding on flowers and foliage likely minor at best.
Research Organization	USDA (7,10,12), State (25,26), USDA-ARS
References	39, 83, 334, 335, 1045, 1104, 1502, 1595, 1752

WEED

Family	Convolvulaceae
Species	*Cuscuta americana* L.
Origin	tropical Americas
Common Name	love vine

AGENT

Species	*Melanagromyza cuscutae* Héring
Classification	(Diptera: Agromyzidae)

RELEASE

Country	Bahamas
Year	1966
Source	Ex. Pakistan
Established	No

(continued on next page)

CONVOLVULACEAE
Cuscuta americana; Melanagromyza cuscutae *(continued)*

Country	Bahamas (continued)
Notes	Heavy rain after initial release hindered establishment in 1966. 1968 releases mistakenly made onto *Cassytha filiformis* L. (Lauraceae) rather than *Cuscuta* spp.
Limiting Factors	Weather
Research Organization	IIBC
References	288, 309

RELEASE

Country	Barbados
Year	1967
Source	Ex. Pakistan
Established	No
Notes	Successfully propagated for three generations and released, but did not establish.
Research Organization	IIBC
References	98, 288, 308, 309, 629

AGENT

Species	*Smicronyx roridus* Marshall
Incorrect Past Names/Synonyms	*Smicronyx cuscutae* Marshall
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Bahamas
Year	1968
Source	Ex. Pakistan
Established	No

(continued at top of next column)

CONVOLVULACEAE
Cuscuta americana; Smicronyx roridus *(continued)*

Country	Bahamas (continued)
Notes	Releases mistakenly made onto *Cassytha filiformis* L. (Lauraceae) though intended for both *Cuscuta americana* and *C. indecora*.
Research Organization	IIBC
References	288, 309

RELEASE

Country	Barbados
Year	1967
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	98, 288, 308, 309, 629

AGENT

Species	*Smicronyx rufovittatus* Anderson
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Barbados
Year	1971
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	288, 312, 313, 314, 629

TABLE 1

CONVOLVULACEAE *(continued)*

WEED	
Family	Convolvulaceae
Species	*Cuscuta indecora* Choisy
Origin	North America, South America, Caribbean
Common Name	love vine, dodder
AGENT	
Species	*Melanagromyza cuscutae* Héring
Classification	(Diptera: Agromyzidae)
RELEASE	
Country	Bahamas
Year	1966
Source	Ex. Pakistan
Established	No
Notes	Heavy rain after initial release hindered establishment in 1966. 1968 releases mistakenly made onto *Cassytha filiformis* L. (Lauraceae) rather than *Cuscuta* spp.
Limiting Factors	Weather
Research Organization	IIBC
References	288, 309
RELEASE	
Country	Barbados
Year	1967
Source	Ex. Pakistan
Established	No
Notes	Successfully propagated for three generations and released, but did not establish.
Limiting Factors	Small release size
Research Organization	IIBC
References	98, 288, 308, 309, 629

CONVOLVULACEAE
Cuscuta indecora *(continued)*

AGENT	
Species	*Smicronyx roridus* Marshall
Incorrect Past Names/Synonyms	*Smicronyx cuscutae* Marshall
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	Bahamas
Year	1968
Source	Ex. Pakistan
Established	No
Notes	Releases mistakenly made onto *Cassytha filiformis* L. (Lauraceae) though intended for both *Cuscuta americana* and *C. indecora*.
Research Organization	IIBC
References	288, 309
RELEASE	
Country	Barbados
Year	1967
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	98, 288, 308, 309, 629

CONVOLVULACEAE
Cuscuta indecora *(continued)*

AGENT	
Species	*Smicronyx rufovittatus* Anderson
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Barbados
Year	1971
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	288, 312, 314, 629

WEED	
Family	Convolvulaceae
Species	*Cuscuta reflexa* Roxb.
Origin	Asia
Common Name	dodder

AGENT	
Species	*Smicronyx roridus* Marshall
Incorrect Past Names/Synonyms	*Smicronyx cuscutae* Marshall
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Bangladesh
Year	1968
Source	Ex. Pakistan
Established	No
Notes	Initially recovered but as weed infestations diminished, insect population declined and eventually disappeared.
Research Organization	IIBC
References	309, 629, 1548

CUCURBITACEAE

TABLE 1

WEED	
Family	Cucurbitaceae
Species	*Coccinia grandis* (L.) Voigt
Origin	East Africa
Common Name	ivy gourd, scarlet gourd, scarlet-fruited gourd

AGENT	
Species	*Acythopeus burkhartorum* O'Brien & Pakaluk
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Guam
Year	2004
Source	Ex. Kenya via Hawaii USA
Established	No
Notes	Parasitism likely contributed to establishment failure.
Limiting Factors	Parasitism
Research Organization	UOG
References	326, 1310, 1554

RELEASE	
Country	Hawaii USA
Year	1999
Source	Ex. Kenya
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued on next page)

TABLE 1

CUCURBITACEAE
Coccinia grandis; Acythopeus burkhartorum *(continued)*

Country	Hawaii USA (continued)
Notes	Initially seemed successful, though not currently known if establishment was permanent.
Limiting Factors	Predation
Research Organization	HDOA
References	266, 326, 386, 762, 1169

RELEASE	
Country	Northern Mariana Islands
Year	2005
Source	Ex. Kenya via Hawaii USA via Guam
Established	No
Notes	Parasitism likely contributed to establishment failure.
Limiting Factors	Parasitism
Research Organization	UOG
References	326, 1310, 1554

AGENT	
Species	*Acythopeus cocciniae* O'Brien & Pakaluk
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Guam
Year	2003
Source	Ex. Kenya via Hawaii USA
Established	Yes
Abundance	Unknown
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

CUCURBITACEAE
Coccinia grandis; Acythopeus cocciniae *(continued)*

Country	Guam (continued)
Notes	Causes defoliation in some areas. Efficacy likely limited by parasitism.
Limiting Factors	Parasitism
Research Organization	UOG
References	1310, 1554

RELEASE	
Country	Hawaii USA
Year	1999
Source	Ex. Kenya
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Substantial control on OA and HA at some sites where well established; however populations generally limited, at least in part due to parasitism. On MA, impact likely negligible due to active herbicide control program.
Limiting Factors	Parasitism; Other control methods
Research Organization	HDOA
References	266, 325, 326, 386, 762, 1169, 1310

RELEASE	
Country	Northern Mariana Islands
Year	2003
Source	Ex. Kenya via Hawaii USA via Guam
Established	Yes
Abundance	Unknown
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Causes defoliation in some areas. Efficacy likely limited by parasitism.
Limiting Factors	Parasitism
Research Organization	UOG
References	1310, 1554

CUCURBITACEAE
Coccinia grandis *(continued)*

AGENT

Species	*Melittia oedipus* Oberthür
Classification	(Lepidoptera: Sesiidae)

RELEASE

Country	Guam
Year	2007
Source	Ex. Kenya via Hawaii USA
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Investigations into efficacy underway. Populations possibly limited by predaceous ants.
Limiting Factors	Predation
Research Organization	UOG
References	1310, 1554

RELEASE

Country	Hawaii USA
Year	1996
Source	Ex. Kenya
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Substantial control on OA and HA where well established; predation occurs at some sites.
Limiting Factors	Predation
Research Organization	HDOA
References	266, 325, 326, 385, 386, 762, 1169, 1310

CUCURBITACEAE
Coccinia grandis; Melittia oedipus *(continued)*

RELEASE

Country	Northern Mariana Islands
Year	2007
Source	Ex. Kenya via Hawaii USA via Guam
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Investigations into efficacy are underway.
Research Organization	UOG
References	1310, 1554

TABLE 1

CYPERACEAE

WEED

Family	Cyperaceae
Species	*Cyperus rotundus* L.
Origin	cosmopolitan
Common Name	nut grass, purple nutsedge, vucesa, soronakabani, oni ani, pakopako

AGENT

Species	*Athesapeuta cyperi* Marshall
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Barbados
Year	1973
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	288, 314, 315, 1491

RELEASE

Country	Cook Islands
Year	1971
Source	Ex. India, Pakistan
Established	No
Research Organization	IIBC
References	312, 1940

CYPERACEAE
Cyperus rotundus; Athesapeuta cyperi *(continued)*

RELEASE

Country	Cook Islands
Year	1974
Source	Ex. India
Established	No
Research Organization	DAC
References	315, 1539, 1940

RELEASE

Country	Fiji
Year	1936
Source	Ex. Philippines via Hawaii USA
Established	No
Research Organization	KRS
References	1373, 1940

RELEASE

Country	Fiji
Year	1971
Source	Ex. Pakistan
Established	No
Research Organization	KRS
References	312, 960, 1940

RELEASE

Country	Hawaii USA
Year	1925
Source	Ex. Philippines
Established	Yes
Abundance	Limited
General Impact	None

(continued on next page)

CYPERACEAE
Cyperus rotundus; Athesapeuta cyperi *(continued)*

Country	Hawaii USA (continued)
Notes	Spread slowly but eventually reached same distribution as *Bactra venosana*. Despite being widespread, populations low and considered ineffective control agent.
Limiting Factors	Parasitism
Other Species Attacked	Also utilizes the native *Cyperus polystachyos* Rottb.
Research Organization	HDOA
References	44, 326, 612, 1349, 1457, 1518, 1940

RELEASE

Country	Mauritius
Year	1981
Source	Ex. India
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially believed to have failed establishment, but by 2013 found in nearly all patches of *Cyperus rotundus* on the island. Widespread but does not impact the weed population.
Research Organization	IIBC
References	320, 321, 328, 586, 608, 1171, 1172

CYPERACEAE
Cyperus rotundus; Athesapeuta cyperi *(continued)*

RELEASE

Country	Tonga
Year	1971
Source	Ex. India, Pakistan
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Established but of little control value. Weed remains a problem, especially on cultivated land.
Research Organization	IIBC
References	312, 962, 1940

AGENT

Species	*Bactra minima* Meyrick
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Barbados
Year	1974
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	288, 315

CYPERACEAE
Cyperus rotundus; Bactra minima *(continued)*

RELEASE

Country	Cook Islands
Year	1971
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	312, 1539, 1940

RELEASE

Country	Fiji
Year	1971
Source	Ex. Pakistan
Established	No
Research Organization	KRS
References	312, 960, 1940

RELEASE

Country	Tonga
Year	1971
Source	Ex. India, Pakistan
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Established but of little control value. Weed remains a problem, especially on cultivated land.
Research Organization	IIBC
References	312, 962, 1940

CYPERACEAE
Cyperus rotundus *(continued)*

AGENT

Species	*Bactra venosana* (Zeller)
Past Names/Synonyms	*Bactra truculenta* Meyrick
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Barbados
Year	1973
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	288, 314, 315, 1491

RELEASE

Country	Cook Islands
Year	1971
Source	Ex. Pakistan
Established	No
Research Organization	IIBC
References	312, 1539, 1940

RELEASE

Country	Fiji
Year	1936
Source	Ex. Philippines via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	None
Notes	Scarce where the weed rampant; limited by indigenous parasites.
Limiting Factors	Parasitism
Research Organization	KRS
References	960, 1373, 1940

CYPERACEAE
Cyperus rotundus; Bactra venosana *(continued)*

RELEASE	
Country	Fiji
Year	1971
Source	Ex. Pakistan
Established	Yes
Abundance	Unknown
General Impact	None
Notes	No increase in impact following release of this population; limited by indigenous parasites.
Limiting Factors	Parasitism
Research Organization	KRS
References	312, 960, 1940

RELEASE	
Country	Hawaii USA
Year	1925
Source	Ex. Philippines
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially very effective, but then highly parasitized resulting in ineffective control.
Limiting Factors	Parasitism
Research Organization	HDOA
References	44, 326, 612, 1518, 1940, 2068

DIOSCOREACEAE

WEED	
Family	Dioscoreaceae
Species	*Dioscorea bulbifera* L.
Origin	Asia, Africa
Common Name	air-potato, air potato

AGENT	
Species	*Lilioceris cheni* Gressitt & Kimoto
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	United States of America
Year	2011
Source	Ex. China
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Too early post release to determine overall abundance and impact, though populations seem well established and effective.
Research Organization	USDA (3)
References	232, 237, 1260

TABLE 1

ERICACEAE

WEED	
Family	Ericaceae
Species	*Calluna vulgaris* (L.) Hull
Origin	Eurasia, northern Africa
Common Name	heather

AGENT	
Species	*Lochmaea suturalis* (Thomson)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	New Zealand
Year	1996
Source	Ex. United Kingdom
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Beetle populations have generally been very slow to build. At a few locations large-scale outbreaks severely damaged weed 10 years following release. Studies demonstrated high populations of beetles more effective than herbicides.
Research Organization	MWLR, DOCNZ
References	761, 1064, 1071, 1489

EUPHORBIACEAE

WEED	
Family	Euphorbiaceae
Species	*Euphorbia cyparissias* L.
Origin	Eurasia
Common Name	cypress spurge

AGENT	
Species	*Aphthona cyparissiae* (Koch)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1982
Source	Ex. Austria, Hungary, Switzerland
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Helps reduce *Euphorbia cyparissias* in the immediate release areas. Most effective in dry, open sites.
Limiting Factors	Habitat
Research Organization	AAFC
References	25, 154, 622, 735, 1140, 1187

RELEASE	
Country	United States of America
Year	1995
Source	Ex. Austria, Hungary, Italy, Switzerland
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional

(continued on next page)

EUPHORBIACEAE
Euphorbia cyparissias; Aphthona cyparissiae *(continued)*

Country	United States of America (continued)
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias*. Abundant in RI, unknown densities in NH. Populations highest in dry, mesic sites with sandy loam soils. Under these conditions, plant density may decrease quickly but unattacked roots recover; numerous years under right conditions required for this agent to decrease populations permanently.
Limiting Factors	Habitat
Research Organization	State (7,11), USDA (10), USDA-APHIS
References	560, 712, 1578

AGENT

Species	*Aphthona czwalinai* (Weise)
Incorrect Past Names/Synonyms	*Aphthona czwalinae* Weise
Classification	(Coleoptera: Chrysomelidae)
Notes	Incorrectly spelled as *Aphthona czwalinae* in select publications. While *A. czwalinai* has in some cases been recorded as the incorrect spelling, it has been confirmed by taxonomists that the correct genitive is "*czwalinai*" and not "*czwalinae*".

RELEASE

Country	Canada
Year	1987
Source	Ex. Austria
Established	No
Research Organization	AAFC
References	25, 152, 154, 735

EUPHORBIACEAE
Euphorbia cyparissias; Aphthona czwalinai *(continued)*

RELEASE

Country	United States of America
Year	1995
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias*. Scarcer than other *Aphthona* spp. in RI where this and *A. lacertosa* being replaced by *A. flava* and *A. nigriscutis*; unknown densities in NH. Does best in mesic habitats with cool summers. Under these conditions, plant density may decrease quickly but unattacked roots recover; numerous years under right conditions required for this agent to decrease populations permanently. Typically most impact in combination with other *Aphthona* spp.
Limiting Factors	Habitat
Research Organization	State (7,11), USDA (10), USDA-APHIS
References	149, 560, 712, 1559, 1578

TABLE 1

EUPHORBIACEAE
Euphorbia cyparissias *(continued)*

AGENT

Species	*Aphthona flava* Guillebeau
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Canada
Year	1982
Source	Ex. Hungary, Italy
Established	No
Research Organization	AAFC
References	25, 154, 735

RELEASE

Country	United States of America
Year	1995
Source	Ex. Italy, Hungary
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias*. Abundant in RI where along with *Aphthona nigriscutis* replacing *A. lacertosa* and *A. czwalinai*; unknown densities in NH. Best suited to mesic-to-dry habitats, in alluvial soils above flood lines, and light shade. Probably less likely to survive low temperatures than other *Aphthona* spp. Under ideal conditions, plant density may decrease quickly but unattacked roots recover; numerous years under right conditions required for this agent to decrease populations permanently.
Limiting Factors	Habitat
Research Organization	State (7,11), USDA (10), USDA-APHIS
References	149, 560, 712

EUPHORBIACEAE
Euphorbia cyparissias *(continued)*

AGENT

Species	*Aphthona lacertosa* Rosenhauer
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	United States of America
Year	1995
Source	Ex. Austria, Hungary, Former Yugoslavia
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias*. Scarcer than other *Aphthona* spp. in RI where this and *A. czwalinai* being replaced by *A. flava* and *A. nigriscutis*, unknown densities in NH. Does best in loamy soils, can adapt locally to both dry and wet habitats. Under some conditions, plant density may decrease quickly but unattacked roots recover; numerous years under right conditions required for this agent to decrease populations permanently. Typically most impact in combination with other *Aphthona* spp.
Limiting Factors	Habitat
Research Organization	State (7,11), USDA (10), USDA-APHIS
References	149, 560, 712, 1559, 1578

EUPHORBIACEAE
Euphorbia cyparissias *(continued)*

AGENT	
Species	*Aphthona nigriscutis* Foudras
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1986
Source	Ex. Hungary
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Helps reduce *Euphorbia cyparissias* in the immediate release areas. Most effective in very dry, open sites.
Research Organization	AAFC
References	25, 152, 154

RELEASE	
Country	United States of America
Year	1995
Source	Ex. Hungary via Canada
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional

(continued at top of next column)

EUPHORBIACEAE
Euphorbia cyparissias; Aphthona nigriscutis *(continued)*

Country	United States of America (continued)
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias*. Abundant in RI where along with *Aphthona flava* replacing *A. lacertosa* and *A. czwalinai*, unknown densities in NH. Prefers sandy or gravel soil and typically drier sites. Under ideal conditions, plant density may decrease quickly but unattacked roots recover; numerous years under right conditions required for this agent to decrease populations permanently.
Limiting Factors	Habitat
Research Organization	State (7,11), USDA (10), USDA-APHIS
References	149, 560, 1456

AGENT	
Species	*Chamaesphecia empiformis* Esper
Classification	(Lepidoptera: Sesiidae)

RELEASE	
Country	Canada
Year	1970
Source	Ex. Austria, Germany, Switzerland
Established	No
Research Organization	AAFC
References	25, 152, 154, 730

RELEASE	
Country	Canada
Year	1989
Source	Ex. Austria, Germany, Switzerland
Established	No
Research Organization	AAFC
References	25, 152, 154

TABLE 1

TABLE 1

EUPHORBIACEAE
Euphorbia cyparissias; Chamaesphecia empiformis *(continued)*

RELEASE	
Country	United States of America
Year	1975
Source	Ex. Austria, Germany, Switzerland
Established	No
Research Organization	USDA (7,10), State (6,7,15)
References	36, 711, 712, 1559

AGENT	
Species	*Hyles euphorbiae* (L.)
Past Names/Synonyms	*Celerio euphorbiae* (L.)
Classification	(Lepidoptera: Sphingidae)

RELEASE	
Country	Canada
Year	1965
Source	Ex. France, Germany, Switzerland
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Increasingly common in AB and other provinces. Densities may be decreased by predation at some sites. Even when populations high, plants recover from defoliation. Limited biocontrol value alone, but may stress weed in combination with other agents
Limiting Factors	Predation; Parasitism
Research Organization	AAFC
References	25, 152, 154, 730, 736, 1087

EUPHORBIACEAE
Euphorbia cyparissias; Hyles euphorbiae *(continued)*

RELEASE	
Country	United States of America
Year	1976
Source	Ex. France, Germany, Switzerland via Canada
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established on the fertile tetraploid form of weed in NY. Initially high densities have since decreased due to high levels of predation. Even where high densities have resulted in total defoliation, impact insignificant as plant populations can tolerate yearly defoliation.
Limiting Factors	Predation
Research Organization	USDA (1)
References	83, 86, 560, 730, 1456, 1578

AGENT	
Species	*Lobesia euphorbiana* (Freyer)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Canada
Year	1991
Source	Ex. Italy
Established	No
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias* but failed to establish.
Research Organization	AAFC
References	154, 735

EUPHORBIACEAE
Euphorbia cyparissias *(continued)*

AGENT

Species	*Oberea erythrocephala* (Schrank)
Classification	(Coleoptera: Cerambycidae)

RELEASE

Country	Canada
Year	1986
Source	Ex. Switzerland
Established	No
Research Organization	AAFC
References	25, 152, 154

AGENT

Species	*Pegomya euphorbiae* (Kieffer)
Past Names/Synonyms	*Pegomya argyrocephala* (Meigen) pars
Classification	(Diptera: Anthomyiidae)
Notes	Previously included with *Pegomya curticornis* (Stein) under *Pegomya argyrocephala* (Meigen)

RELEASE

Country	Canada
Year	1989
Source	Ex. Hungary
Established	No
Notes	Initially survived in cages but redistribution failed; currently no established field populations.
Research Organization	AAFC
References	25, 154, 622

EUPHORBIACEAE
Euphorbia cyparissias *(continued)*

AGENT

Species	*Spurgia capitigena* (Bremi)
Past Names/Synonyms	*Bayeria capitigena* Bremi
Classification	(Diptera: Cecidomyiidae)
Notes	Previously included with *Spurgia esulae* Gagné under *Bayeria capitigena* Bremi. The agent was transferred to *Spurgia* and separated into two distinct species in 1990 by the entomologist R.J. Gagné. More recent studies with these species revealed no evidence for two fly species, or two fly species separated by host plant. However, a revision of this group has not been published, so the two names created by Gagné remained valid at the time of publication of this version of the catalogue.

RELEASE

Country	Canada
Year	1990
Source	Ex. Italy via USA
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Galls prevent flower formation and seed production though overall impact appears negligible.
Research Organization	AAFC
References	25, 152, 154, 622

TABLE 1

EUPHORBIACEAE
Euphorbia cyparissias (continued)

AGENT

Species	*Spurgia esulae* Gagné
Past Names/Synonyms	*Bayeria capitigena* Bremi
Classification	(Diptera: Cecidomyiidae)
Notes	Previously included with *Spurgia capitigena* (Bremi) under *Bayeria capitigena* Bremi. The agent was transferred to *Spurgia* and separated into two distinct species in 1990 by the entomologist R.J. Gagné. More recent studies with these species revealed no evidence for two fly species, or two fly species separated by host plant. However, a revision of this group has not been published, so the two names created by Gagné remained valid at the time of publication of this version of the catalogue.

RELEASE

Country	Canada
Year	1990
Source	Ex. Italy via USA
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Released at one site but with no record of follow up on establishment.
Research Organization	AAFC
References	152, 154, 622

EUPHORBIACEAE
Euphorbia cyparissias; Spurgia esulae (continued)

RELEASE

Country	United States of America
Year	1995
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	None
Notes	Redistributed from *Euphorbia esula* to *E. cyparissias*. Sporadic in NH, abundant at one site in RI. No damage apparent, galls form following flowering so overall impact insignificant.
Research Organization	State (7,11), USDA (10), USDA-APHIS
References	149, 560

EUPHORBIACEAE *(continued)*

WEED

Family	Euphorbiaceae
Species	*Euphorbia esula* L.
Notes	A controversial and morphologically variable species considered to represent a complex of forms, species and hybrids.
Origin	Eurasia
Common Name	leafy spurge
References	149, 622

AGENT

Species	*Aphthona abdominalis* (Duftschmidt)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	United States of America
Year	1993
Source	Ex. Italy
Established	No
Research Organization	State (15,28), USDA (10,14)
References	149, 332, 334, 335, 622, 710, 712, 1586

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT

Species	*Aphthona cyparissiae* (Koch)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Canada
Year	1982
Source	Ex. Austria, Hungary, Switzerland
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	High populations effectively control *Euphorbia esula* populations in dry, open sites but insect densities too low and ineffective elsewhere.
Limiting Factors	Habitat
Research Organization	AAFC
References	117, 154, 432, 622, 734, 735, 1140, 1187

RELEASE

Country	United States of America
Year	1986
Source	Ex. Austria, Hungary, Italy, Switzerland
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

TABLE 1

EUPHORBIACEAE
Euphorbia esula; Aphthona cyparissiae *(continued)*

Country	United States of America (continued)
Notes	Well established at few release sites but overall much less abundant than other *Aphthona* spp. Populations highest at dry, mesic sites with sandy loam soils. Under these conditions, plant density may decrease quickly but unattacked roots recover; numerous years under right conditions required for this agent to decrease populations permanently. Damage typically greatest in combination with other *Aphthona* spp.
Limiting Factors	Habitat
Research Organization	USDA (7,10,14), State (7,9,11,13,15,28), USDA-APHIS
References	36, 332, 334, 622, 711, 712, 1122, 1367, 1456, 1458, 1578, 1586

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT	
Species	*Aphthona czwalinai* (Weise)
Incorrect Past Names/Synonyms	*Aphthona czwalinae* Weise
Classification	(Coleoptera: Chrysomelidae)
Notes	Incorrectly spelled as *Aphthona czwalinae* in select publications. While *A. czwalinai* has in some cases been recorded as the incorrect spelling, it has been confirmed by taxonomists that the correct genitive is “*czwalinai*” and not “*czwalinae*”.

RELEASE	
Country	Canada
Year	1985
Source	Ex. Austria
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Does best in mesic habitats with cool summers, though distribution limited throughout range. Release sites now dominated by *Aphthona lacertosa*. Sampling over 100 release mixed locations from 1999-2012 have yielded extremely low numbers of *A. czwalinai*; populations appear to be morphologically all *A. lacertosa*. Resampling efforts currently underway at initially pure *A. czwalinai* sites and pure *A. lacertosa* sites throughout Canada for molecular analysis.
Limiting Factors	Habitat
Research Organization	AAFC
References	152, 154, 432, 622, 735, 1187, 1585

EUPHORBIACEAE
Euphorbia esula; Aphthona czwalinai *(continued)*

RELEASE

Country	Canada
Year	1995
Source	Ex. Austria, Hungary via USA
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Does best in mesic habitats with cool summers, though distribution limited throughout range. Release sites now dominated by *Aphthona lacertosa*. Sampling over 100 release mixed locations from 1999-2012 have yielded extremely low numbers of *A. czwalinai*; populations appear to be morphologically all *A. lacertosa*. Resampling efforts currently underway at initially pure *A. czwalinai* sites and pure *A. lacertosa* sites throughout Canada for molecular analysis.
Limiting Factors	Habitat
Research Organization	AAFC
References	117, 151, 152, 154, 432, 959, 1187, 1578, 1585

RELEASE

Country	United States of America
Year	1987
Source	Ex. Austria, Hungary
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

EUPHORBIACEAE
Euphorbia esula; Aphthona czwalinai *(continued)*

Country	United States of America (continued)
Notes	Does best in mesic sites. Control of leafy spurge on local level within specific habitats achieved primarily by *Aphthona nigriscutis*, *A. czwalinai* and *A. lacertosa*. *A. czwalinai* thought to have been a major component in early years of biocontrol program until it was discovered that most of what was being called *A. czwalinai* was in fact *A. lacertosa*. Subsequently considered insignificant, until large populations recently found in ND.
Limiting Factors	Habitat
Research Organization	USDA (7,10,12,15), State (7), USDA-APHIS
References	36, 207, 334, 560, 622, 711, 712, 1367, 1456, 1578, 1585, 1586

RELEASE

Country	United States of America
Year	1993
Source	Ex. Russia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Released at one remote location that has since experienced large range fire. Follow up evaluation lacking so remains unknown if this population established.
Research Organization	USDA (7,10,12,15), State (7), USDA-APHIS
References	1103, 1578

TABLE 1

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT	
Species	*Aphthona flava* Guillebeau
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1982
Source	Ex. Hungary, Italy
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Not as abundant as *Aphthona nigriscutis*. *Euphorbia esula* density declined where populations of *A. flava* high, however not possible to attribute the reduction to *A. flava* alone as the site has been grazed by sheep, and *A. nigriscutis* also present. Does best at mesic-dry sites with sandy soil and warm temperatures.
Limiting Factors	Habitat
Research Organization	AAFC
References	152, 154, 432, 1187, 1585

RELEASE	
Country	United States of America
Year	1985
Source	Ex. Italy, Hungary
Established	Yes
Abundance	Limited
General Impact	Variable

(continued at top of next column)

EUPHORBIACEAE
Euphorbia esula; Aphthona flava *(continued)*

Country	United States of America (continued)
Notes	Best suited to mesic-to-dry habitats, in alluvial soils above flood lines, and light shade. Probably less likely to survive low temperatures than other *Aphthona* spp. In one area in MT its effect has been spectacular, but overall is much less abundant than other *Aphthona* spp.; persists at fairly low levels with little noticeable impact on infestations.
Limiting Factors	Habitat
Research Organization	USDA (7,10,12) State (6,7,9,11,13,15), USDA-APHIS
References	36, 149, 332, 334, 560, 711, 712, 1122, 1367, 1456, 1460, 1578, 1586

AGENT	
Species	*Aphthona lacertosa* Rosenhauer
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1987
Source	Ex. Hungary, Former Yugoslavia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized

(continued on next page)

EUPHORBIACEAE
Euphorbia esula; Aphthona lacertosa *(continued)*

Country	Canada (continued)
Notes	High beetle densities significantly reduce *Euphorbia esula* stem density. This species best suited for mesic to moist sites. Sampling over 100 *Aphthona czwalinai* release locations from 1999-2012 have yielded extremely low numbers of *A. czwalinai*; populations are morphologically all *A. lacertosa*. Resampling efforts currently underway for pure *A. czwalinai* release sites and pure *A. lacertosa* sites throughout Canada for phylogenetic analysis.
Limiting Factors	Habitat
Research Organization	AAFC
References	151, 152, 154, 432, 735, 959, 1187, 1585

RELEASE

Country	Canada
Year	1995
Source	Ex. Hungary via USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	High beetle densities significantly reduce *Euphorbia esula* stem density. This species best suited for mesic to moist sites.
Limiting Factors	Habitat
Research Organization	AAFC
References	117, 151, 152, 154, 432, 959, 1187, 1585

EUPHORBIACEAE
Euphorbia esula; Aphthona lacertosa *(continued)*

RELEASE

Country	United States of America
Year	1993
Source	Ex. Austria, Hungary, Former Yugoslavia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Does best in loamy soils, can adapt locally to both dry and wet habitats. Along with *Aphthona nigriscutis*, significantly reducing plant density at local level in most regions. Not effective at all sites.
Limiting Factors	Habitat
Research Organization	State (15), USDA-APHIS
References	36, 207, 334, 335, 560, 622, 711, 712, 1122, 1367, 1559, 1578, 1586, 1895, 1904

AGENT

Species	*Aphthona nigriscutis* Foudras
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Canada
Year	1983
Source	Ex. Hungary
Established	Yes
Abundance	Variable
General Impact	Variable

(continued on next page)

TABLE 1

EUPHORBIACEAE
Euphorbia esula; Aphthona nigriscutis *(continued)*

RELEASE

Country	Canada (continued)
Notes	Extremely effective at reducing or removing *Euphorbia esula* in open, warm, very dry habitats with lighter soils. Populations low or absent at moist, sheltered sites on heavy soil.
Limiting Factors	Habitat
Research Organization	AAFC
References	25, 117, 151, 154, 432, 734, 735, 959, 1187

RELEASE

Country	United States of America
Year	1989
Source	Ex. Hungary via Canada
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Prefers sandy or gravel soil and typically drier sites. Along with *Aphthona lacertosa*, significantly reducing plant density at local level in most regions. Not effective at all sites. Impact may be hindered by bacterium which causes high mortality in males, resulting in female biased populations.
Limiting Factors	Habitat; Disease
Other Species Attacked	Spillover feeding observed on the native *Euphorbia robusta* (Engelm.); as *Euphorbia esula* L. density declined, so did feeding on *E. robusta* and *E. robusta* populations increased.
Research Organization	USDA (10,14), State (6,7,9,11,13,15,28), USDA-APHIS
References	73, 149, 207, 334, 560, 622, 711, 712, 1090, 1122, 1456, 1586, 1904

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT

Species	*Chamaesphecia astatiformis* Herrich-Schäffer
Classification	(Lepidoptera: Sesiidae)

RELEASE

Country	Canada
Year	1993
Source	Ex. Former Yugoslavia
Established	No
Notes	Though has overwintered successfully in cages at AB, did not establish in open releases on prairies.
Research Organization	AAFC
References	154, 622, 735

AGENT

Species	*Chamaesphecia crassicornis* Bartel
Classification	(Lepidoptera: Sesiidae)

RELEASE

Country	Canada
Year	1994
Source	Ex. Hungary
Established	No
Notes	Though has overwintered successfully in cages at AB, did not establish in open releases on prairies.
Research Organization	AAFC
References	154, 622, 735

EUPHORBIACEAE
Euphorbia esula; Chamaesphecia crassicornis (continued)

RELEASE	
Country	United States of America
Year	1994
Source	Ex. Romania
Established	No
Research Organization	USDA (10,14), State (15)
References	149, 332, 334, 335, 622, 712

AGENT	
Species	*Chamaesphecia hungarica* Tomala
Classification	(Lepidoptera: Sesiidae)

RELEASE	
Country	Canada
Year	1991
Source	Ex. Former Yugoslavia
Established	No
Notes	Though has overwintered successfully in cages at AB, did not establish in open releases on prairies.
Research Organization	AAFC
References	154, 622, 735

RELEASE	
Country	United States of America
Year	1993
Source	Ex. Hungary, Former Yugoslavia
Established	No
Notes	Initially recovered and well established at one site by 1996 but has since been considered a failure.
Research Organization	USDA (10,14), State (7)
References	622, 711, 712

EUPHORBIACEAE
Euphorbia esula (continued)

AGENT	
Species	*Chamaesphecia tenthrediniformis* (Denis & Schiffermüller)
Classification	(Lepidoptera: Sesiidae)

RELEASE	
Country	Canada
Year	1971
Source	Ex. Austria, Greece
Established	No
Notes	Did not develop on *Euphorbia esula* targets in Canada.
Research Organization	AAFC
References	154, 622, 730

RELEASE	
Country	United States of America
Year	1975
Source	Ex. Austria
Established	No
Notes	Establishment failure due to agent being so specific as to not be able to survive on North American biotypes of this weed.
Limiting Factors	Specificity
Research Organization	USDA (7,10), State (6,7,15)
References	622, 712, 1456, 1731

TABLE 1

TABLE 1

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT

Species	*Hyles euphorbiae* (L.)
Past Names/Synonyms	*Celerio euphorbiae* (L.)
Classification	(Lepidoptera: Sphingidae)

RELEASE

Country	Canada
Year	1966
Source	Ex. France, Germany, Switzerland
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Scattered but widespread in ON, though increasingly common in AB and other provinces. Densities often low due to predation. Even when populations high, plants recover from defoliation. Limited biocontrol value alone, but may stress weed in combination with other agents.
Limiting Factors	Predation
Research Organization	AAFC
References	152, 154, 432, 730, 736, 1185, 1187

RELEASE

Country	United States of America
Year	1966
Source	Ex. France, Germany, Switzerland via Canada
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

EUPHORBIACEAE
Euphorbia esula; Hyles euphorbiae *(continued)*

Country	United States of America (continued)
Notes	Though moth densities may be locally high in some years, disease and predation typically prevent densities from developing to levels substantial enough to impact leafy spurge populations in some areas. Even where high densities resulted in total plant defoliation, impact insignificant as this does not kill plants.
Limiting Factors	Disease; Predation
Research Organization	USDA (7,10), State (6,7,9,13), USDA-APHIS, USDA-ARS
References	36, 83, 86, 149, 332, 560, 710, 712, 730, 1456, 1512, 1731

RELEASE

Country	United States of America
Year	1980
Source	Ex. Hungary
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	This release not differentiated from earlier release sourced via Canada. Though moth densities may be locally high in some years, disease and predation typically prevent densities from developing to levels substantial enough to impact leafy spurge populations in some areas. Even where high densities resulted in total plant defoliation, impact insignificant as this does not kill plants.
Research Organization	State (7,15), USDA (10)
References	36, 149, 332, 334, 712, 1456, 1578

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT	
Species	*Lobesia euphorbiana* (Freyer)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Canada
Year	1983
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Densities vary with plant populations; low in some provinces but high enough for redistribution in BC and MB. Repeated heavy attack may kill target plant.
Research Organization	AAFC
References	117, 154, 432, 622, 735, 1187

AGENT	
Species	*Minoa murinata* (Scopoli)
Classification	(Lepidoptera: Geometridae)

RELEASE	
Country	Canada
Year	1988
Source	Ex. Germany, Austria
Established	No
Notes	Initially survived in field cages in AB and SK, being abundant in AB cages in 1996 and with a few individuals found outside. In subsequent years, considered to have failed establishment at any field site.
Research Organization	AAFC
References	152, 154, 622, 1185, 1187

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT	
Species	*Oberea erythrocephala* (Schrank)
Classification	(Coleoptera: Cerambycidae)

RELEASE	
Country	Canada
Year	1979
Source	Ex. Switzerland
Established	Yes
Abundance	Rare
General Impact	None
Notes	At high densities small plants can be killed, however field populations too low to have significant impact.
Research Organization	AAFC
References	117, 152, 154, 730, 1187

RELEASE	
Country	United States of America
Year	1980
Source	Ex. Italy
Established	No
Research Organization	USDA (7,10), State (7,13,15), USDA-APHIS
References	334, 1456, 1560

TABLE 1

EUPHORBIACEAE
Euphorbia esula; Oberea erythrocephala *(continued)*

RELEASE	
Country	United States of America
Year	1982
Source	Ex. Austria, Hungary, Italy
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially believed to potentially greatly depress leafy spurge populations, but densities have remained too low to impart significant impact in the field. Believed to cause decline of larger plants at some infestations. This species may attack only specific biotypes of leafy spurge, thus limiting its efficacy in many areas.
Limiting Factors	Specificity
Research Organization	USDA (7,10), State (7,13,15)
References	332, 334, 335, 711, 712, 1367, 1456, 1536, 1560, 1578, 1895

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT	
Species	*Pegomya curticornis* (Stein)
Past Names/Synonyms	*Pegomya argyrocephala* (Meigen) pars
Classification	(Diptera: Anthomyiidae)
Notes	Previously included with *Pegomya euphorbiae* (Kieffer) under *Pegomya argyrocephala* (Meigen)

RELEASE	
Country	Canada
Year	1988
Source	Ex. Hungary
Established	No
Notes	Said to have overwintered successfully for 1 year in Regina SK but these individuals were likely *Pegomya euphorbiae* because original host specificity testing indicated *P. curticornis* would not develop on North American *Euphorbia esula*. It is possible all material released was *P. euphorbiae*. All Canadian *P. euphorbiae* populations failed to permanently establish in the field.
Research Organization	AAFC
References	152, 154, 1185, 1187

TABLE 1

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT

Species	*Pegomya euphorbiae* (Kieffer)
Past Names/Synonyms	*Pegomya argyrocephala* (Meigen) pars
Classification	(Diptera: Anthomyiidae)
Notes	Previously included with *Pegomya curticornis* (Stein) under *Pegomya argyrocephala* (Meigen)

RELEASE

Country	Canada
Year	1988
Source	Ex. Hungary
Established	No
Notes	Survived in field cages in AB for 4 years but redistribution failed; currently no established field populations.
Research Organization	AAFC
References	152, 154, 735, 1185, 1187

EUPHORBIACEAE
Euphorbia esula *(continued)*

AGENT

Species	*Spurgia capitigena* (Bremi)
Past Names/Synonyms	*Bayeria capitigena* Bremi
Classification	(Diptera: Cecidomyiidae)
Notes	Previously included with *Spurgia esulae* Gagné under *Bayeria capitigena* Bremi. The agent was transferred to *Spurgia* and separated into two distinct species in 1990 by the entomologist R.J. Gagné. More recent studies with these species revealed no evidence for two fly species, or two fly species separated by host plant. However, a revision of this group has not been published, so the two names created by Gagné remained valid at the time of publication of this version of the catalogue.

RELEASE

Country	Canada
Year	1987
Source	Ex. Italy via USA
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Galls prevent flower formation and seed production though overall impact appears negligible.
Research Organization	AAFC
References	152, 154, 432, 622

TABLE 1

EUPHORBIACEAE
Euphorbia esula; Spurgia capitigena *(continued)*

RELEASE	
Country	United States of America
Year	2001
Source	Ex. France
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Released at two locations in ND; only the first yielded galls during subsequent surveys. Current abundance and impact unknown. Different population believed to be present after inadvertent introduction as contaminant in one release of *Spurgia esulae* collected from Italy.
Research Organization	USDA (16)
References	1106, 1142

AGENT	
Species	*Spurgia esulae* Gagné
Past Names/Synonyms	*Bayeria capitigena* Bremi
Classification	(Diptera: Cecidomyiidae)
Notes	Previously included with *Spurgia capitigena* (Bremi) under *Bayeria capitigena* Bremi. The agent was transferred to *Spurgia* and separated into two distinct species in 1990 by the entomologist R.J. Gagné. More recent studies with these species revealed no evidence for two fly species, or two fly species separated by host plant. However, a revision of this group has not been published, so the two names created by Gagné remained valid at the time of publication of this version of the catalogue.

EUPHORBIACEAE
Euphorbia esula; Spurgia esulae *(continued)*

RELEASE	
Country	Canada
Year	1987
Source	Ex. Italy via USA
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Galls prevent flower formation and seed production though overall impact appears negligible.
Research Organization	AAFC
References	117, 152, 154, 432, 622, 1185, 1187

RELEASE	
Country	United States of America
Year	1985
Source	Ex. Italy
Established	Yes
Abundance	Limited
General Impact	None
Notes	No damage apparent. Densities generally low, but even where most abundant, galls form following flowering so overall impact insignificant.
Research Organization	USDA (7,10,12,14), State (7,11,13,15,28), USDA-APHIS
References	39, 149, 335, 560, 711, 712, 1106, 1449, 1456

EUPHORBIACEAE *(continued)*

WEED	
Family	Euphorbiaceae
Species	*Euphorbia oblongata* Griseb.
Origin	Europe
Common Name	oblong spurge
AGENT	
Species	*Hyles euphorbiae* (L.)
Past Names/Synonyms	*Celerio euphorbiae* (L.)
Classification	(Lepidoptera: Sphingidae)
RELEASE	
Country	United States of America
Year	1974
Source	Ex. France, Germany, Switzerland via Canada
Established	No
Research Organization	USDA (7)
References	231, 712, 1512

EUPHORBIACEAE *(continued)*

WEED	
Family	Euphorbiaceae
Species	*Jatropha gossypiifolia* L.
Origin	Mexico, Caribbean, South America
Common Name	bellyache bush
AGENT	
Species	*Agonosoma trilineatum* (Fabricius)
Classification	(Heteroptera: Scutelleridae)
RELEASE	
Country	Australia
Year	2003
Source	Ex. Venezuela, Curaçao (formerly Netherlands Antilles)
Established	No
Research Organization	CSIRO, QLD State, NT
References	768, 770

TABLE 1

FABACEAE

WEED	
Family	Fabaceae
Species	*Acacia baileyana* F. Muell.
Origin	Australia
Common Name	Bailey's wattle

AGENT	
Species	*Melanterius maculatus* Lea
Classification	(Coleoptera: Curculionidae)
Notes	Taxonomic and molecular evidence have revealed no intra-specific differences in different provenances of *Melanterius maculatus*, but patterns of host-use indicate that host-specific strains may occur.
References	871

RELEASE	
Country	Republic of South Africa
Year	2006
Source	Ex. Australia
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Release is too recent for meaningful evaluation; establishment has been confirmed at one release site, but further overseas collections are required to facilitate introductions into new areas.
Research Organization	ARC-PPRI
References	869, 871, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia cyclops* A. Cunn. ex G. Don
Origin	Australia
Common Name	red eye/rooikrans

AGENT	
Species	*Dasineura dielsi* Rübsaamen
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	Republic of South Africa
Year	2001
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Variable
Notes	Established in WC during 2001 field host-specificity testing. Official approval for release was subsequently obtained. High populations initially led to enormous gall loads, virtually eliminating pod production in some areas. At many other sites, levels of pod suppression vary from year to year, driven largely by considerable fluctuations in the extent and duration of annual plant flowering. Parasitism (typically <10%) and predation limit populations at some areas and in some years.
Limiting Factors	Parasitism; Predation

(continued on next page)

FABACEAE
Acacia cyclops; Dasineura dielsi (continued)

Country	Republic of South Africa (continued)
Other Species Attacked	Also attacks other exotic but sometimes commercially important *Acacia* spp. including: *A. floribunda* (Vent.) Willd., *A. implexa* Benth., *A. longifolia* (Andr.) Willd., *A. melanoxylon* R. Br., *A. pendula* A. Cunn. Ex G. Don., and *A. saligna* (Labill.) H.L. Wendl. though the impact is expected to be negligible.
Research Organization	ARC-PPRI
References	4, 869, 871, 874, 992, 1522

FABACEAE
Acacia cyclops (continued)

AGENT	
Species	*Melanterius servulus* Pascoe
Past Names/Synonyms	*Melanterius servulus* Pascoe (type A)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	1991
Source	Ex. Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Initially slow to disperse, eventually widespread. Adult and larval feeding causes seed mortality highly variable between sites; overall impacts moderate. Initially believed inconsistencies in pod availability (due to heavy *Dasineura dielsi* impact) might cause lasting declines and even local extinctions of this agent, but the weevil has since demonstrated an ability to persist through periods of extremely low pod availability and to rebound when pods become available again.
Limiting Factors	Interspecific competition
Research Organization	ARC-PPRI
References	477, 867, 869, 871, 872, 874, 992

TABLE 1

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia dealbata* Link
Origin	Australia
Common Name	silver wattle

AGENT	
Species	*Melanterius maculatus* Lea
Past Names/Synonyms	*Melanterius* sp. nr *maculatus*
Classification	(Coleoptera: Curculionidae)
Notes	Taxonomic and molecular evidence have revealed no intra-specific differences in different provenances of *Melanterius maculatus*, but patterns of host-use indicate that host-specific strains may occur.
References	871

RELEASE	
Country	Republic of South Africa
Year	1994
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Seed damage has ranged from 64-93% (mean 79%) at the few sites where establishment is confirmed. Additional monitoring needed.
Research Organization	ARC-PPRI
References	477, 869, 871, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia decurrens* (Wendl.) Willd.
Origin	Australia
Common Name	green wattle

AGENT	
Species	*Melanterius maculatus* Lea
Classification	(Coleoptera: Curculionidae)
Notes	Taxonomic and molecular evidence have revealed no intra-specific differences in different provenances of *Melanterius maculatus*, but patterns of host-use indicate that host-specific strains may occur.
References	871

RELEASE	
Country	Republic of South Africa
Year	1998
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Seed damage has ranged from 42-93% (mean 63%) at the few sites where establishment is confirmed. Additional monitoring needed.
Research Organization	ARC-PPRI
References	867, 869, 871, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia longifolia* (Andrews) Willd.
Origin	Australia
Common Name	long-leaved wattle
AGENT	
Species	*Melanterius ventralis* Lea
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially slow to disperse, but currently widely distributed throughout weed range. Highly active and extremely efficient at locating pods. Reduces seed production by average of 72.5% during pod growing season, complementing impact of *Trichilogaster acaciaelongifoliae* earlier in the season. The two species together have reduced seed production to only 1% of levels formerly found in South Africa; *Acacia longifolia* now found only in localized and generally isolated thickets with no indications of expanding into surrounding areas.
Research Organization	ARC-PPRI
References	476, 477, 514, 867, 869, 871, 992

FABACEAE
Acacia longifolia (continued)

AGENT	
Species	*Trichilogaster acaciaelongifoliae* (Froggatt)
Classification	(Hymenoptera: Pteromalidae)
RELEASE	
Country	Republic of South Africa
Year	1982
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Can reduce seed production >95% directly by galling reproductive buds and indirectly by increasing abscission of some remaining inflorescences. Causes some mortality of adult trees at sites under stressful environmental conditions. Impact initially varied by location; lower efficacy in hot inland valleys and elevated cooler mist belt regions was attributed to poor climatic matching. Given more time for dispersal, there were no indications climatic conditions were influencing distribution. In conjunction with *Melanterius ventralis*, reduces seed production of *Acacia longifolia* to only 1% of levels formerly found in South Africa. *A. longifolia* now found only in localized and generally isolated thickets with no indications of expanding into surrounding areas. High levels of parasitism by native parasitoids do not seem to decrease efficacy significantly.

(continued on next page)

TABLE 1

FABACEAE
Acacia longifolia; Trichilogaster acaciaelongifoliae (continued)

Country	Republic of South Africa (continued)
Other Species Attacked	Also attacks other exotic but sometimes commercially important *Acacia* spp. including: *A. floribunda* (Vent.) Willd. and *A. melanoxylon* R. Br. as well as the closely related *Paraserianthes lophantha* (Willd.) Nielsen.
Research Organization	ARC-PPRI
References	475, 476, 477, 478, 514, 867, 869, 871, 992, 1339

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Acacia mearnsii* De Wild.
Origin	Australia
Common Name	black wattle

AGENT

Species	*Melanterius maculatus* Lea
Classification	(Coleoptera: Curculionidae)
Notes	Taxonomic and molecular evidence have revealed no intra-specific differences in different provenances of *Melanterius maculatus*, but patterns of host-use indicate that host-specific strains may occur.
References	871

RELEASE

Country	Republic of South Africa
Year	1993
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Variable
Notes	Can cause substantial levels of seed reduction, however damage is not consistent (ranging from 4-78%, mean 49%) and considerable quantities of seed are still produced annually.
Research Organization	ARC-PPRI
References	477, 869, 870, 871, 992

TABLE 1

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia melanoxylon* R. Br.
Origin	Australia
Common Name	Australian blackwood
AGENT	
Species	*Melanterius acaciae* Lea
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	Republic of South Africa
Year	1986
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially slow to disperse, but currently widely distributed causing significant seed damage, typically >90%. Concerns about the invasiveness of *Acacia melanoxylon* have diminished since the proliferation of *Melanterius acaciae*.
Other Species Attacked	Spillover attack occurs on the exotic *Acacia cyclops* A. Cunn. ex G. Don and *A. saligna* (Labill.) H.L. Wendl. when growing near *A. melanoxylon* R. Br. when pods of *A. melanoxylon* are not available.
Research Organization	ARC-PPRI
References	476, 477, 869, 871, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia podalyriifolia* A. Cunn. ex G. Don
Origin	Australia
Common Name	pearl acacia
AGENT	
Species	*Melanterius maculatus* Lea
Classification	(Coleoptera: Curculionidae)
Notes	Taxonomic and molecular evidence have revealed no intra-specific differences in different provenances of *Melanterius maculatus*, but patterns of host-use indicate that host-specific strains may occur.
References	871
RELEASE	
Country	Republic of South Africa
Year	2008
Source	Ex. Australia
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	ARC-PPRI
References	871, 992

TABLE 1

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia pycnantha* Benth.
Origin	Australia
Common Name	golden wattle

AGENT	
Species	*Melanterius maculatus* Lea
Classification	(Coleoptera: Curculionidae)
Notes	Taxonomic and molecular evidence have revealed no intra-specific differences in different provenances of *Melanterius maculatus*, but patterns of host-use indicate that host-specific strains may occur.
References	871

RELEASE	
Country	Republic of South Africa
Year	2005
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Since 2006, seed damage levels have reached 56% at some sites. Though populations still increasing, all indications are that because of combination of this species with *Trichilogaster signiventris*, *Acacia pycnantha* is no longer a threat to natural habitats in South Africa.
Research Organization	ARC-PPRI
References	871, 874, 992

FABACEAE
Acacia pycnantha *(continued)*

AGENT	
Species	*Trichilogaster signiventris* (Girault)
Past Names/Synonyms	*Trichilogaster* sp. B, *Trichilogaster* sp.
Classification	(Hymenoptera: Pteromalidae)

RELEASE	
Country	Republic of South Africa
Year	1987
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Initially believed both releases failed to establish; by 1995 was realized the 1992 release succeeded. Besides substantial reductions in seed production, galls serve as nutrient sinks. In some cases, extensive galling causes collapse of branches and toppling of whole trees. Still, many seed pods successfully produced. *Melanterius maculatus* released in 2005 to complement wasp effects. Though *M. maculatus* is still increasing, all indications are that both agents combined have made *Acacia pycnantha* no longer a threat to natural habitats in South Africa.
Research Organization	ARC-PPRI
References	477, 479, 825, 869, 871, 874, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Acacia saligna* (Labill.) H. L. Wendl.
Origin	Australia
Common Name	Port Jackson willow

AGENT	
Species	*Melanterius compactus* Lea
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	2001
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Very effective in established locations where seed damage typically >90%. Nicely complements impacts by *Uromycladium tepperianum*. Redistributions to additional *Acacia saligna* infestations a priority.
Research Organization	ARC-PPRI
References	869, 871, 874, 992

FABACEAE
Acacia saligna *(continued)*

AGENT	
Species	*Uromycladium tepperianum* (Sacc.) McAlpine
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Republic of South Africa
Year	1987
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Prevalent wherever *Acacia saligna* occurs. Has caused dramatic decline in population density and longevity of mature trees, as well as reduction in canopy cover and seed production. Though highly effective, takes ~5 years to kill infected plants and ~5 more to reduce tree densities to low levels, allowing infected trees to set seeds for number of years before succumbing. Efficacy increased in conjunction with *Melanterius compactus*, whose populations are continuing to increase. Parasitism observed, though its impact on rust efficacy unknown.
Limiting Factors	Possibly Parasitism
Research Organization	ARC-PPRI
References	871, 874, 992, 1281, 1282, 2007

TABLE 1

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Caesalpinia decapetala* (Roth) Alston
Notes	May exist as several biotypes
Origin	Asia
Common Name	Mauritius thorn, Kraaldoring
AGENT	
Species	*Sulcobruchus subsuturalis* (Pic)
Past Names/Synonyms	*Sulcobruchus bakeri* Kingsolver, *Bruchus subsuturalis* Pic, *Bruchus ocularis* Pic
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	Republic of South Africa
Year	1999
Source	Ex. India
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Tentatively believed established. Though widely released, remains scarce where present. Causes high seed mortality in the laboratory when populations are large, but which may have limited to no effect on the population dynamics of *Caesalpinia decapetala* in the field. High levels of parasitism and predation likely limit populations. *C. decapetala* may exist as several biotypes, and the local variety may not be a suitable host for the form of *Sulcobruchus subsuturalis* that has been imported into South Africa.
Limiting Factors	Parasitism; Predation; Specificity
Research Organization	ARC-PPRI, WUSA
References	209, 211, 299, 301, 958, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Cytisus scoparius* (L.) Link
Past Names/Synonyms	*Cytisus scoparius* (L.) Link subsp. *scoparius*, *Sarothamnus scoparius* (L.) Wimm. ex W. D. J. Koch
Origin	Europe
Common Name	Scotch broom, broom
AGENT	
Species	*Aceria genistae* (Nalepa)
Classification	(Acari: Eriophyidae)
Notes	Research indicates *Aceria genistae* includes a number of distinct strains, each of which is specific to one species of plant.
RELEASE	
Country	Australia
Year	2008
Source	Ex. France (southern)
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Though established on mainland, impact not yet known. Field studies currently underway. Well established in TAS and starting to disperse; causing severe damage to target plants at some sites.
Research Organization	TAS State, VIC State, CSIRO
References	848, 883, 1601, 1698

FABACEAE
Cytisus scoparius; Aceria genistae (continued)

RELEASE	
Country	New Zealand
Year	2007
Source	Ex. France
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Some sites have very large numbers of galls with plants clearly exhibiting leaf loss, stem-tip dieback, and mortality. At other sites agent populations still increasing post release.
Research Organization	MWLR
References	761, 848, 1063, 1064, 1443, 1601, 1698

AGENT	
Species	*Agonopterix assimilella* Treitschke
Classification	(Lepidoptera: Oecophoridae)

RELEASE	
Country	New Zealand
Year	2007
Source	Ex. England, France
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Despite multiple and ongoing releases, establishment has yet to be confirmed.
Research Organization	MWLR
References	542, 761, 1060, 1064

FABACEAE
Cytisus scoparius (continued)

AGENT	
Species	*Arytainilla spartiophila* (Förster)
Classification	(Hemiptera: Psyllidae)

RELEASE	
Country	Australia
Year	1994
Source	Ex. France via New Zealand
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Only few specimens ever collected in SA to confirm establishment there. Elsewhere, no recent comprehensive surveys carried out to verify long-term establishment, abundance or impact.
Research Organization	CSIRO, NSW State, SA State
References	119, 365, 848, 849, 1178, 1418

RELEASE	
Country	New Zealand
Year	1993
Source	Ex. England
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Damages new growth in spring and becoming common, but damaging outbreaks occur rarely; predation may limit populations in some areas. Formal evaluation lacking.
Limiting Factors	Predation
Research Organization	MWLR
References	720, 761, 1064, 1770

TABLE 1

FABACEAE
Cytisus scoparius *(continued)*

AGENT

Species	*Bruchidius villosus* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1995
Source	Ex. France; Ex. England via New Zealand
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Easy to find at one NSW site, established in limited numbers at only one VIC site. Additional studies warranted but evidence suggests weed populations not significantly impacted by this species.
Research Organization	CSIRO, NSW State
References	848, 849

RELEASE

Country	New Zealand
Year	1987
Source	Ex. England
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

FABACEAE
Cytisus scoparius; Bruchidius villosus *(continued)*

Country	New Zealand (continued)
Notes	Becoming common throughout New Zealand, though unable to destroy sufficient seed to suppress *Cytisus scoparius* populations alone. Seed destruction rates of 73% in combination with absence of honeybee pollination could cause *C. scoparius* extinction at many sites, though seed rain predicted to be sufficient to maintain *C. scoparius* invasions over many sites largely due to continued presence of beehives.
Limiting Factors	Parasitism
Other Species Attacked	Also feeds on the exotic *Chamaecytisus prolifer* (L. f.) Link subsp. *prolifer* var. *palmensis* (Christ) A. Hansen & Sunding, a plant regarded as weedy in portions of New Zealand, but that also has benefits including use as fodder in high country farms when there is drought, as a pollen source for beekeepers, and as a supplementary food source for the threatened native pigeon in New Zealand.
Research Organization	DSIR
References	704, 720, 1064, 1445, 1652, 1773

FABACEAE
Cytisus scoparius *(continued)*

AGENT	
Species	*Exapion fuscirostre* (Fabricius)
Past Names/Synonyms	*Apion fuscirostre* Fabricius
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	United States of America
Year	1964
Source	Ex. Italy
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Seed reduction between 20-60% insufficient to impart significant control of plant populations alone, but may contribute to slowed rate of spread. More studies needed. Parasitism typically low but may limit populations in some regions.
Limiting Factors	Parasitism
Research Organization	USDA (7,12), State (9,15)
References	42, 46, 332, 335, 339, 340, 1578, 1752

FABACEAE
Cytisus scoparius *(continued)*

AGENT	
Species	*Gonioctena olivacea* (Forster)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	New Zealand
Year	2006
Source	Ex. England
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Widespread and ongoing releases have led to establishment in some areas, though it is still too soon to formally evaluate impact.
Research Organization	MWLR
References	542, 761, 1053, 1060, 1064

TABLE 1

FABACEAE
Cytisus scoparius *(continued)*

AGENT

Species	*Leucoptera spartifoliella* (Hübner)
Classification	(Lepidoptera: Lyonetiidae)

RELEASE

Country	Australia
Year	1993
Source	Ex. Unknown via New Zealand
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Well established at one site in NSW from where it was redistributed to VIC and later to TAS and SA. Recovered in TAS following most recent release but establishment needs to be confirmed. First release failed in SA; status of recent release unknown.
Limiting Factors	Parasitism
Research Organization	CSIRO, NSW State, VIC State
References	119, 848, 849, 886

FABACEAE
Cytisus scoparius; Leucoptera spartifoliella *(continued)*

RELEASE

Country	United States of America
Year	1960
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced in 1960 but found to have already been present. Both populations subsequently not differentiated in the literature. Widespread in CA and OR but present at limited sites in WA. High population numbers can deform plants and cause stem dieback but plant density not affected and overall impact is negligible. Heavily parasitized and does not do well in hot, dry sites.
Limiting Factors	Parasitism; Habitat
Research Organization	USDA (7), State (15)
References	39, 42, 332, 335, 339, 340, 593, 1928

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Galega officinalis* L.
Origin	western Asia, southern Europe
Common Name	goat's rue

AGENT	
Species	*Uromyces galegae* (Opiz) Sacc.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Chile
Year	1973
Source	Ex. France via Switzerland
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Though established, impact negligible.
Research Organization	UACH
References	84, 1356, 1362, 1378

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Leucaena leucocephala* (Lam.) de Wit
Origin	Mexico, Central America
Common Name	leucaena, lead tree

AGENT	
Species	*Acanthoscelides macrophthalmus* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Republic of South Africa
Year	1999
Source	Ex. USA (FL, TX)
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Original laboratory colony sourced in Texas USA but later augmented with population from Florida when colony declined in quarantine. Literature does not differentiate between this population and the later release from Mexico. Widespread throughout KZN. Seed damage varies 2-62% and <30% on average. Extent of distribution elsewhere in the country unknown. Attack rates likely insufficient to regulate populations of *Leucaena leucocephala* in South Africa. Beetle populations hindered by several factors, including oviposition preferences, parasitism and low seed predation rates when seed abundance high.
Limiting Factors	Parasitism; Agent-host synchronization
Research Organization	ARC-PPRI, UKZN
References	992, 1388, 1390, 1646, 1663

TABLE 1

FABACEAE; *Leucaena leucocephala; Acanthoscelides macrophthalmus* (continued)

RELEASE	
Country	Republic of South Africa
Year	2005
Source	Ex. Mexico
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Literature does not differentiate between this population and the earlier release from the USA. Widespread throughout KZN. Seed damage varies 2-62% and <30% on average. Extent of distribution elsewhere in the country unknown. Attack rates likely insufficient to regulate populations of *Leucaena leucocephala* in South Africa. Beetle populations hindered by several factors, including oviposition preferences, parasitism and low seed predation rates when seed abundance high.
Limiting Factors	Parasitism; Agent-host synchronization
Research Organization	ARC-PPRI, UKZN
References	992, 1388, 1390, 1646

FABACEAE (continued)

WEED	
Family	Fabaceae
Species	*Mimosa diplotricha* C. Wright
Past Names/Synonyms	*Mimosa invisa* Mart.
Origin	tropical Americas
Common Name	giant sensitive plant, creeping sensitive plant, nila grass, vao fefe palagi, pikika'a papa'a, la'au fefe palagi, co gadrogadro, wa ngandrongandro ni wa, ngalelevu, wagadrogadro levu, limemeihr laud
References	1037, 1225, 1791

AGENT	
Species	*Heteropsylla spinulosa* Muddiman, Hodkinson & Hollis
Classification	(Hemiptera: Psyllidae)

RELEASE	
Country	American Samoa
Year	1997
Source	Ex. Brazil via Australia via Samoa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Has provided sustained suppression of the weed requiring little or no additional management efforts.
Research Organization	DAFF, QLD State
References	427, 1037

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa *(continued)*

RELEASE	
Country	Australia
Year	1988
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established. Plants severely stunted, shoot elongation reduced by 84% and seed cluster density reduced by 80%. Successful control of the weed.
Research Organization	QLD State
References	1, 1225, 1979

RELEASE	
Country	Cook Islands
Year	1994
Source	Ex. Brazil via Australia via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Has provided sustained suppression of the weed requiring little or no additional management efforts.
Research Organization	SPC
References	427, 1037, 1868

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa *(continued)*

RELEASE	
Country	Federated States of Micronesia
Year	1992
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Suppressed weed within four years of release, requiring little or no additional management efforts. Where weed can be found in small patches on newly opened ground, *Heteropsylla spinulosa* still well established.
Research Organization	COM, QLD State
References	427, 552, 1037, 1939

RELEASE	
Country	Fiji
Year	1993
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

TABLE 1

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa *(continued)*

Country	Fiji (continued)
Notes	After the first release from Samoa was believed to have failed, a second population from Australia was released. It was eventually determined both populations successfully established and both were subsequently not differentiated in the literature. Has provided sustained suppression of the weed requiring little or no additional management efforts. In some areas populations limited by climate as *Heteropsylla spinulosa* can get washed off plants in heavy rain.
Limiting Factors	Climate; Predation
Research Organization	KRS
References	418, 427, 1037, 1050, 1868, 1939

RELEASE

Country	Fiji
Year	1993
Source	Ex. Brazil via Australia via Samoa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Has provided sustained suppression of the weed requiring little or no additional management efforts. In some areas populations limited by climate as *Heteropsylla spinulosa* can get washed off plants in heavy rain.
Limiting Factors	Climate; Predation
Research Organization	KRS
References	418, 427, 1037, 1050, 1868, 1939

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa *(continued)*

RELEASE

Country	Guam
Year	2008
Source	Ex. Brazil via Australia via Federated States of Micronesia
Established	No
Research Organization	UOG
References	552, 1553, 1939

RELEASE

Country	Guam
Year	2008
Source	Ex. Brazil via Australia via Palau
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	UOG
References	427, 1037, 1553, 1939

RELEASE

Country	Niue
Year	1994
Source	Ex. Brazil via Australia via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Successful control in most areas.
References	418, 1225, 1401

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa (continued)

RELEASE	
Country	Northern Mariana Islands
Year	2008
Source	Ex. Brazil via Australia via Federated States of Micronesia
Established	No
Research Organization	NMC
References	552, 1553, 1939

RELEASE	
Country	Northern Mariana Islands
Year	2008
Source	Ex. Brazil via Australia via Palau
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	NMC
References	427, 1037, 1553, 1939

RELEASE	
Country	Palau
Year	1999
Source	Ex. Brazil via Australia via Federated States of Micronesia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Has provided sustained suppression of weed, requiring little or no additional management efforts.
References	427, 550, 1037, 1225, 1553, 1939

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa (continued)

RELEASE	
Country	Papua New Guinea
Year	1993
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Provided significant control within 12 months at some release sites. Weed now patchy due at least in part to *Heteropsylla spinulosa*. Impact high in drier areas where insect populations high, but low in wetter areas where insect is less frequent.
Limiting Factors	Climate; Habitat
Research Organization	RSL, QLD State
References	418, 427, 1036, 1037, 1038, 1039, 1939

RELEASE	
Country	Samoa
Year	1988
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially not believed to be widespread or effective. More recently, has provided sustained suppression of the weed requiring little or no additional management efforts.
Research Organization	DAFF, QLD State
References	427, 1037, 1868, 1979

TABLE 1

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa (continued)

RELEASE	
Country	Solomon Islands
Year	1994
Source	Ex. Brazil via Australia via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Has provided sustained suppression of the weed requiring little or no additional management efforts.
Research Organization	SPC
References	427, 1037, 1403, 1868

RELEASE	
Country	Timor Leste
Year	2008
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	QLD State, MAFF, UNTL
References	418, 966, 1225

FABACEAE
Mimosa diplotricha; Heteropsylla spinulosa (continued)

RELEASE	
Country	Tonga
Year	2008
Source	Ex. Brazil via Australia via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Released at only *Mimosa diplotricha* outbreak site known; now effective and suppressing the weed.
Research Organization	SPC
References	1403

RELEASE	
Country	Vanuatu
Year	1994
Source	Ex. Brazil via Australia via Fiji
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Not very damaging. Populations impacted by heavy rains.
Limiting Factors	Climate
References	204, 418, 1401

FABACEAE
Mimosa diplotricha (continued)

AGENT

Species	*Psigida walkeri* (Grote)
Classification	(Lepidoptera: Saturniidae)

RELEASE

Country	Cook Islands
Year	1994
Source	Ex. Brazil via Australia
Established	No
Research Organization	SPC
References	1225, 1868, 1917

AGENT

Species	*Scamurius* sp.
Classification	(Hemiptera: Coreidae)

RELEASE

Country	Australia
Year	1987
Source	Ex. Brazil
Established	No
Research Organization	QLD State
References	765, 1225

RELEASE

Country	Samoa
Year	1988
Source	Ex. Brazil via Australia
Established	No
Research Organization	DAFF, QLD State
References	1225

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Mimosa pigra* L.
Past Names/Synonyms	*Mimosa pigra* L. var. *pigra*
Origin	tropical Americas
Common Name	giant sensitive plant, mimosa, giant mimosa

AGENT

Species	*Acanthoscelides puniceus* Johnson
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1983
Source	Ex. Mexico
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Destroys up to 10% of seeds which may slow seedling recruitment on infestation edges. Alone, unlikely to have any significant impact wherever seed production is strongly seasonal.
Limiting Factors	Agent-host synchronization
Research Organization	CSIRO, NT
References	765, 774, 1440, 1441, 1442, 1980, 1982

TABLE 1

FABACEAE
Mimosa pigra; Acanthoscelides puniceus *(continued)*

RELEASE	
Country	Malaysia
Year	1991
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Intentionally introduced, though separate population of unintentional individuals migrating from Thailand subsequently established in same regions and populations are no longer differentiated. Increasingly spreading, however attack rates minimal (less than 12% damage to pods) and have limited impact on weed population.
Research Organization	MARDI, DOAM
References	55, 56, 58, 765, 774

RELEASE	
Country	Myanmar
Year	1988
Source	Ex. Mexico via Australia via Thailand
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread naturally from Thailand where it was intentionally introduced. Also intentionally introduced with both populations subsequently not differentiated. Overall status unknown.
Research Organization	NBCRC
References	774, 1327

FABACEAE
Mimosa pigra; Acanthoscelides puniceus *(continued)*

RELEASE	
Country	Thailand
Year	1983
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread in all infested areas. With *Acanthoscelides quadridentatus* resulted in up to 100% plant infestation although seed destruction relatively low (less than 50%). Unlikely to have significant impact on weed populations.
Research Organization	NBCRC
References	774, 1326, 1327, 1328, 1746

RELEASE	
Country	Vietnam
Year	1987
Source	Ex. Mexico via Australia via Thailand
Established	Yes
Abundance	High
General Impact	None
Notes	Though well established, has had no impact on seed production.
Research Organization	VNBCRC
References	219, 765, 774, 1327, 1329, 1711

FABACEAE
Mimosa pigra *(continued)*

AGENT

Species	*Acanthoscelides quadridentatus* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1983
Source	Ex. Mexico
Established	No
Notes	Established initially in NT, but has not persisted.
Research Organization	CSIRO, NT
References	765, 1440, 1980, 1982

RELEASE

Country	Myanmar
Year	1988
Source	Ex. Mexico via Australia via Thailand
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread naturally from Thailand where it was intentionally introduced. Also intentionally introduced with both populations subsequently not differentiated. Overall status unknown.
Research Organization	NBCRC
References	774, 1327

FABACEAE
Mimosa pigra; Acanthoscelides quadridentatus *(continued)*

RELEASE

Country	Thailand
Year	1983
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread in all infested areas. With *Acanthoscelides puniceus* resulted in up to 100% plant infestation although seed destruction relatively low (less than 50%). Unlikely to have significant impact on weed populations.
Research Organization	NBCRC
References	774, 1326, 1327, 1328, 1746

RELEASE

Country	Vietnam
Year	1987
Source	Ex. Mexico via Australia via Thailand
Established	Yes
Abundance	High
General Impact	None
Notes	Though well established, has had no impact on seed production.
Research Organization	VNBCRC
References	219, 765, 774, 1327, 1329, 1711

TABLE 1

FABACEAE
Mimosa pigra *(continued)*

AGENT	
Species	*Carmenta mimosa* Eichlin & Passoa
Classification	(Lepidoptera: Sesiidae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Established in all catchments with *Mimosa pigra* in NT. Spreading at 2 km/year. Weed infestations contracting when *Carmenta mimosa* is present due to reduced seed rain, seedling numbers and seed bank, increases in other vegetation, and susceptibility to fire. Further significant impact on stands is predicted.
Research Organization	CSIRO, NT
References	202, 765, 1408, 1441, 1444, 1982

RELEASE	
Country	Indonesia
Year	1998
Source	Ex. Mexico via Australia
Established	No
Notes	Only released at one site and failed to establish.
Research Organization	NBCRC
References	765

FABACEAE
Mimosa pigra; Carmenta mimosa *(continued)*

RELEASE	
Country	Malaysia
Year	1997
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Appeared to establish but recent information on progress lacking.
Research Organization	NBCRC
References	55, 56, 774

RELEASE	
Country	Thailand
Year	1989
Source	Ex. Mexico via Australia
Established	No
Research Organization	NBCRC
References	774, 1328, 1746

RELEASE	
Country	Thailand
Year	1993
Source	Ex. Mexico via Australia
Established	No
Notes	Believed to have established initially while being ineffective, but more recently considered a failed introduction.
Research Organization	NBCRC
References	774, 1329, 1746

FABACEAE
Mimosa pigra; Carmenta mimosa (continued)

RELEASE	
Country	Vietnam
Year	1996
Source	Ex. Mexico via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Attacks only new shoots and young plants which limits efficacy when spreading naturally. Now mass-reared and released in combination with other methods such as cutting or pulling
Research Organization	VNBCRC
References	220, 774, 1329, 1711, 1982

AGENT	
Species	*Chalcodermus serripes* Fåhraeus
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1996
Source	Ex. Brazil, Mexico, Venezuela
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Thought to have failed establishment until discovered in 2008. Now found in large populations over several river catchments. Increasing and causing heavy damage to flowers and seeds.
Research Organization	CSIRO, NT
References	765, 767

FABACEAE
Mimosa pigra (continued)

AGENT	
Species	*Chlamisus mimosae* Karren
Past Names/Synonyms	*Chlamisus* sp. nr. *sidae*
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1985
Source	Ex. Brazil
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established in low numbers in only one river system in NT despite wide releases. Not effective.
Limiting Factors	Predation
Research Organization	CSIRO, NT
References	765, 967, 1408, 1982

RELEASE	
Country	Thailand
Year	1985
Source	Ex. Brazil via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Believed to have established initially, but soon disappeared from release sites. Current status unknown.
Research Organization	NBCRC
References	774, 967, 1326, 1327, 1328, 1746

TABLE 1

TABLE 1

FABACEAE
Mimosa pigra; Chlamisus mimosae *(continued)*

RELEASE	
Country	Vietnam
Year	1990
Source	Ex. Brazil via Australia via Thailand
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	This release was a single attempt with a small number of individuals; fate unknown.
Research Organization	NBCRC, VNBCRC
References	774, 1329

AGENT	
Species	*Coelocephalapion aculeatum* (Fall)
Past Names/Synonyms	*Apion aculeatum* Fall
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Australia
Year	1992
Source	Ex. Mexico
Established	No
Notes	Initially reported to have established, but has not been found since 2002. This insect is an obligate flower feeder and probably failed to survive the dry seasons when flowers are absent.
Research Organization	CSIRO, NT
References	579, 765, 774, 1408, 1440

FABACEAE
Mimosa pigra; Coelocephalapion aculeatum *(continued)*

RELEASE	
Country	Thailand
Year	1991
Source	Ex. Mexico via Australia
Established	No
Research Organization	NBCRC
References	579, 774, 1746

AGENT	
Species	*Coelocephalapion pigrae* Kissinger
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Australia
Year	1994
Source	Ex. Venezuela
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established and spreading to isolated stands. Feeds on both flowers and leaves, enabling it to survive the dry season when no flowers are produced. Flower production reduced by up to 10% only.
Research Organization	CSIRO, NT
References	765, 772, 1408, 1442, 1599, 1914, 1915

FABACEAE
Mimosa pigra (continued)

AGENT	
Species	*Diabole cubensis* (Arthur & J.R. Johnst.) Arthur
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Australia
Year	1996
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though symptoms were found initially following inoculation, subsequently believed to have failed establishment. Detected again in NT in 2011.
Research Organization	IIBC, CSIRO, NT
References	765, 780, 781, 1639

AGENT	
Species	*Leuciris fimbriaria* (Stoll)
Classification	(Lepidoptera: Geometridae)

RELEASE	
Country	Australia
Year	2004
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

FABACEAE
Mimosa pigra; Leuciris fimbriaria (continued)

Country	Australia (continued)
Notes	Though widespread, densities low. Likely to have only slight localized impacts on *Mimosa pigra* infestations.
Research Organization	CSIRO, NT
References	765, 771

AGENT	
Species	*Macaria pallidata* (Warren)
Classification	(Lepidoptera: Geometridae)

RELEASE	
Country	Australia
Year	2002
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Widespread. Populations fluctuate markedly; outbreak levels coincide with wet season rainfall. When abundant, causes significant damage in field. Formal study quantifying overall impact lacking.
Limiting Factors	Climate
Research Organization	CSIRO, NT
References	765, 771, 1599

TABLE 1

TABLE 1

FABACEAE
Mimosa pigra *(continued)*

AGENT

Species	*Malacorhinus irregularis* Jacoby
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	2000
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely established, abundance variable in space and time. Where populations high at one site, significant damaged observed. Formal study quantifying overall impact lacking.
Research Organization	CSIRO, NT
References	765, 775, 1599, 1914, 1915

AGENT

Species	*Nesaecrepida infuscata* (Schaeffer)
Past Names/Synonyms	*Syphrea bibiana* Bechyné
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	2007
Source	Ex. Mexico
Established	Yes
Abundance	Unknown
General Impact	Too early post release

(continued at top of next column)

FABACEAE
Mimosa pigra; Nesaecrepida infuscata *(continued)*

Country	Australia (continued)
Notes	Recovered at a release site 20 weeks after release in 2010, suggesting they are breeding in the field.
Research Organization	CSIRO, NT
References	762

AGENT

Species	*Neurostrota gunniella* (Busck)
Classification	(Lepidoptera: Gracillariidae)

RELEASE

Country	Australia
Year	1989
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed with greater abundance and impact at edges of stands where up to 50% reduction in seed production may occur.
Limiting Factors	Host plant resistance
Other Species Attacked	Also found attacking native *Neptunia major* (Benth.) Winder growing adjacent to *Mimosa pigra* L., though impact determined to be low. Net effect determined beneficial for *N. major* as it colonized areas vacated by dying *M. pigra*.
Research Organization	CSIRO, NT
References	765, 1115, 1442, 1443, 1782, 1914, 1915, 1981, 1982

FABACEAE
Mimosa pigra (continued)

AGENT

Species	*Phloeospora mimosae-pigrae* Evans & Carrión
Classification	(Dothideomycetes: Capnodiales)

RELEASE

Country	Australia
Year	1994
Source	Ex. Mexico
Established	No
Notes	The fungus never developed to its sexual form in Australia, which is assumed to be vital for survival. Failed to survive beyond the wet season of its release.
Research Organization	IIBC, CSIRO, NT
References	554, 765, 780, 781, 1639

FABACEAE
Mimosa pigra (continued)

AGENT

Species	*Scamurius* sp.
Classification	(Hemiptera: Coreidae)

RELEASE

Country	Australia
Year	1988
Source	Ex. Brazil
Established	No
Research Organization	QLD State, NT
References	765, 1225

AGENT

Species	*Sibinia fastigiata* Clark
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1997
Source	Ex. Mexico, Brazil
Established	No
Research Organization	CSIRO
References	765, 774, 777, 1408

TABLE 1

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Paraserianthes lophantha* (Willd.) Nielsen
Past Names/Synonyms	*Albizia lophantha* (Willd.) Benth.
Origin	Australia
Common Name	stink bean
AGENT	
Species	*Melanterius servulus* Pascoe
Past Names/Synonyms	*Melanterius servulus* Pascoe (type B)
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	Republic of South Africa
Year	1989
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Overall seed damage near WC release sites 81.5%. Establishment only recently occurred in EC. Redistributions of this species essential.
Research Organization	ARC-PPRI
References	476, 477, 871, 992

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Parkinsonia aculeata* L.
Origin	tropical and subtropical Americas
Common Name	retama, Jerusalem thorn, palo verde, parkinsonia
AGENT	
Species	*Mimosestes ulkei* (Horn)
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	Australia
Year	1993
Source	Ex. USA (AZ)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially believed to have established in NT where killed up to 5.3% of seeds, as well as WA and QLD. Not reported in past 10 years, despite intensive and widespread sampling.
Research Organization	NT, QLD State, WA State
References	285, 515, 570, 766, 1121, 1878

FABACEAE
Parkinsonia aculeata *(continued)*

AGENT	
Species	*Penthobruchus germaini* (Pic)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1995
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established readily and rapidly reached high densities at all sites. Disperses well, even to isolated host plants. Seed predation rates of more than 30% rare, and generally peak before or after the period when most seeds available for predation. Consequently, not causing population level impacts.
Limiting Factors	Parasitism; Agent-host synchronization
Research Organization	NT, QLD State, WA State
References	285, 570, 1872, 1877, 1878

FABACEAE
Parkinsonia aculeata *(continued)*

AGENT	
Species	*Rhinacloa callicrates* Herring
Classification	(Hemiptera: Miridae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. USA (AZ)
Established	Yes
Abundance	Moderate
General Impact	None
Notes	Widespread in central QLD but not in WA or NT. Causes no useful damage in field.
Research Organization	NT, QLD State, WA State
References	516, 1878

TABLE 1

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Prosopis juliflora* (Sw.) DC.
Origin	Colombia, Ecuador, Mexico, Peru, Venezuela
Common Name	Mexican thorn

AGENT

Species	*Algarobius prosopis* (Le Conte)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Ascension Island
Year	1997
Source	Ex. USA (AZ) via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Seed destruction rates vary from 5% within freshly matured pods to 50% within older pods, though could be underestimated. Possibly reducing spread but impact minor compared to *Rhinocloa* sp. Necessary research is lacking.
Research Organization	IIBC, ARC-PPRI
References	97, 582, 584, 585, 919, 1879, 1966, 2072

FABACEAE
Prosopis juliflora (continued)

AGENT

Species	*Neltumius arizonensis* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Ascension Island
Year	1997
Source	Ex. USA (AZ) via Republic of South Africa
Established	Yes
Abundance	Rare
General Impact	None
Notes	Initially considered to have failed establishment but has since been determined to be present albeit rare. Impact likely insignificant, though necessary research lacking.
Research Organization	IIBC, ARC-PPRI
References	97, 300, 582, 585, 1879, 1966

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Prosopis* spp.
Notes	Comprises a complex of taxa occurring in mixed stands and often hybridizing freely. In Australia, these include *Prosopis glandulosa* Torrey (including both varieties, *glandulosa* and *torreyana*), *Prosopis pallida* (Humboldt & Bonpland ex Willd.) Kunth, and *Prosopis velutina* Wooton. A fourth species, *Prosopis juliflora* (Sw.) DC., has been documented at a few sites in Australia but may no longer be present there. Species invasive in South Africa are *Prosopis velutina* Wooton, *Prosopis glandulosa* Torrey (including both varieties, *glandulosa* and *torreyana*), *Prosopis juliflora* (Sw.) DC., and *Prosopis* hybrids. Egypt species include *Prosopis juliflora* (Sw.) DC. and *Prosopis glandulosa* Torr. Species in Namibia include *Prosopis chilensis* (Molina) Stuntz, *Prosopis glandulosa* Torr. var. *torreyana* (L. D. Benson) M. C. Johnst., and *Prosopis velutina* Wooton. In Yemen, the nonnative species include *Prosopis chilensis* (Molina) Stuntz, *Prosopis glandulosa* Torrey var. *glandulosa*, and *Prosopis juliflora* (Sw.) DC.
Origin	Americas
Common Name	mesquite, prosopis, algaroba

FABACEAE
***Prosopis* spp.** *(continued)*

AGENT

Species	*Algarobius bottimeri* Kingsolver
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1997
Source	Ex. USA (TX) via Republic of South Africa
Established	Yes
Abundance	Rare
General Impact	None
Notes	Initially believed to have established widely but not recovered in recent surveys, indicating it is either rare or has gone extinct.
Research Organization	QLD State
References	1873, 1875, 1882, 2072

RELEASE

Country	Republic of South Africa
Year	1990
Source	Ex. USA (TX)
Established	No
Notes	Recovered in low numbers for a short period after the initial releases, but is now believed to have failed establishment.
Research Organization	ARC-PPRI
References	873, 992, 2055, 2072

TABLE 1

TABLE 1

FABACEAE
***Prosopis* spp.** *(continued)*

AGENT	
Species	*Algarobius prosopis* (Le Conte)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1996
Source	Ex. USA (AZ) via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely established, unlikely to be causing population level impacts as seed predation rates in mature pods low, always below 20%.
Research Organization	QLD State
References	1873, 1875, 1882, 2072

RELEASE	
Country	Republic of South Africa
Year	1987
Source	Ex. USA (AZ)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

FABACEAE
Prosopis* spp.; *Algarobius prosopis *(continued)*

Country	Republic of South Africa (continued)
Notes	Has rapidly dispersed over most of the range of the weed, regularly destroying over 90% of the seeds in fenced areas where the pods are not grazed by vertebrate herbivores. In grazed settings, *Algarobius prosopis* able to utilize some of the seed in dung pellets. Even under the highest attack rates, sufficient seeds escape herbivory to maintain weed populations.
Research Organization	ARC-PPRI
References	868, 873, 992, 1879, 2055, 2072

AGENT	
Species	*Evippe* sp. #1
Classification	(Lepidoptera: Gelechiidae)
Notes	Undescribed species externally similar to *Evippe omphalopa* Meyrick

RELEASE	
Country	Australia
Year	1998
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Widely distributed. High densities causing prolonged defoliation in the Pilbara region (WA) resulting in population suppression due to greatly reduced seed production and growth rates. No impact in NSW where insect is rare, only limited impact in NT and intermediate (still significant) impacts in QLD.
Research Organization	CSIRO
References	1873, 1875, 1876, 1879, 1882

FABACEAE
***Prosopis* spp.** *(continued)*

AGENT

Species	*Neltumius arizonensis* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Republic of South Africa
Year	1993
Source	Ex. USA (AZ)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed, far less common than *Algarobius prosopis*, causing only 1-10% seed destruction inflicted by biocontrol agents within a year. Hindered by parasitism and inferior competitor to *A. prosopis*. Seed pods are frequently eaten by grazing animals, and seed within dung pellets inaccessible to *Neltumius arizonensis*, but can be utilized by *A. prosopis*. *N. arizonensis* alone and in combination with *A. prosopis* insufficient to control mesquite populations.
Limiting Factors	Parasitism; Interspecific competition
Research Organization	ARC-PPRI
References	300, 873, 1879, 2055

FABACEAE
***Prosopis* spp.** *(continued)*

AGENT

Species	*Prosopidopsylla flava* Burckhardt
Classification	(Hemiptera: Psyllidae)

RELEASE

Country	Australia
Year	1998
Source	Ex. Argentina
Established	Yes
Abundance	Limited
General Impact	None
Notes	Tenuous establishment in 2001 at only two locations in northwestern NSW and southwestern QLD, but not evaluated since. Limited establishment likely due to unfavorable climate at release locations. No impact.
Limiting Factors	Climate
Research Organization	CSIRO
References	1873, 1874, 1875, 1876, 1879

FABACEAE *(continued)*

TABLE 1

WEED	
Family	Fabaceae
Species	*Sesbania punicea* (Cav.) Benth.
Origin	South America
Common Name	red sesbania

AGENT	
Species	*Neodiplogrammus quadrivittatus* (Olivier)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Two populations introduced and subsequently not differentiated in the literature. Larvae destroy vascular tissues on older plants. Though unlikely to be successful alone, in combination with *Rhyssomatus marginatus* and *Trichapion lativentre*, successfully controls *Sesbania punicea* throughout South Africa.
Other Species Attacked	Also found on the native *Sesbania macrantha* Welw. ex E. Phillips & Hutch. and introduced *Sesbania bispinosa* (Jacq.) W. Wight, but with no records of completing development on these hosts.
Research Organization	ARC-PPRI
References	823, 826, 827, 828, 829, 830, 992

FABACEAE
Sesbania punicea; Neodiplogrammus quadrivittatus (continued)

RELEASE	
Country	Republic of South Africa
Year	1987
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Two populations introduced and subsequently not differentiated in the literature. Larvae destroy vascular tissues on older plants. Though unlikely to be successful alone, in combination with *Rhyssomatus marginatus* and *Trichapion lativentre*, successfully controls *Sesbania punicea* throughout South Africa.
Research Organization	ARC-PPRI
References	823, 827, 829, 992

FABACEAE
Sesbania punicea (continued)

AGENT	
Species	*Rhyssomatus marginatus* Fåhraeus
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Can destroy approximately 84% of developing seeds, though this is insufficient to control the weed alone. In combination with *Trichapion lativentre* and *Neodiplogrammus quadrivittatus*, successfully controls *Sesbania punicea* throughout South Africa.
Research Organization	ARC-PPRI
References	823, 827, 829, 830, 992

FABACEAE (continued)

WEED	
Family	Fabaceae
Species	*Ulex europaeus* L.
Origin	western Europe
Common Name	gorse, furze

AGENT	
Species	*Agonopterix umbellana* (Fabricius)
Past Names/Synonyms	*Agonopterix ulicetella* (Stainton)
Classification	(Lepidoptera: Oecophoridae)
References	884

RELEASE	
Country	Australia
Year	2007
Source	Ex. England via New Zealand
Established	Yes
Abundance	Unknown
General Impact	Too early post release
Notes	VIC release site subsequently destroyed by fire. In TAS spread over 1 ha 3 years after release. Additional studies warranted to confirm field establishment and efficacy.
Research Organization	VIC State, TAS State
References	883, 884

TABLE 1

FABACEAE
Ulex europaeus; Agonopterix umbellana *(continued)*

RELEASE	
Country	Chile
Year	1997
Source	Ex. England via New Zealand via Hawaii USA; Ex. Portugal via Hawaii USA
Established	No
Notes	Colonized plants initially but populations decreased over time. No longer considered established.
Research Organization	INIA
References	1355, 1358, 1359

RELEASE	
Country	Chile
Year	1998
Source	Ex. England
Established	No
Notes	Colonized plants initially but populations decreased over time. No longer considered established.
Research Organization	INIA
References	1355, 1358, 1359

RELEASE	
Country	Hawaii USA
Year	1988
Source	Ex. England via New Zealand
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

FABACEAE
Ulex europaeus; Agonopterix umbellana *(continued)*

Country	Hawaii USA (continued)
Notes	While larval feeding can destroy high percentage of shoot tips and sometimes leads to dieback, plants frequently compensate by initiating growth of new shoots later in season when this agent no longer active. Impact limited by parasitism. Widespread on HA but well established only at high elevations (>1,000m) on MA.
Limiting Factors	Parasitism; Elevation
Research Organization	HDOA, USDA-FS
References	326, 385, 813, 1148, 1157, 1169, 2049

RELEASE	
Country	Hawaii USA
Year	1991
Source	Ex. Portugal
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	A warmer adapted population released in the hope that it would establish at lower elevations. Subsequent reports do not distinguish between this and the English introduction. While larval feeding can destroy high percentage of shoot tips and sometimes leads to dieback, plants frequently compensate by initiating growth of new shoots later in season when this agent no longer active. Impact limited by parasitism. Widespread on HA but well established only at high elevations (>1,000m) on MA.
Limiting Factors	Parasitism; Elevation
Research Organization	HDOA, USDA-FS
References	326, 385, 813, 1148, 1157, 1169, 2049

FABACEAE
Ulex europaeus; Agonopterix umbellana *(continued)*

RELEASE	
Country	New Zealand
Year	1990
Source	Ex. England
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Common in parts of South Island but still rare on North Island. Where outbreaks occur damage to gorse is noticeable, but plants frequently compensate later in growing season. Formal evaluation lacking.
Research Organization	DSIR/MWLR
References	720, 809, 813, 815, 1064

AGENT	
Species	*Apion* sp.
Classification	(Coleoptera: Brentidae)
Notes	Possibly *Apion uliciperda* Pandelle

RELEASE	
Country	Hawaii USA
Year	1958
Source	Ex. Spain, Portugal
Established	No
Research Organization	HDOA
References	398, 813, 1154

FABACEAE
Ulex europaeus *(continued)*

TABLE 1

AGENT	
Species	*Cydia succedana* (Denis & Schiffermüller)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	New Zealand
Year	1992
Source	Ex. England, Portugal
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	In conjunction with *Exapion ulicis* can destroy up to 100% of spring/summer seed crop. However, New Zealand gorse produces greatest amount of seed in autumn when populations of *Cydia succedana* lower and only infest up to 10% of pods.
Limiting Factors	Agent-host synchronization
Other Species Attacked	Also attacks the exotic *Cytisus scoparius* L., *Genista monspessulana* (L.) L. A. S. Johnson, *Lupinus arboreus* Sims and *Lotus* spp.
Research Organization	MWLR
References	720, 808, 809, 813, 1064

TABLE 1

FABACEAE
Ulex europaeus *(continued)*

AGENT

Species	*Exapion ulicis* (Forster)
Past Names/Synonyms	*Apion ulicis* (Forster)
Classification	(Coleoptera: Brentidae)
References	814, 884, 2069

RELEASE

Country	Australia
Year	1939
Source	Ex. England via New Zealand
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed throughout southeastern Australia. Studies in TAS show 12-55% destruction of mature seeds, insufficient to exert control.
Research Organization	SA State
References	396, 557, 884, 886, 1989

RELEASE

Country	Chile
Year	1976
Source	Ex. England via New Zealand
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	At some sites can reduces biomass, seed production, and seedling colonization; however has no significant effect in diminishing gorse invasiveness.
Research Organization	INIA, UACH
References	1355, 1357, 1359, 1360, 1361, 1362

FABACEAE
Ulex europaeus; Exapion ulicis *(continued)*

RELEASE

Country	Hawaii USA
Year	1926
Source	Ex. England
Established	No
Research Organization	HDOA
References	326, 635, 859, 1154, 1451

RELEASE

Country	Hawaii USA
Year	1949
Source	Ex. England via New Zealand
Established	No
Notes	Few adults were seen at release site in 1953, but none later and all attempts considered unsuccessful.
Research Organization	HDOA
References	635, 1154

RELEASE

Country	Hawaii USA
Year	1955
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

FABACEAE
Ulex europaeus; Exapion ulicis *(continued)*

Country	Hawaii USA (continued)
Notes	After two failed releases, third consignment was sourced from more southerly regions in France to better match the climate in Hawaii. Initial HA release site subsequently treated and weevils did not survive but were successfully reintroduced from MA populations. Weevil populations variable between years and also below 1000m in elevation, possibly due to fungal infection. Though attack rates can exceed 95% of pods, this frequently has only limited impact on gorse invasiveness. Feeding damage may increase susceptibility of plants to pathogenic fungus *Colletotrichum* sp.
Limiting Factors	Disease
Research Organization	HDOA
References	635, 762, 813, 1154, 1155, 1157

RELEASE

Country	Hawaii USA
Year	1956
Source	Ex. England
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

FABACEAE
Ulex europaeus; Exapion ulicis *(continued)*

Country	Hawaii USA (continued)
Notes	This fourth consignment released on the same islands as 1955 release and both were subsequently not differentiated in the literature. Initial HA release site subsequently treated and weevils did not survive but were successfully reintroduced from MA populations. Weevil populations variable between years and also below 1000m in elevation, possibly due to fungal infection. Though attack rates can exceed 95% of pods, this frequently has only limited impact on gorse invasiveness. Feeding damage may increase susceptibility of plants to pathogenic fungus *Colletotrichum* sp.
Limiting Factors	Disease
Research Organization	HDOA
References	635, 762, 813, 1154, 1155, 1157

RELEASE

Country	New Zealand
Year	1931
Source	Ex. England
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	In conjunction with *Cydia succedana* can destroy up to 100% of spring/summer seed crop. However, New Zealand gorse produces greatest amount of seed in autumn when weevils no longer present, so majority of seeds escape attack.
Limiting Factors	Agent-host synchronization
Research Organization	DSIR
References	353, 720, 810, 813, 1064, 1246

TABLE 1

TABLE 1

FABACEAE
Ulex europaeus; Exapion ulicis *(continued)*

RELEASE	
Country	United States of America
Year	1953
Source	Ex. England (southern)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread throughout range of weed in Pacific Northwest. From 30-95% of seedpods attacked. May retard spread of plant, but does not reduce established stand density. Ineffective on seed maturing in autumn/winter. Most effective in open, sunny pastures and hillsides.
Limiting Factors	Habitat
Research Organization	USDA (7), State (9,14,15)
References	332, 334, 337, 813, 986, 1156, 1501, 1578

FABACEAE
Ulex europaeus *(continued)*

AGENT	
Species	*Pempelia genistella* (Duponchel)
Classification	(Lepidoptera: Pyralidae)

RELEASE	
Country	Hawaii USA
Year	1996
Source	Ex. Portugal
Established	No
General Impact	Compromised
Notes	Initially recovered in small amounts. Release sites subsequently exterminated by fire and herbicides and agent populations did not survive.
Limiting Factors	Other control methods
Research Organization	USDA-FS, HDOA
References	326, 386, 762, 813, 1148, 1157

RELEASE	
Country	New Zealand
Year	1996
Source	Ex. Portugal
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established at limited number of sites despite widespread release effort. At some locations damage to gorse is noticeable. Formal evaluation lacking so overall impact unknown.
Research Organization	MWLR
References	760, 761, 813, 881, 1064

FABACEAE
Ulex europaeus *(continued)*

AGENT

Species	*Scythris grandipennis* (Haworth)
Classification	(Lepidoptera: Scythrididae)

RELEASE

Country	New Zealand
Year	1993
Source	Ex. England
Established	No
Research Organization	DSIR
References	720, 761, 809, 813, 877, 1064

AGENT

Species	*Sericothrips staphylinus* Haliday
Classification	(Thysanoptera: Thripidae)

RELEASE

Country	Australia
Year	2001
Source	Ex. England via New Zealand
Established	Yes
Abundance	Moderate
General Impact	None
Notes	Slow dispersal initially but now increasing more quickly in TAS and becoming widespread and abundant, albeit too low to cause observable field damage.
Research Organization	VIC State
References	120, 883, 884, 888

FABACEAE
Ulex europaeus; Sericothrips staphylinus *(continued)*

RELEASE

Country	Australia
Year	2003
Source	Ex. Portugal via Hawaii USA via New Zealand
Established	Yes
Abundance	Moderate
General Impact	None
Notes	This second introduction made with individuals sourced from different population. These cannot be distinguished by behavioral traits and are becoming interspersed in the field. Slow dispersal initially but now increasing more quickly in TAS and becoming widespread and abundant, albeit too low to cause observable field damage.
Research Organization	VIC State
References	120, 883, 884, 888

RELEASE

Country	Hawaii USA
Year	1991
Source	Ex. England, Portugal
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread on HA, discernible bronzing of mature gorse plants only occasionally found, but not plant death. Thrips of Portuguese origin dispersed much faster than thrips from England following release. Subsequent accounts of this species did not differentiate between all populations.
Research Organization	USDA-FS, HDOA
References	326, 385, 762, 814, 1156, 1157

TABLE 1

FABACEAE
Ulex europaeus; Sericothrips staphylinus *(continued)*

RELEASE	
Country	Hawaii USA
Year	1992
Source	Ex. France
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread on HA, discernible bronzing of mature gorse plants only occasionally found, but not plant death. Infestations not monitored in recent years.
Research Organization	HDOA
References	326, 385, 762, 814, 1157

RELEASE	
Country	New Zealand
Year	1990
Source	Ex. England
Established	Yes
Abundance	Variable
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Although widely established, spread slowly from release points because winged individuals rare. Second population released to increase dispersal; this established widely and intermixed. Thrips now typically common on gorse. Though severely damaged plants rare, impact not formally evaluated.
Research Organization	DSIR, IIBC
References	720, 761, 809, 814, 1064

FABACEAE
Ulex europaeus; Sericothrips staphylinus *(continued)*

RELEASE	
Country	New Zealand
Year	2001
Source	Ex. Portugal via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	This population released to increase dispersal; established widely and intermixed with existing English population. Thrips now typically common on gorse. Though severely damaged plants rare, impact not formally evaluated.
Research Organization	MWLR
References	761, 888, 1064

AGENT	
Species	*Stenopterapion scutellare* (Kirby)
Past Names/Synonyms	*Apion scutellare* Kirby
Classification	(Coleoptera: Brentidae)
References	1286, 2069

RELEASE	
Country	Hawaii USA
Year	1961
Source	Ex. Portugal
Established	No
General Impact	Compromised
Notes	Release site burned shortly after release.
Limiting Factors	Other control methods
Research Organization	HDOA
References	326, 385, 407, 408, 1154, 1156, 2049

FABACEAE
Ulex europaeus; Stenopterapion scutellare *(continued)*

RELEASE	
Country	Hawaii USA
Year	1989
Source	Ex. Portugal
Established	No
Research Organization	HDOA
References	326, 385, 893, 1157

RELEASE	
Country	Hawaii USA
Year	1990
Source	Ex. Spain
Established	No
Research Organization	HDOA
References	326, 893, 1157

RELEASE	
Country	Hawaii USA
Year	1991
Source	Ex. France
Established	No
Research Organization	HDOA
References	326, 385, 893, 1157

FABACEAE
Ulex europaeus *(continued)*

TABLE 1

AGENT	
Species	*Tetranychus lintearius* Dufour
Classification	(Acari: Tetranychidae)

RELEASE	
Country	Australia
Year	1998
Source	Ex. England, Portugal, Spain via New Zealand
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed. Initially effective at reducing weed growth but more recently impact restricted by predators.
Limiting Factors	Predation
Research Organization	VIC State
References	120, 395, 883, 884, 889

RELEASE	
Country	Chile
Year	1997
Source	Ex. England, Portugal, Spain via New Zealand via USA (OR) via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional

(continued on next page)

TABLE 1

FABACEAE
Ulex europaeus; Tetranychus lintearius (continued)

Country	Chile (continued)
Notes	Two separate releases not differentiated in efficacy discussion in literature. Decreases rate of spread into new areas. Long term attack decreases competitive ability; gorse slowly being replaced by native species. Most effective in regions with low rainfall; impact hindered by predation.
Limiting Factors	Climate; Predation
Research Organization	INIA, UACH
References	333, 1359, 1360

RELEASE

Country	Chile
Year	1997
Source	Ex. Portugal
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Two separate releases not differentiated in efficacy discussion in literature. Decreases rate of spread into new areas. Long term attack decreases competitive ability; gorse slowly being replaced by native species. Most effective in regions with low rainfall; impact hindered by predation.
Limiting Factors	Climate; Predation
Research Organization	INIA, UACH
References	1359, 1360

FABACEAE
Ulex europaeus; Tetranychus lintearius (continued)

RELEASE

Country	Hawaii USA
Year	1995
Source	Ex. England, Portugal, Spain via New Zealand via USA (OR)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Partial to substantial control until 2000 when predacious mites may have first appeared.
Limiting Factors	Predation
Research Organization	USDA (7), State (15), HDOA
References	326, 332, 333, 385, 813, 1157

RELEASE

Country	New Zealand
Year	1989
Source	Ex. England
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread in drier, cooler areas, but generally failed to establish in warmer and wetter climates. Initially effective at reducing gorse growth but more recently populations limited by predation.
Limiting Factors	Climate; Predation
Research Organization	DSIR
References	720, 761, 809, 811, 812, 813, 1064

FABACEAE
Ulex europaeus; Tetranychus lintearius *(continued)*

RELEASE	
Country	New Zealand
Year	1991
Source	Ex. Portugal, Spain
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Successfully established in warm, moist areas where English population failed. Populations high initially, reducing gorse growth but more recently limited by predation.
Limiting Factors	Predation
Research Organization	DSIR
References	720, 761, 809, 811, 813, 1064

RELEASE	
Country	St Helena
Year	1995
Source	Ex. England, Portugal via New Zealand
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Causing some local damage, but effects limited by predation from *Phytoseiulus* spp. (Acari).
Limiting Factors	Predation
Research Organization	IIBC
References	582, 585, 1081

FABACEAE
Ulex europaeus; Tetranychus lintearius *(continued)*

RELEASE	
Country	United States of America
Year	1994
Source	Ex. England, Portugal, Spain via New Zealand
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially widely distributed, leading to 80% reduction in flowering in OR. Was most effective in open patches in inland areas susceptible to severe winters. Populations have since decreased significantly due to heavy predation. Now considered ineffective agent.
Limiting Factors	Predation; Habitat; Climate
Research Organization	USDA (7), State (9,14,15)
References	332, 334, 337, 813, 986, 1531

AGENT	
Species	*Uromyces pisi* f.sp. *europaei* M. Wilson & D.M. Hend.
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Hawaii USA
Year	2000
Source	Ex. England
Established	No
Notes	In 2002, single pustule detected in HA near release site of 2 years previous; not detected since.
Research Organization	HDOA
References	326, 386, 813

TABLE 1

TABLE 1

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Vachellia nilotica* subsp. *indica* (Benth.) Kyal. & Boatwr
Past Names/Synonyms	*Acacia nilotica* (L.) Delile, *Acacia nilotica* (L.) Delile subsp. *indica* (Benth.) Brenan
Notes	Following the International Botanical Congress in 2011, it was agreed the thorny Acacias belong to a separate genus *Vachellia*; consequently *A. nilotica* was transferred to *V. nilotica*. Australian populations of *Vachellia nilotica* are mostly comprised of subspecies *indica*, though a few individuals are genetically identical to an unidentified genotype from Pakistan not previously reported in Australia.
Origin	Indian sub continent
Common Name	prickly acacia
References	1043, 1791

AGENT

Species	*Bruchidius sahlbergi* Schilsky
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1982
Source	Ex. Pakistan
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

FABACEAE
Vachellia nilotica; Bruchidius sahlbergi (continued)

Country	Australia (continued)
Notes	Though widely established and abundant, largely ineffective due to seed pod predation levels too low to impact populations. Efficacy may be higher in areas protected from cattle grazing.
Limiting Factors	Land use
Research Organization	QLD State, IIBC
References	1419, 1544, 1977

AGENT

Species	*Chiasmia assimilis* (Warren)
Classification	(Lepidoptera: Geometridae)

RELEASE

Country	Australia
Year	1999
Source	Ex. Kenya
Established	No
Notes	Establishment failure likely impacted by release in areas with unsuitable climates and possibly to loss of genetic diversity in lab cultures.
Limiting Factors	Climate
Research Organization	QLD State
References	1419, 1420

FABACEAE
Vachellia nilotica; Chiasmia assimilis *(continued)*

RELEASE	
Country	Australia
Year	2002
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Widely distributed in QLD though coastal populations much more abundant. Causes significant to complete defoliation at coastal sites; less effective at western QLD locations where climate is less suitable. More effective on seedlings growing beneath prickly acacia canopy than full sunlight, indicating may help limit the formation of dense infestations where plants already exist.
Limiting Factors	Climate
Research Organization	QLD State
References	1110, 1418, 1419, 1420, 1640

AGENT	
Species	*Chiasmia inconspicua* (Warren)
Classification	(Lepidoptera: Geometridae)

RELEASE	
Country	Australia
Year	1998
Source	Ex. Kenya
Established	No
Notes	Establishment failure likely impacted by release in areas with unsuitable climates and possibly to loss of genetic diversity in lab cultures.
Limiting Factors	Climate
Research Organization	QLD State
References	1418, 1419, 1420

FABACEAE
Vachellia nilotica *(continued)*

AGENT	
Species	*Cometaster pyrula* (Hopffer)
Classification	(Lepidoptera: Erebidae)

RELEASE	
Country	Australia
Year	2004
Source	Ex. Republic of South Africa
Established	No
Notes	Establishment failure likely due to small release size and the insect not doing as well on *Vachellia nilotica* subsp. *indica* as the preferred host *V. nilotica* subsp. *kraussiana*.
Research Organization	QLD State
References	1413, 1419, 1422

TABLE 1

TABLE 1

FABACEAE
Vachellia nilotica *(continued)*

AGENT

Species	*Cuphodes profluens* (Meyrick)
Classification	(Lepidoptera: Gracillariidae)

RELEASE

Country	Australia
Year	1983
Source	Ex. Pakistan
Established	No
Notes	Released at 14 sites but indications of establishment occurred only at one coastal site. The prickly acacia at this site subsequently eradicated; insect now regarded as failed. Failure at other sites likely due to small release size and climate.
Limiting Factors	Climate; Small release size
Research Organization	QLD State, IIBC
References	1413, 1419, 1977

AGENT

Species	*Homichloda barkeri* (Jacoby)
Past Names/Synonyms	*Weiseana barkeri* Jacoby
Incorrect Past Names/Synonyms	*Homicloda barkeri* (Jacoby)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1996
Source	Ex. Kenya
Established	No
Research Organization	QLD State
References	1111, 1419

HALORAGACEAE

WEED

Family	Haloragaceae
Species	*Myriophyllum aquaticum* (Vell.) Verdc.
Origin	South America
Common Name	parrot's feather

AGENT

Species	*Lysathia* sp.
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Republic of South Africa
Year	1994
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	*Lysathia* sp. populations crash in winter, building up again throughout summer. Causes die-back of emergent vegetation. Regrowth occurs from submerged stems, which are again attacked by *Lysathia* sp. After several years of defoliation, the weed mat collapses and little to no regrowth occurs.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	276, 297, 804, 992

HYDROCHARITACEAE

WEED

Family	Hydrocharitaceae
Species	*Hydrilla verticillata* (L. f.) Royle
Notes	Two biotypes (dioecious and monoecious) are present in the continental USA
Origin	Africa, Asia, Australia, portions of Europe
Common Name	hydrilla, Florida elodea

AGENT

Species	*Bagous affinis* Hustache
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1987
Source	Ex. India
Established	No
Notes	Initially recovered in CA and FL but permanent establishment not reported. Establishment limited by the agent requiring extensive drawdown conditions which expose the sediment surface and allow immatures access to buried tubers.
Limiting Factors	Habitat
Research Organization	USDA (3,4,7,14,15), State (3,14), IIBC, USAE
References	77, 193, 194, 200, 239, 633, 682, 1963

AGENT

Species	*Bagous hydrillae* O'Brien
Past Names/Synonyms	*Bagous* n. sp. Z
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1991
Source	Ex. Australia
Established	No
Notes	Temporarily recovered in FL and TX but permanent establishment not reported.
Research Organization	USAE, USDA (3,4,15), TVA
References	77, 200, 234, 682, 683, 1961, 1963

AGENT

Species	*Hydrellia balciunasi* Bock
Classification	(Diptera: Ephydridae)

RELEASE

Country	United States of America
Year	1989
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	None
Notes	Larval mining causes decay of leaves. No major impact has been observed in the field since populations have remained low and range expansion has been limited.
Research Organization	USAE, USDA (3,4,15), State (3)
References	77, 200, 335, 367, 681, 683

TABLE 1

HYDROCHARITACEAE
Hydrilla verticillata *(continued)*

AGENT

Species	*Hydrellia pakistanae* Deonier
Classification	(Diptera: Ephydridae)

RELEASE

Country	Mexico
Year	1995
Source	Ex. India via USA
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	USDA (7,14), State (14)
References	497

RELEASE

Country	United States of America
Year	1987
Source	Ex. India
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Larval feeding on leaves decreases photosynthesis and reduces tuber numbers. High fly densities locally correlated with decreases in weed populations. Fly populations limited by parasitism and cold weather; densities decrease with decreasing temperatures.
Limiting Factors	Parasitism; Climate
Research Organization	IIBC, USAE, USDA (3,4,7,14), TVA, State (3,14,18)
References	77, 193, 200, 234, 240, 634, 683, 1962

HYDROCHARITACEAE
Hydrilla verticillata; Hydrellia pakistanae *(continued)*

RELEASE

Country	United States of America
Year	1990
Source	Ex. Pakistan
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	This release no longer differentiated from earlier Indian release. Larval feeding on leaves decreases photosynthesis and reduces tuber numbers. High fly densities locally correlated with decreases in weed populations. Fly populations limited by parasitism and cold weather; densities decrease with decreasing temperatures.
Limiting Factors	Parasitism; Climate
Research Organization	USAE
References	77, 200, 234, 240, 683, 1962

HYDROCHARITACEAE
Hydrilla verticillata; Hydrellia pakistanae *(continued)*

RELEASE	
Country	United States of America
Year	1992
Source	Ex. China (northern)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	This population released to increase survival in more temperate regions. Subsequent visits to release sites in FL resulted in high fly populations, though it was impossible to determine which introduction (or all three) was responsible. Fly populations limited by parasitism and cold weather; densities decrease with decreasing temperatures.
Limiting Factors	Parasitism; Climate
Research Organization	USAE
References	200, 237, 240, 683, 1962

HYPERICACEAE

WEED	
Family	Hypericaceae
Species	*Hypericum androsaemum* L.
Origin	Asia Minor, Europe, northern Africa
Common Name	tutsan

AGENT	
Species	*Chrysolina hyperici* (Forster)
Past Names/Synonyms	*Chrysomela hyperici* Forster
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	New Zealand
Year	1948
Source	Ex. England via Australia
Established	No
Notes	Redistributed from *Hypericum perforatum* to *H. androsaemum*. Initially believed to have established, but died out by 1950. Though adults may sometimes feed on foliage, larvae develop slowly and die before maturation. Preferred host is *H. perforatum*.
Other Species Attacked	Found feeding and laying eggs on the native *Hypericum involutum* (Labill.) Choisy.
Research Organization	DSIR
References	169, 686, 1054, 1058, 1246

TABLE 1

HYPERICACEAE *(continued)*

WEED

Family	Hypericaceae
Species	*Hypericum perforatum* L.
Origin	Asia, Europe, northern Africa
Common Name	St John's wort, St Johnswort, klamath weed, goatweed, San Juan herb

AGENT

Species	*Actinotia hyperici* (Denis & Schiffermüller)
Classification	(Lepidoptera: Noctuidae)

RELEASE

Country	Australia
Year	1985
Source	Ex. France (southern)
Established	No
Notes	Establishment failure suspected due to predation and parasitism.
Limiting Factors	Predation; Parasitism
Research Organization	CSIRO
References	169, 172, 173

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT

Species	*Aculus hyperici* (Liro)
Classification	(Acari: Eriophyidae)

RELEASE

Country	Australia
Year	1991
Source	Ex. France (southern)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Widely distributed. Reduced plant vigor and density at local sites but has not been widely evaluated. Some genotypes of *Hypericum perforatum* resistant to attack. Generally ineffective.
Other Species Attacked	Small populations sustained on the native *Hypericum gramineum* Forst. ver, however impacts on growth and productivity appear minimal.
Research Organization	CSIRO, CRCWMS, VIC State, NSW State
References	173, 953, 954, 955, 1135, 1974

TABLE 1

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT

Species	*Agrilus hyperici* (Creutzer)
Classification	(Coleoptera: Buprestidae)

RELEASE

Country	Australia
Year	1939
Source	Ex. France (southern)
Established	Yes
Abundance	Rare
General Impact	None
Notes	Established and showed initial promise but later confined to very restricted area. Only one remaining population known. No contribution to control. Release of *Chrysolina* spp. at the same time and in similar sites thought to have hindered establishment and efficacy.
Limiting Factors	Interspecific competition
Research Organization	CSIR*
References	166, 167, 173, 223, 455, 1435, 1988, 1989

RELEASE

Country	Australia
Year	1984
Source	Ex. France
Established	No
Research Organization	CSIRO
References	167, 172, 173, 380

HYPERICACEAE
Hypericum perforatum; Agrilus hyperici *(continued)*

RELEASE

Country	Australia
Year	1989
Source	Ex. France
Established	No
Notes	Only one colony survived longer than the initial season of release but has since been considered a failure.
Research Organization	CSIRO
References	167, 169, 172, 173, 380

RELEASE

Country	Canada
Year	1955
Source	Ex. France via USA (CA)
Established	No
Notes	Establishment failure possibly due to fungal attack at damp release sites.
Limiting Factors	Disease
Research Organization	AAFC
References	117, 635, 740, 741, 912

RELEASE

Country	Canada
Year	1964
Source	Ex. France via USA (CA)
Established	No
Notes	Establishment failure possibly due to fungal attack at damp release sites.
Limiting Factors	Disease
Research Organization	AAFC
References	117, 740, 741, 912

TABLE 1

HYPERICACEAE
Hypericum perforatum; Agrilus hyperici *(continued)*

RELEASE	
Country	Canada
Year	1977
Source	Ex. France via USA (CA)
Established	No
Notes	Shipping stress likely led to establishment failure.
Limiting Factors	Shipment stress
Research Organization	AAFC
References	117, 738, 912

RELEASE	
Country	Canada
Year	1987
Source	Ex. France via USA (ID)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Typically uncommon throughout range; at only one site were populations large enough to redistribute. Impact has been negligible.
Research Organization	AAFC
References	117, 912

RELEASE	
Country	Republic of South Africa
Year	1974
Source	Ex. France (southern) via Australia; Ex. France via USA (CA)
Established	No

(continued at top of next column)

HYPERICACEAE
Hypericum perforatum; Agrilus hyperici *(continued)*

Country	Republic of South Africa (continued)
Notes	Not established following release of small numbers on seven occasions until 1981. On some occasions plants killed by *Chrysolina quadrigemina*.
Limiting Factors	Interspecific competition
Research Organization	ARC-PPRI
References	51, 173, 660, 992, 1503

RELEASE	
Country	United States of America
Year	1950
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Disperses widely but populations typically low until occasional explosions. Initially displayed ability to destroy *Hypericum perforatum* in CA but was displaced by *Chrysolina quadrigemina*; persisted only in some areas. Infestation levels reached up to 87% in WA. Contributed significantly to *H. perforatum* suppression in ID where it is still abundant. Populations now vary throughout Pacific Northwest. Typically found in mountainous areas; will attack plants in shady habitats frequently avoided by *Chrysolina* spp.
Other Species Attacked	Attacks the native *Hypericum concinnum* Benth.
Research Organization	USDA (7,10), State (4,6,7,9,15)
References	39, 222, 332, 1179, 1501, 1503, 1578, 1731, 1992

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT	
Species	*Aphis chloris* Koch
Classification	(Hemiptera: Aphididae)

RELEASE	
Country	Australia
Year	1986
Source	Ex. France (southern)
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Though widely established, populations go through seasonal cycles of growth and dispersal without building to damaging levels. Drought, competition with *Chrysolina quadrigemina* and predation all limit populations.
Limiting Factors	Climate; Interspecific competition; Predation
Research Organization	CSIRO
References	164, 165, 169, 173, 174

HYPERICACEAE
Hypericum perforatum; Aphis chloris *(continued)*

RELEASE	
Country	Canada
Year	1979
Source	Ex. Austria, Germany, Hungary
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Appears adapted only to NS and interior BC where it does best in cool, humid climates. Significant control at some sites, though populations fluctuate due to weather and abundance/impact of *Chrysolina* spp.
Limiting Factors	Climate; Interspecific competition
Research Organization	AAFC
References	117, 432, 437, 738, 912, 1285

RELEASE	
Country	Republic of South Africa
Year	1982
Source	Ex. Germany via Canada
Established	No
Notes	Though eggs were laid following adult release, they did not hatch because winter temperatures in the release areas were too mild.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	660, 912, 992

TABLE 1

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT

Species	*Aplocera efformata* (Guenée)
Past Names/Synonyms	*Anaitis efformata* Guenée
Classification	(Lepidoptera: Geometridae)

RELEASE

Country	Australia
Year	1936
Source	Ex. England
Established	No
Notes	Predation and climate probable causes of failure.
Limiting Factors	Predation; Climate
Research Organization	CSIR*
References	169, 173, 387, 1989

RELEASE

Country	Australia
Year	1981
Source	Ex. France
Established	No
Notes	Establishment failure likely due to predation, parasitism and disease.
Limiting Factors	Parasitism; Predation; Disease
Research Organization	CSIRO
References	163, 169, 172, 173, 456

HYPERICACEAE
Hypericum perforatum; Aplocera efformata *(continued)*

RELEASE

Country	Republic of South Africa
Year	1983
Source	Ex. France via Australia
Established	No
Notes	Though released adults successfully laid eggs and larvae hatched, larvae failed to overwinter.
Research Organization	ARC-PPRI
References	173, 660, 992

AGENT

Species	*Aplocera plagiata* (L.)
Past Names/Synonyms	*Anaitis plagiata* L.
Classification	(Lepidoptera: Geometridae)

RELEASE

Country	Australia
Year	1936
Source	Ex. England
Established	No
Notes	Predation and climate probable causes of failure.
Limiting Factors	Predation; Climate
Research Organization	CSIR*
References	169, 173, 387, 726, 1989

HYPERICACEAE
Hypericum perforatum; Aplocera plagiata *(continued)*

RELEASE	
Country	Canada
Year	1967
Source	Ex. Germany
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Initially believed to have failed establishment, but discovered at release site 14 years later. Populations from the three sources (Germany, Switzerland, France) intermixed following establishment and were subsequently not differentiated. Disperses readily throughout southern interior BC but populations remain low and do minimal damage.
Research Organization	AAFC
References	117, 432, 437, 738, 740, 741, 912

RELEASE	
Country	Canada
Year	1977
Source	Ex. Switzerland
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Populations from the three sources (Germany, Switzerland, France) intermixed following establishment and were subsequently not differentiated. Disperses readily throughout southern interior BC but populations remain low and do minimal damage.
Research Organization	AAFC
References	117, 318, 432, 437, 738, 912

HYPERICACEAE
Hypericum perforatum; Aplocera plagiata *(continued)*

RELEASE	
Country	Canada
Year	1980
Source	Ex. France
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Populations from the three sources (Germany, Switzerland, France) intermixed following establishment and were subsequently not differentiated. Disperses readily throughout southern interior BC but populations remain low and do minimal damage.
Research Organization	AAFC
References	117, 432, 437, 738, 912

RELEASE	
Country	United States of America
Year	1989
Source	Ex. France, Germany, Switzerland via Canada
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Where locally abundant, defoliation hinders and may kill plants outright. Overall abundance limited. Most effective in warm, dry areas where the insect can complete two generations.
Limiting Factors	Climate
Research Organization	USDA (10), State (7,9,15)
References	117, 332, 334, 335, 473, 1179, 1503, 1512, 1898

TABLE 1

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT

Species	*Chrysolina brunsvicensis* (Gravenhorst)
Past Names/Synonyms	*Chrysomela brunsvicensis* Gravenhorst
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1930
Source	Ex. England
Established	No
Notes	Establishment failure likely due to predation and unfavorable climatic conditions.
Limiting Factors	Predation; Climate
Research Organization	CSIR*
References	169, 173, 387, 1989

AGENT

Species	*Chrysolina hyperici* (Forster)
Past Names/Synonyms	*Chrysomela hyperici* Forster
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1930
Source	Ex. England
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

HYPERICACEAE
Hypericum perforatum; Chrysolina hyperici *(continued)*

Country	(Australia (continued)
Notes	Not recovered until five years after releases ceased. Initially abundant until outcompeted by *Chrysolina quadrigemina*. Although relatively rare compared to *C. quadrigemina*, more effective in cooler areas. In combination with *C. quadrigemina* provides good control in open areas. Plants frequently recover from defoliation.
Limiting Factors	Interspecific competition; Climate; Habitat
Research Organization	CSIR*
References	169, 173, 387, 455, 1435, 1988, 1989

RELEASE

Country	Australia
Year	1980
Source	Ex. France
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Population selected from part of native range more climatically similar to release sites with high summer rainfall. Assumed established but could not be distinguished from earlier releases. No improvement in control by first introduction; in combination with *Chrysolina quadrigemina* provides good control in open areas and is more effective than *C. quadrigemina* in cooler areas. Plants frequently recover from defoliation.
Limiting Factors	Interspecific competition; Climate; Habitat
Research Organization	CSIRO
References	169, 173, 455, 456, 1989

TABLE 1

HYPERICACEAE
Hypericum perforatum; Chrysolina hyperici *(continued)*

RELEASE	
Country	Canada
Year	1951
Source	Ex. England via Australia via USA (CA, ID, OR)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Contributed to control along with (though not as effective as) *Chrysolina quadrigemina* 5-13 years following release. Does best in cool, moist climates of BC and Maritime provinces; on drier release sites has been completely or partially replaced by *C. quadrigemina*. In recent years populations decreased along with crash in weed population. As weed has been recovering, redistributions of this agent have resumed. Long term impact from this species minimal in cool regions where plants can recover from heavy defoliation in absence of drought stress.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 432, 635, 738, 740, 741, 912, 1285

HYPERICACEAE
Hypericum perforatum; Chrysolina hyperici *(continued)*

RELEASE	
Country	Chile
Year	1953
Source	Ex. England via Australia via USA (CA)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Readily established. Provides effective control in most infestations.
Research Organization	MAC
References	84, 635, 649, 1362, 1889

RELEASE	
Country	New Zealand
Year	1943
Source	Ex. England via Australia
Established	Yes
Abundance	High
General Impact	Variable
Notes	Established rapidly throughout distribution of weed, now frequently occurs in mixed populations with *Chrysolina quadrigemina*. Significant impact in some areas but overall level of control varies both temporally and spatially.
Other Species Attacked	Found feeding and laying eggs on the native *Hypericum involutum* (Labill.) Choisy.
Research Organization	DSIR
References	169, 686, 687, 707, 720, 1064, 1245, 1246, 1771

TABLE 1

HYPERICACEAE
Hypericum perforatum; Chrysolina hyperici *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1960
Source	Ex. England via Australia
Established	No
Research Organization	ARC-PPRI
References	51, 635, 992, 1342

RELEASE	
Country	Republic of South Africa
Year	1973
Source	Ex. England via Australia via USA via Canada
Established	No
Research Organization	ARC-PPRI
References	51, 635, 992

HYPERICACEAE
Hypericum perforatum; Chrysolina hyperici *(continued)*

RELEASE	
Country	United States of America
Year	1945
Source	Ex. England via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Initially credited (along with *Chrysolina quadrigemina*) with causing drastic reductions of the weed in CA and OR. Frequently mixed with populations of *C. quadrigemina* and still considered widespread and abundant in portions of Pacific Northwest, but more often believed to be limited and inferior compared to *C. quadrigemina* throughout western states. Unknown if still established in CA. Does better than *C. quadrigemina* at sites with more moisture and colder winter temperatures.
Limiting Factors	Climate
Research Organization	USDA (7), State (4,6,7,9,15)
References	222, 332, 334, 335, 508, 837, 838, 1179, 1501, 1503, 1731, 1992

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT

Species	*Chrysolina quadrigemina* (Suffrian)
Past Names/Synonyms	*Chrysomela quadrigemina* Suffrian, *Chrysomela gemellata* Rossi, *Chrysolina gemellata* Rossi
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1939
Source	Ex. France (southern)
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Became very common and displaced *Chrysolina hyperici*. Present throughout most of weed range. Has greatly assisted control in open infestations and can cause extensive defoliation over wide areas. Not well adapted to shade and high summer rainfall. Plants frequently recover from defoliation.
Limiting Factors	Climate; Habitat
Research Organization	CSIR*
References	162, 169, 173, 455, 1435, 1988, 1989

HYPERICACEAE
Hypericum perforatum; Chrysolina quadrigemina *(continued)*

RELEASE

Country	Australia
Year	1980
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Population selected from part of native range more climatically similar to release sites with high summer rainfall. Could not be distinguished from earlier releases so impact similar to 1939 introduction: most widespread and effective of *Chrysolina* spp. Has greatly assisted control in open infestations and can cause extensive defoliation over wide areas. Not well adapted to shade and high summer rainfall. Plants frequently recover from defoliation.
Limiting Factors	Climate; Habitat
Research Organization	CSIRO
References	162, 169, 173, 455, 456, 1989

RELEASE

Country	Canada
Year	1952
Source	Ex. France via Australia via USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional

(continued on next page)

TABLE 1

HYPERICACEAE
Hypericum perforatum; Chrysolina quadrigemina *(continued)*

Country	Canada (continued)
Notes	Provided excellent control of weed 5-13 years following release. Frequently mixed with *Chrysolina hyperici* but *C. quadrigemina* is the more effective agent. Does best in warm, dry regions where it has completely or partially replaced *C. hyperici*. In recent years populations decreased along with crash in weed population. As weed has been recovering, redistributions of this agent have resumed.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 432, 437, 635, 734, 735, 738, 740, 741, 912

RELEASE

Country	Chile
Year	1953
Source	Ex. France via Australia via USA (CA)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Readily established. Provides effective control in most infestations.
Research Organization	MAC
References	84, 635, 649, 1362, 1889

HYPERICACEAE
Hypericum perforatum; Chrysolina quadrigemina *(continued)*

RELEASE

Country	Hawaii USA
Year	1965
Source	Ex. France via Australia via USA (CA)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Populations established throughout island of HA. Gives excellent control in combination with *Zeuxidiplosis giardi*.
Research Organization	HDOA
References	326, 401, 405, 411, 612, 635, 1149

RELEASE

Country	New Zealand
Year	1965
Source	Ex. France via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially believed to have failed but found again in 1984. Subsequent releases of second population may have boosted numbers, though unknown if this was only result of first introduction increasing naturally. Species now widely distributed in mixed populations with *Chrysolina hyperici*, though *C. quadrigemina* probably the more significant contributor of the two to high levels of defoliation. Along with *C. hyperici*, causes significant impact in some areas, especially warm regions. Overall program considered a success.
Research Organization	DSIR
References	169, 589, 686, 687, 707, 720, 761, 913, 1064

HYPERICACEAE
Hypericum perforatum; Chrysolina quadrigemina *(continued)*

RELEASE	
Country	New Zealand
Year	1990
Source	Ex. France via Australia via USA via Canada
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	This population believed to be better adapted to New Zealand climatic conditions and released to increase efficacy of first release material. Unknown if the second introduction established; if it did, is indistinguishable from earlier releases, and monitoring was insufficient to say if this population established or not.
Research Organization	DSIR
References	635, 686, 720, 761

RELEASE	
Country	Republic of South Africa
Year	1960
Source	Ex. France via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Caused spectacular damage and the near destruction of dense stands within 2-3 years. Together with *Zeuxidiplosis giardi* has since contained and controlled the weed in WC, where it remains an insignificant invader in a few localized areas.
Research Organization	ARC-PPRI
References	660, 992, 1342, 1386

HYPERICACEAE
Hypericum perforatum; Chrysolina quadrigemina *(continued)*

RELEASE	
Country	United States of America
Year	1946
Source	Ex. France via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Within 10 years of its release, weed population reduced more than 99% in CA. Has since become main factor controlling the weed throughout western USA. At many locations where established, populations of both weed and agent follow boom/bust cycle. Not as effective as *Chrysolina hyperici* at sites with more moisture and colder winter temperatures.
Limiting Factors	Climate
Other Species Attacked	Attacks the native *Hypericum concinnum* Benth. and the exotic *H. calycinum* L.
Research Organization	USDA (7), State (4,6,7,9)
References	133, 222, 332, 334, 335, 508, 837, 838, 863, 1179, 1501, 1503, 1578, 1731

TABLE 1

TABLE 1

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT

Species	*Chrysolina varians* (Schaller)
Past Names/Synonyms	*Chrysomela varians* (Schaller)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1930
Source	Ex. England
Established	No
Notes	Establishment failure likely due to predation and unfavorable climatic conditions.
Limiting Factors	Predation; Climate
Research Organization	CSIR*
References	169, 173, 387, 1989

RELEASE

Country	Canada
Year	1957
Source	Ex. Sweden
Established	No
Notes	Establishment failure of initial release likely due to release sites being too dry. Second release initially established but failed to persist.
Limiting Factors	Climate
Research Organization	AAFC
References	117, 740, 741, 912

HYPERICACEAE
Hypericum perforatum; Chrysolina varians *(continued)*

RELEASE

Country	United States of America
Year	1950
Source	Ex. Europe
Established	No
Research Organization	USDA (7), State (4)
References	41, 222, 740, 1503

AGENT

Species	*Zeuxidiplosis giardi* (Kieffer)
Classification	(Diptera: Cecidomyiidae)

RELEASE

Country	Australia
Year	1953
Source	Ex. France via USA (CA)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed though not common. Populations not large enough to contribute significantly to control.
Research Organization	CSIRO
References	173, 455, 1989

HYPERICACEAE
Hypericum perforatum; Zeuxidiplosis giardi *(continued)*

RELEASE	
Country	Canada
Year	1955
Source	Ex. France via USA (CA)
Established	No
Notes	Populations thrived the first summer of release but were subsequently annihilated due to sudden sub-zero temperatures in mid-November.
Limiting Factors	Climate
Research Organization	AAFC
References	635, 740, 741, 912

RELEASE	
Country	Hawaii USA
Year	1965
Source	Ex. France via USA (CA) via Australia via New Zealand
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Establishment extensive on HA. Provides excellent control in combination with *Chrysolina quadrigemina*.
Research Organization	HDOA
References	326, 401, 405, 411, 612, 635, 1149

HYPERICACEAE
Hypericum perforatum; Zeuxidiplosis giardi *(continued)*

RELEASE	
Country	New Zealand
Year	1961
Source	Ex. France via USA (CA) via Australia
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Well established only in northern parts of South Island. Unlikely to contribute significantly to control but not formally evaluated so impact on plant populations unknown.
Research Organization	DSIR
References	631, 635, 707, 720, 1064, 1068

RELEASE	
Country	Republic of South Africa
Year	1972
Source	Ex. France via USA (CA) via Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Causes death of seedlings and reduces growth and flowering. In conjunction with *Chrysolina quadrigemina* has since contained and controlled the weed in WC, where it remains an insignificant invader in a few localized areas.
Limiting Factors	Parasitism
Research Organization	ARC-PPRI
References	51, 173, 660, 661, 662, 992, 1386

TABLE 1

HYPERICACEAE
Hypericum perforatum; Zeuxidiplosis giardi *(continued)*

RELEASE

Country	United States of America
Year	1950
Source	Ex. France
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Reduces growth in heavily infested plants. Heavily parasitized so populations limited. Seems to prefer damp locations with moderate to high relative humidity and high elevations.
Limiting Factors	Parasitism; Climate
Other Species Attacked	Found reproducing on the native *Hypericum concinnum* Benth. though in low numbers.
Research Organization	USDA (7), State (4,6,7,9)
References	20, 41, 222, 235, 236, 242, 332, 334, 635, 1501, 1503, 1731

RELEASE

Country	United States of America
Year	1992
Source	Ex. France via USA (CA) via Australia via New Zealand via Hawaii USA
Established	No
Notes	Several releases of adults were made, none of which established.
Research Organization	State (15)
References	332, 334, 635

LAMIACEAE

WEED

Family	Lamiaceae
Species	*Clerodendrum chinense* (Osbeck) Mabb.
Past Names/Synonyms	*Clerodendrum philippinum* Schauer, *Clerodendrum fragans* Vent.
Origin	India, Myanmar, China, Laos, Cambodia, Vietnam
Common Name	Honolulu rose

AGENT

Species	*Phyllocharis undulata* (L.)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Thailand
Year	1990
Source	Ex. Vietnam
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established and spreading slowly 7 years following release. More recent status unknown.
Research Organization	NBCRC
References	1326, 1329, 1330

LAMIACEAE *(continued)*

WEED

Family	Lamiaceae
Species	*Marrubium vulgare* L.
Origin	southern and western Europe, central and western Asia, North Africa
Common Name	horehound

AGENT

Species	*Chamaesphecia mysiniformis* Rambur
Classification	(Lepidoptera: Sesiidae)

RELEASE

Country	Australia
Year	1997
Source	Ex. Spain
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Causing plant mortality at release sites on mainland. Formal evaluation of impact lacking. No evidence of successful establishment in TAS when surveys last conducted in early 2012; high level of egg predation suspected.
Limiting Factors	Predation
Research Organization	VIC State, UASA, NSW State
References	284, 883, 1956, 1975

LAMIACEAE
Marrubium vulgare (continued)

AGENT

Species	*Wheeleria spilodactylus* (Curtis)
Past Names/Synonyms	*Pterophorus spilodactylus* Curtis
Classification	(Lepidoptera: Pterophoridae)

RELEASE

Country	Australia
Year	1994
Source	Ex. France
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Additional importation from France made in 1997 and released in SA; fared much better in field than the inbred first. Widely established. In moderate to high rainfall areas (>450mm) suppresses plant growth and reduces seed production.
Limiting Factors	Climate; Inbreeding of starter colony (first introduction)
Research Organization	VIC State, SA State, NSW State
References	284, 1418, 1954, 1955, 1956, 1957, 1975

TABLE 1

LAMIACEAE
Marrubium vulgare; Wheeleria spilodactylus *(continued)*

RELEASE

Country	Australia
Year	1997
Source	Ex. Spain
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Though released separately, this second introduction (from Spain) could now be intermixed in the field. Increasingly common. In moderate to high rainfall areas (>450mm) suppresses plant growth and reduces seed production.
Limiting Factors	Climate
Research Organization	VIC State, SA State, NSW State
References	284, 1954, 1955, 1956

WEED

Family	Lamiaceae
Species	*Salvia aethiopis* L.
Origin	Eurasia
Common Name	Mediterranean sage

AGENT

Species	*Phrydiuchus spilmani* Warner
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1969
Source	Ex. Italy
Established	No
Research Organization	USDA (7,12), State (15)
References	43, 332, 334, 336, 341

LAMIACEAE
Salvia aethiopis *(continued)*

AGENT

Species	*Phrydiuchus tau* Warner
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	United States of America
Year	1971
Source	Ex. Former Yugoslavia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Abundant in portions of CA, OR and ID; limited in other regions where established. High weevil populations associated with decreased *Salvia aethiopis* densities in communities with high competing perennial grasses. In salt desert scrub, annual grass-dominated and heavily grazed communities, little change in *S. aethiopis* density despite good weevil presence.
Limiting Factors	Habitat; Land use
Research Organization	USDA (7,12), State (6,14,15)
References	43, 332, 334, 336, 341, 1578, 1905, 1908

LORANTHACEAE

WEED

Family	Loranthaceae
Species	*Phthirusa stelis* (L.) Kuijt
Past Names/Synonyms	*Phthirusa adunca* (G.Mey.) Maguire, *Phthirusa* spp.
Origin	South America
Common Name	bird vine
References	1030

AGENT

Species	*Ceratitella tomentosa* De Meijere
Past Names/Synonyms	*Ceratitella asiatica* Hardy
Classification	(Diptera: Tephritidae)

RELEASE

Country	Trinidad and Tobago
Year	1978
Source	Ex. Pakistan
Established	No
Notes	Although adults lived for up to 29 days on Trinidad, no recoveries made at release site.
Research Organization	IIBC
References	288, 318, 319, 629

LYGODIACEAE

WEED

Family	Lygodiaceae
Species	*Lygodium microphyllum* (Cav.) R. Br.
Origin	Australia, Africa, Asia, Oceania
Common Name	Old World climbing fern

AGENT

Species	*Austromusotima camptozonale* (Hampson)
Past Names/Synonyms	*Cataclysta camptozonale* (Hampson)
Classification	(Lepidoptera: Crambidae)

RELEASE

Country	United States of America
Year	2004
Source	Ex. Australia
Established	No
Notes	Both *Neochetina* weevils responsible for significant reduction in water hyacinth extent. Weed now considered under substantial control on Lake Victoria, possibly aided by wind and wave action and weather events. On rivers in Tanga Region, weevils reduced amount of manual removal required to keep river channels open.
Limiting Factors	Predation; Low fertility
Research Organization	USDA (3,4), CSIRO
References	142, 145, 148, 237

TABLE 1

LYGODIACEAE
Lygodium microphyllum *(continued)*

AGENT	
Species	*Floracarus perrepae* Knihinicki & Boczek
Classification	(Acari: Eriophyidae)

RELEASE	
Country	United States of America
Year	2008
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Too early post release
Notes	Though released widely, only established and persisted at limited number of sites. Variations in response to galling might be attributed to genetic differences in susceptibility to gall induction between different geographic populations of *Lygodium microphyllum*.
Limiting Factors	Host plant resistance
Research Organization	USDA (4), CSIRO
References	143, 147, 1698

LYGODIACEAE
Lygodium microphyllum *(continued)*

AGENT	
Species	*Neomusotima conspurcatalis* (Warren)
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	United States of America
Year	2008
Source	Ex. Australia
Established	Yes
Abundance	Variable
General Impact	Too early post release
Notes	Though too early to evaluate overall impact, well established across wide areas of southeastern FL with period outbreak populations. Outbreaks of agent cause substantial damage to weed. Some regrowth from dormant lateral buds occurs after defoliation events; however regrowth subject to oviposition and subsequent rounds of larval defoliation. Low winter temperatures cause drastic population reductions of agent and enable partial recovery of fern. Several species of native parasitoid attack agent, but parasitism rates generally low and not likely high enough to substantially impact agent populations.
Limiting Factors	Climate
Research Organization	USDA (4), CSIRO
References	143, 144, 146, 148, 237, 1031, 1528

LYTHRACEAE

WEED

Family	Lythraceae
Species	*Lythrum salicaria* L.
Origin	Europe, northern Africa, Asia
Common Name	purple loosestrife

AGENT

Species	*Galerucella calmariensis* (L.)
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Canada
Year	1992
Source	Ex. Germany
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	The most widely released agent on *Lythrum salicaria* in Canada due to its ease of rearing, reproduction, and redistribution. Frequently occurs with *Galerucella pusilla*. Together have provided excellent control throughout majority of the weed's range.
Other Species Attacked	Limiting feeding has been observed in the field on the native *Lythrum alatum* Pursh and *Decodon verticillatus* (L.) Elliott, though this is believed to be temporary spillover.
Research Organization	AAFC
References	347, 432, 437, 480, 794, 1097

LYTHRACEAE
Lythrum salicaria; Galerucella calmariensis *(continued)*

RELEASE

Country	United States of America
Year	1992
Source	Ex. Germany
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Well established in some states, infrequent in others. *Galerucella calmariensis* generally more abundant than *G. pusilla*, but the reverse is true at some sites for unknown reasons. High densities of *Galerucella* spp. have heavy impact by reducing seed production and stunting growth. At some sites, plant density has decreased up to 90%, though at others density remains unchanged. Boom-bust cycles common for this system: as agent populations build, greater dispersal results in increases in weed population, followed by increases in agent populations. Impact greatest in mixed plant communities that provide competition to recovering *Lythrum salicaria*. Agents do best in habitats where dry overwintering sites available. Predation may limit populations at some locations.
Limiting Factors	Habitat; Predation

(continued on next page)

TABLE 1

TABLE 1

LYTHRACEAE
Lythrum salicaria; Galerucella calmariensis *(continued)*

Country	United States of America (continued)
Other Species Attacked	Following mass outbreaks of beetles, limited spillover feeding observed on the native *Salix discolor* Muhl., *Potentilla anserina* L., *Cornus stolonifera* Michx. (whose name has since been changed to *Cornus sericea* L. subsp. *sericea*) and the exotic *Rosa multiflora* Thunb. Temporary adult feeding recorded on the native *Decodon verticillatus* (L.) Elliott and *Lythrum alatum* Pursh. (the latter only recorded in Canada). Spillover feeding on *Lagerstroemia indica* L. in a post-release open-field test near a mass outbreak of weevils, though reproduction did not occur on this species; no attack has thus far been recorded on *L. indica* outside of this field experiment.
Research Organization	USFWS, State (34,32,15); Additional contributions from State (1,9,31,37,38,39,42), USDA
References	127, 128, 130, 131, 335, 673, 794, 1073, 1105, 1432, 1507, 1624, 1694, 1896, 1901, 1903, 1909, 1910

LYTHRACEAE
Lythrum salicaria *(continued)*

AGENT	
Species	*Galerucella pusilla* (Duftschmidt)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Canada
Year	1992
Source	Ex. Germany
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Frequently occurs with *Galerucella calmariensis*. Together have provided excellent control throughout majority of the weed's range. Initially widespread but more recent surveys indicate most *Galerucella* populations consist primarily or wholly of *G. calmariensis*.
Research Organization	AAFC
References	117, 347, 432, 437, 480, 794, 1097

LYTHRACEAE
Lythrum salicaria; Galerucella pusilla *(continued)*

RELEASE

Country United States of America
Year 1992
Source Ex. Germany
Established Yes
Abundance Variable
General Impact Variable
Notes Well established in some states, infrequent in others. *Galerucella calmariensis* generally more abundant than *G. pusilla*, but the reverse is true at some sites for unknown reasons. High densities of *Galerucella* spp. have heavy impact by reducing seed production and stunting growth. At some sites, plant density has decreased up to 90%, though at others density remains unchanged. Boom-bust cycles common for this system: as agent populations build, greater dispersal results in increases in weed population, followed by increases in agent populations. Impact greatest in mixed plant communities that provide competition to recovering *Lythrum salicaria*. Agents do best in habitats where dry overwintering sites available. Predation may limit populations at some locations.
Limiting Factors Habitat; Predation

(continued at top of next column)

LYTHRACEAE
Lythrum salicaria; Galerucella pusilla *(continued)*

Country United States of America (continued)
Other Species Attacked Following mass outbreaks of beetles, limited spillover feeding observed on the native *Salix discolor* Muhl., *Potentilla anserina* L., *Cornus stolonifera* Michx. (whose name has since been changed to *Cornus sericea* L. subsp. *sericea*) and the exotic *Rosa multiflora* Thunb. Temporary adult feeding recorded on the native *Decodon verticillatus* (L.) Elliott and *Lythrum alatum* Pursh. (the latter only recorded in Canada). Spillover feeding on *Lagerstroemia indica* L. in a post-release open-field test near a mass outbreak of weevils, though reproduction did not occur on this species; no attack has thus far been recorded on *L. indica* outside of this field experiment.
Research Organization USFWS, State (34,32,15); Additional contributions from State (1,9,31,37,38,39,42), USDA
References 126, 127, 128, 130, 335, 673, 794, 1073, 1105, 1507, 1624, 1694, 1896, 1901, 1903, 1909, 1910

TABLE 1

LYTHRACEAE
Lythrum salicaria *(continued)*

AGENT	
Species	*Hylobius transversovittatus* (Goeze)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Canada
Year	1992
Source	Ex. Germany, Finland
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	The limited populations and cryptic nature make this species difficult to study so its current status in Canada is largely unknown and requires further study.
Research Organization	AAFC
References	117, 125, 128, 347, 432, 437, 794, 1097, 1138

LYTHRACEAE
Lythrum salicaria; Hylobius transversovittatus *(continued)*

RELEASE	
Country	United States of America
Year	1991
Source	Ex. Germany
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Slower to disperse and reproduce than other established agents. Believed to have well established populations in WA and ID, but largely limited elsewhere. Extensive root feeding by this agent can complement defoliation by *Galerucella* spp., sometimes resulting in plant death. However, establishment and impact both difficult to assess as larvae are hidden feeders and adults are active at night.
Research Organization	USFWS, State (34), USDA (10,14), State (32,15); Additional contributions from State (1,9,14,43,31,37,38,39,42), USDA
References	83, 127, 128, 129, 332, 335, 794, 925, 1507, 1512, 1901, 1903, 1909, 1911

LYTHRACEAE
Lythrum salicaria *(continued)*

AGENT	
Species	*Nanophyes marmoratus* (Goeze)
Classification	(Coleoptera: Nanophyidae)

RELEASE	
Country	Canada
Year	1997
Source	Ex. Germany
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	AAFC
References	37, 132, 347, 437, 1097

RELEASE	
Country	United States of America
Year	1994
Source	Ex. France, Germany
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

LYTHRACEAE
Lythrum salicaria; Nanophyes marmoratus *(continued)*

Country	United States of America (continued)
Notes	Feeding on floral buds often results in abortion and failure to produce seeds, which does not kill plants but reduces population spread. Populations typically limited, but may be an important agent at sites with decreasing *Lythrum salicaria* and smaller populations of other agents. Does not do well at sites with high populations of *Galerucella* spp. (the more effective agents) as heavy defoliation by the leaf-feeders reduces food availability.
Limiting Factors	Interspecific competition
Research Organization	USFWS, State (34,15,9,32); Additional contributions from State (14,31,37,38)
References	127, 128, 129, 332, 334, 335, 1105, 1432, 1502, 1507, 1512, 1752, 1893, 1901, 1903, 1909

TABLE 1

MALVACEAE

TABLE 1

WEED	
Family	Malvaceae
Species	*Sida acuta* Burm. f.
Origin	tropical Americas
Common Name	spinyhead sida, broomweed, broom stick
AGENT	
Species	*Calligrapha pantherina* Stål
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1989
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Causes severe defoliation, reducing seed production and plant density. Maximum impact on coastal and sub-coastal stands. Survival during severe dry season can be poor as often needs to be reintroduced to areas where high densities present the previous dry season.
Limiting Factors	Climate
Research Organization	CSIRO, NT, QLD State
References	569, 577, 766, 769, 773, 1114, 1983

MALVACEAE
Sida acuta; Calligrapha pantherina *(continued)*

RELEASE	
Country	Fiji
Year	2002
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Providing effective control.
Research Organization	SPC
References	418, 427, 769, 951, 1125, 1401

RELEASE	
Country	Papua New Guinea
Year	2000
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Severe infestations brought under control within 12 months. Still spreading to additional provinces.
Research Organization	SPC
References	427, 769, 971, 1039, 1403

MALVACEAE
Sida acuta; Calligrapha pantherina *(continued)*

RELEASE	
Country	Samoa
Year	pre 1998
Source	Ex. Unknown
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	418

RELEASE	
Country	Vanuatu
Year	2005
Source	Ex. Mexico via Australia via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Confirmed under control on all islands that have been surveyed.
Research Organization	SPC, DLQS
References	203, 204, 418, 427, 769, 1401, 1402

MALVACEAE
Sida acuta *(continued)*

AGENT	
Species	*Eutinobothrus pilosellus* (Boheman)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1997
Source	Ex. Mexico
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Survived first dry season following release but subsequent status unknown.
Research Organization	CSIRO, NT
References	766, 769, 1418

AGENT	
Species	*Eutinobothrus* sp.
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1994
Source	Ex. Mexico
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Survived first dry season following release but subsequent status unknown.
Research Organization	CSIRO, NT
References	423, 766, 769

TABLE 1

TABLE 1

MALVACEAE *(continued)*

WEED

Family	Malvaceae
Species	*Sida rhombifolia* L.
Origin	tropical Americas
Common Name	Paddy's lucerne, common sida, broomweed, broom stick

AGENT

Species	*Calligrapha pantherina* Stål
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1989
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established at few sites in coastal northern QLD but failed to establish in southern QLD. Poorer performance on *Sida rhombifolia* than *S. acuta* thought to be due to climatic factors relating to *S. rhombifolia*'s distribution.
Limiting Factors	Climate
Research Organization	CSIRO, QLD State
References	577, 766, 769, 773

MALVACEAE
Sida rhombifolia; Calligrapha pantherina (continued)

RELEASE

Country	Fiji
Year	2002
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Providing effective control.
Research Organization	SPC
References	418, 427, 769, 951, 1125, 1401

RELEASE

Country	Papua New Guinea
Year	2000
Source	Ex. Mexico via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Severe infestations brought under control within 12 months. Still spreading to additional provinces.
Research Organization	SPC
References	427, 769, 971, 1039, 1403

RELEASE

Country	Samoa
Year	pre 1998
Source	Ex. Unknown
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	427

MALVACEAE
Sida rhombifolia; Calligrapha pantherina *(continued)*

RELEASE	
Country	Vanuatu
Year	2005
Source	Ex. Mexico via Australia via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Confirmed under control on all islands that have been surveyed. In Vanuatu, *Sida rhombifolia* is not as problematic as the closely related *S. acuta* so biocontrol impact on *S. rhombifolia* is no longer recorded.
Research Organization	SPC, DLQS
References	203, 204, 418, 427, 769, 1401, 1402

MALVACEAE
Sida rhombifolia *(continued)*

AGENT	
Species	*Eutinobothrus pilosellus* (Boheman)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1998
Source	Ex. Mexico
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Survived first dry season following release but subsequent status unknown.
Research Organization	CSIRO
References	766, 769, 1418

AGENT	
Species	*Eutinobothrus* sp.
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Australia
Year	1994
Source	Ex. Mexico
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Survived first dry season following release but subsequent status unknown.
Research Organization	CSIRO, NT
References	766, 769

TABLE 1

MELASTOMATACEAE

WEED	
Family	Melastomataceae
Species	*Clidemia hirta* (L.) D. Don
Origin	tropical Central and South America, Caribbean
Common Name	Koster's curse, the curse

AGENT	
Species	*Antiblemma acclinalis* Hübner
Classification	(Lepidoptera: Erebidae)

RELEASE	
Country	Hawaii USA
Year	1995
Source	Ex. Tobago
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established on OA and KA but rare, likely from parasitism.
Limiting Factors	Parasitism
Research Organization	HDOA
References	323, 326, 385, 386, 762, 1169

MELASTOMATACEAE
Clidemia hirta *(continued)*

AGENT	
Species	*Ategumia matutinalis* (Guenée)
Incorrect Past Names/Synonyms	*Ategumia ebulealis* (Guenée), *Blepharomastix ebulealis* Guenée
Classification	(Lepidoptera: Crambidae)
References	324, 783

RELEASE	
Country	Hawaii USA
Year	1970
Source	Ex. Puerto Rico, Trinidad
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Although established, heavily parasitized so populations are suppressed and have had little impact on *Clidemia hirta*.
Limiting Factors	Parasitism
Other Species Attacked	Also feeds on the exotic *Melastoma septemnervium* Lour. and *Tibouchina semidecandra* (Schrank & Mart. ex DC.) Cogn. though impact is believed to be negligible.
Research Organization	HDOA
References	324, 402, 403, 762, 1147, 1321, 1562, 1959

MELASTOMATACEAE
Clidemia hirta; Ategumia matutinalis *(continued)*

RELEASE

Country	Palau
Year	1972
Source	Ex. Puerto Rico, Trinidad via Hawaii USA
Established	No
Research Organization	UOG
References	324, 1627

AGENT

Species	*Carposina bullata* Meyrick
Classification	(Lepidoptera: Carposinidae)

RELEASE

Country	Hawaii USA
Year	1995
Source	Ex. Trinidad, Tobago
Established	No
Notes	OA releases likely failed due to low numbers (3 and 4 individuals in 1995 and 1998 respectively). Insects established initially on HA (recovered 2002) but never recovered again for reasons unknown.
Limiting Factors	Small release size
Research Organization	HDOA
References	324, 326, 385, 386, 1169

MELASTOMATACEAE
Clidemia hirta *(continued)*

AGENT

Species	*Colletotrichum clidemiae* B. Weir & P.R. Johnst.
Past Names/Synonyms	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f.sp. *clidemiae* E.E. Trujillo, Latterell & A.E. Rossi
Classification	(Sordariomycetes: Incertae sedis)
References	987, 1967

RELEASE

Country	Hawaii USA
Year	1986
Source	Ex. Panama
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	During variable outbreaks diseased plants common throughout all islands in cool, wet, windy areas, resulting in frequent defoliation. However impact typically low as infected plants often regenerate quickly. Natural dispersal of this fungus uncommon due to its production of spores in a mucoid mass. A volunteer-assisted redistribution program was initiated to aid in repeated inoculations and spread of this pathogen.
Limiting Factors	Climate
Research Organization	HDOA
References	253, 323, 324, 325, 326, 385, 489, 1147, 1825, 1826

TABLE 1

MELASTOMATACEAE
Clidemia hirta *(continued)*

AGENT	
Species	*Liothrips urichi* Karny
Classification	(Thysanoptera: Phlaeothripidae)

RELEASE	
Country	American Samoa
Year	1974
Source	Ex. Trinidad via Fiji
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Believed to have provided reasonable level of control; inhibits growth and vigor of weed, preventing it from becoming dominant. Recent though very limited surveys yielded only isolated or patchy plants and no agents.
References	324, 331, 1712, 1779, 1885, 1940

RELEASE	
Country	Fiji
Year	1930
Source	Ex. Trinidad
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Excellent control in most areas. Able to reduce regrowth and competitive ability of weed. Little effect in very wet areas under dense shade or where grazing is intense as competing vegetation is unable to suppress the weed.
Limiting Factors	Climate; Habitat; Land use
Research Organization	DAF
References	288, 324, 606, 1373, 1547, 1682, 1683, 1684, 1686

MELASTOMATACEAE
Clidemia hirta; Liothrips urichi *(continued)*

RELEASE	
Country	Hawaii USA
Year	1953
Source	Ex. Trinidad via Fiji
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Provides excellent control in open pastureland of OA and MA but ineffective in shaded, forested watershed and conservation areas of both islands. Infrequently encountered on HA, even in open habitat.
Limiting Factors	Habitat; Predation
Research Organization	HDOA
References	325, 405, 489, 612, 762, 1147, 1561, 1563, 1949, 1959

RELEASE	
Country	Palau
Year	1972
Source	Ex. Trinidad via Fiji via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Effective primarily in sunny areas.
Limiting Factors	Habitat
Research Organization	UOG
References	324, 1627

MELASTOMATACEAE
Clidemia hirta; Liothrips urichi *(continued)*

RELEASE

Country	Solomon Islands
Year	1938
Source	Ex. Trinidad via Fiji
Established	No
Notes	Establishment failure largely due to the very small numbers which survived the journey.
Limiting Factors	Small release size
Research Organization	MAL
References	288, 324, 1093, 1548

RELEASE

Country	Solomon Islands
Year	1973
Source	Ex. Trinidad via Fiji
Established	No
Research Organization	MAL
References	324, 1126

AGENT

Species	*Lius poseidon* Napp
Classification	(Coleoptera: Buprestidae)

RELEASE

Country	Hawaii USA
Year	1988
Source	Ex. Trinidad
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

MELASTOMATACEAE
Clidemia hirta; Lius poseidon *(continued)*

Country	Hawaii USA (continued)
Notes	Widespread throughout islands but uncommon. Damage may be greater in combination with *Liothrips urichi*, though damage to weed overall appears minimal. Parasitism may be factor.
Limiting Factors	Parasitism
Research Organization	HDOA
References	323, 324, 325, 326, 385, 489, 762, 1147, 1169

AGENT

Species	*Mompha trithalama* Meyrick
Classification	(Lepidoptera: Momphidae)

RELEASE

Country	Hawaii USA
Year	1995
Source	Ex. Trinidad, Tobago
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Possible impact on viable seed production but needs formal evaluation. Widespread distribution and high abundance for multiple years indicate impact is low. Parasitism recently documented on island of HA.
Limiting Factors	Parasitism
Research Organization	HDOA
References	324, 325, 326, 385, 386, 762, 1169

TABLE 1

MELASTOMATACEAE *(continued)*

WEED

Family	Melastomataceae
Species	*Melastoma septemnervium* Lour.
Past Names/Synonyms	*Melastoma candidum* D. Don
Incorrect Past Names/Synonyms	*Melastoma malabathricum* L.
Notes	Initially incorrectly identified as *Melastoma malabathricum* L. but subsequently corrected to *M. candidum* D. Don, a name that has since been synonymized with *M. septemnervium* Lour.
Origin	southeast Asia
Common Name	Asian melastome; sometimes referred to as Indian rhododendron or Malabar melastome which were the common names of the incorrectly identified *Melastoma malabathricum*
References	326, 1924

AGENT

Species	*Ategumia adipalis* (Lederer)
Past Names/Synonyms	*Bocchoris adipalis* (Lederer)
Classification	(Lepidoptera: Crambidae)

RELEASE

Country	Hawaii USA
Year	1965
Source	Ex. Singapore, Malaysia (mainland)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Low population levels; ineffective control.
Research Organization	HDOA
References	325, 405, 411, 612, 762

MELASTOMATACEAE
Melastoma septemnervium *(continued)*

AGENT

Species	*Ategumia fatualis* (Lederer)
Past Names/Synonyms	*Bocchoris fatualis* (Lederer)
Classification	(Lepidoptera: Crambidae)

RELEASE

Country	Hawaii USA
Year	1958
Source	Ex. Philippines
Established	Yes
Abundance	Limited
General Impact	None
Notes	Low population levels; ineffective control.
Research Organization	HDOA
References	398, 405, 406, 411, 612, 762, 1025, 1169

MELASTOMATACEAE
Melastoma septemnervium (continued)

AGENT	
Species	*Rhynchopalpus brunellus* Hampson
Past Names/Synonyms	*Selca brunella* Hampson
Classification	(Lepidoptera: Nolidae)

RELEASE	
Country	Hawaii USA
Year	1965
Source	Ex. Singapore, Malaysia (mainland)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	In heavily infested localities foliar skeletonizing is moderate and fruits attacked, but control only partial.
Other Species Attacked	Also attacks the exotic (occasionally cultivated) *Melastoma sanguineum* Sims and found established on the exotic *Tibouchina urvilleana* (DC.) Cogn.
Research Organization	HDOA
References	325, 326, 401, 405, 411, 612, 635, 762, 836

MELASTOMATACEAE *(continued)*

WEED	
Family	Melastomataceae
Species	*Miconia calvescens* DC.
Origin	tropical Americas
Common Name	miconia

AGENT	
Species	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f.sp. *miconiae* Killgore & L. Sugiyama
Classification	(Sordariomycetes: Incertae sedis)

RELEASE	
Country	French Polynesia
Year	2000
Source	Ex. Brazil via Hawaii USA
Established	Yes
Abundance	High
General Impact	Variable
Notes	Causes significant mortality of seedlings and partial defoliation of large plants which increases light penetration, in turn increasing recruitment by native species. Impact largely restricted to higher elevations with cool temperatures and high humidity.
Limiting Factors	Climate
Research Organization	HDOA, DRFP
References	1234, 1235, 1237, 1238

TABLE 1

MELASTOMATACEAE
Miconia calvescens; Colletotrichum gloeosporioides *(continued)*

TABLE 1

RELEASE	
Country	Hawaii USA
Year	1997
Source	Ex. Brazil
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Can cause premature leaf drop in saplings, however restricted to wet and windy climatic conditions.
Limiting Factors	Climate
Research Organization	HDOA
References	325, 326, 386, 981

MYRICACEAE

WEED	
Family	Myricaceae
Species	*Morella faya* (Aiton) Wilbur
Past Names/Synonyms	*Myrica faya* Aiton
Origin	Azores, Madeira and Canary Islands
Common Name	firebush, firetree, faya, fayatree
References	678, 1100

AGENT	
Species	*Caloptilia coruscans* (Walsingham)
Past Names/Synonyms	*Caloptilia schinella* (Walsingham), *Caloptilia* nr *schinella* (Walsingham)
Incorrect Past Names/Synonyms	*Phyllonorycter myricae* Deschka
Classification	(Lepidoptera: Gracillariidae)

RELEASE	
Country	Hawaii USA
Year	1991
Source	Ex. Azores, Madeira
Established	Yes
Abundance	Limited
General Impact	None
Notes	Established in only a few regions on island of HA. Largely no measurable effect, likely due to parasitism and predation.
Limiting Factors	Parasitism; Predation
Research Organization	USDA, HDOA
References	326, 386, 1083, 1145

MYRICACEAE
Morella faya *(continued)*

AGENT

Species	*Septoria hodgesii* D.E. Gardner
Classification	(Dothideomycetes: Capnodiales)

RELEASE

Country	Hawaii USA
Year	1997
Source	Ex. USA (NC)
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Though initially established at all release sites, appeared to have no effect on weed populations. Has not been monitored recently.
Research Organization	HDOA
References	325, 326, 386

AGENT

Species	*Strepsicrates smithiana* Walsingham
Incorrect Past Names/Synonyms	*Eucosma smithiana* (Walsingham)
Classification	(Lepidoptera: Tortricidae)

RELEASE

Country	Hawaii USA
Year	1956
Source	Ex. USA (FL, GA)
Established	No
Other Species Attacked	Not established on *Morella faya* (Aiton) Wilbur on which it was released, but became established on the closely related but less problematic southern wax myrtle, *Morella cerifera* (L.) Small, on Hawaii.
Research Organization	HDOA
References	44, 386, 400, 406, 612, 1083, 1952

MYRTACEAE

WEED

Family	Myrtaceae
Species	*Leptospermum laevigatum* (Gaertn.) F. Muell.
Origin	Australia
Common Name	Australian myrtle

AGENT

Species	*Aristaea thalassias* (Meyrick)
Past Names/Synonyms	*Parectopa thalassias* Meyrick
Classification	(Lepidoptera: Gracillariidae)

RELEASE

Country	Republic of South Africa
Year	1996
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Repeated mining and abscission of young leaves on seedlings can reduce their vigor and growth, but mature *Leptospermum laevigatum* trees are largely unaffected. Even in combination with *Dasineura strobila*, at some sites may contribute to a reduction in the growth and stature of *L. laevigatum* seedlings, but overall suppression of the weed is negligible.
Research Organization	ARC-PPRI
References	654, 657, 992

TABLE 1

MYRTACEAE
Leptospermum laevigatum *(continued)*

AGENT	
Species	*Dasineura strobila* Dorchin
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	Republic of South Africa
Year	1997
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced and redistributed, though was then found to be already established. Both populations subsequently not differentiated in the literature. Initially developed very dense populations until it acquired several species of local predatory mites and parasitic wasps that caused a marked decline in population levels. In combination with *Aristaea thalassias*, at some sites may contribute to a reduction in the growth and stature of *Leptospermum laevigatum* seedlings, but overall suppression of the weed is negligible.
Limiting Factors	Predation
Research Organization	ARC-PPRI
References	517, 654, 657, 658, 992

MYRTACEAE *(continued)*

WEED	
Family	Myrtaceae
Species	*Melaleuca quinquenervia* (Cav.) S. T. Blake
Origin	Australia, New Caledonia, New Guinea
Common Name	melaleuca, broad-leaved paperbark

AGENT	
Species	*Boreioglycaspis melaleucae* Moore
Classification	(Hemiptera: Psyllidae)

RELEASE	
Country	United States of America
Year	2002
Source	Ex. Australia
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Well established throughout FL, though seasonably variable and densities greatest in south. In combination with *Oxyops vitiosa* and *Puccinia psidii*, causes severe damage to mature melaleuca trees through reduced plant height, branching and biomass of surviving coppices as well as increased fruit abortion and seedling/sapling mortality. Saliva thought to be phytotoxic and cause premature leaf drop. Summer temperatures possibly reduce population growth; predation by generalists sometimes significant. Small population found near Los Angeles International Airport in CA in 2009. Unknown if originated from FL population, or native population in Australia.

(continued on next page)

MYRTACEAE; *Melaleuca quinquenervia*
Boreioglycaspis melaleucae* *(continued)

RELEASE

Country	United States of America (continued)
Limiting Factors	Climate; Predation
Research Organization	USDA (3,4)
References	80, 243, 244, 245, 246, 254, 1529, 1530, 1551

AGENT

Species	*Fergusobia quinquenerviae* Davies & Giblin-Davis
Classification	(Tylenchida: Neotylenchidae)

RELEASE

Country	United States of America
Year	2005
Source	Ex. Australia
Established	No
Notes	*Fergusobia quinquenerviae* is a mutualistic nematode of the fly *Fergusonina turneri* that is deposited with eggs of the fly and appears to initiate gall formation. Both were released together. Failed to establish despite effort to increase number of individuals released and improve release timing with susceptible stage of host (buds). Along with *F. turneri* temporarily colonized release sites, but disappeared completely after three generations.
Research Organization	USDA (3,4)
References	237, 245, 246, 626, 875

MYRTACEAE
Melaleuca quinquenervia *(continued)*

TABLE 1

AGENT

Species	*Fergusonina turneri* Taylor
Classification	(Diptera: Fergusoninidae)

RELEASE

Country	United States of America
Year	2005
Source	Ex. Australia
Established	No
Notes	*Fergusobia quinquenerviae* is a mutualistic nematode of the fly *Fergusonina turneri* that is deposited with eggs of the fly and appears to initiate gall formation. Both were released together. Failed to establish despite effort to increase number of individuals released and improve release timing with susceptible stage of host (buds). Along with *F. quinquenerviae* temporarily colonized release sites, but disappeared completely after three generations.
Research Organization	USDA (3,4)
References	237, 245, 246, 626, 875

TABLE 1

MYRTACEAE
Melaleuca quinquenervia *(continued)*

AGENT	
Species	*Lophodiplosis trifida* Gagné
Classification	(Diptera: Cecidomyiidae)

RELEASE	
Country	United States of America
Year	2008
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Though only recently introduced, established successfully at all sites except one where agents killed by frost. Populations largely moderately abundant; high in areas with long hydroperiod (wetlands) but lower in upland systems where they are restricted to the lower canopy. While too early to determine fully, preliminary evidence indicates galling can kill seedlings and severely modify plant architecture. In concert with other established herbivores, decreases plant growth and survival. Currently under evaluation.
Limiting Factors	Habitat
Research Organization	USDA (3,4)
References	237, 246, 607, 875, 1527, 1528

MYRTACEAE
Melaleuca quinquenervia *(continued)*

AGENT	
Species	*Oxyops vitiosa* Pascoe
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	United States of America
Year	1997
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Well established throughout FL, though densities greatest in south. In combination with *Boreioglycaspis melaleucae* and *Puccinia psidii*, causes severe damage to mature melaleuca trees. Damage occurs as reduced plant height, branching and biomass of surviving coppices as well as increased seedling mortality. Repeated attack enables other plant species to colonize sites. Pupates in soil so persistent populations rare in permanently flooded habitats.
Limiting Factors	Habitat
Research Organization	USDA (3,4)
References	80, 245, 246, 247, 1529, 1530, 1551

OROBANCHACEAE

WEED	
Family	Orobanchaceae
Species	*Orobanche minor* Sm.
Origin	Eurasia
Common Name	broomrape
AGENT	
Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)
RELEASE	
Country	Chile
Year	1998
Source	Ex. Morocco
Established	No
Notes	Not recovered after initial releases.
Research Organization	INIA
References	994, 1355, 1356, 1941

OROBANCHACEAE *(continued)*

WEED	
Family	Orobanchaceae
Species	*Phelipanche ramosa* (L.) Pomel
Past Names/Synonyms	*Orobanche ramosa* L.
Origin	Eurasia
Common Name	broomrape, branched broomrape
References	922, 1463
AGENT	
Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)
RELEASE	
Country	Chile
Year	1998
Source	Ex. Morocco
Established	No
Notes	Not recovered after initial releases.
Research Organization	INIA
References	994, 1354, 1355, 1356, 1941

TABLE 1

TABLE 1

OROBANCHACEAE *(continued)*

WEED	
Family	Orobanchaceae
Species	*Striga hermonthica* (Del.) Benth.
Origin	Africa
Common Name	purple witchweed

AGENT	
Species	*Eulocastra argentisparsa* Hampson
Classification	(Lepidoptera: Noctuidae)

RELEASE	
Country	Ethiopia
Year	1974
Source	Ex. India
Established	No
Notes	Recovery surveys not conducted for several years following release due to political unrest. Has since been determined agent did not establish.
Research Organization	IIBC, FAO
References	669, 1780

OROBANCHACEAE
Striga hermonthica (continued)

AGENT	
Species	*Smicronyx albovariegatus* Faust
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Ethiopia
Year	1974
Source	Ex. India
Established	No
Notes	Recovery surveys not conducted for several years following release due to political unrest. Has since been determined agent did not establish.
Research Organization	IIBC, FAO
References	669, 1780

RELEASE	
Country	Ethiopia
Year	1978
Source	Ex. India
Established	No
Notes	Recovered in 1979 but additional surveys not conducted for several years following release due to political unrest. Has since been determined agent did not establish.
Research Organization	IIBC, FAO
References	669, 1780

PASSIFLORACEAE

WEED	
Family	Passifloraceae
Species	*Passiflora tarminiana* Coppens & V. E. Barney
Incorrect Past Names/Synonyms	*Passiflora tripartita* (Juss.) Poir. var. *tripartita*, *Passiflora mollissima* (Kunth) L.H. Bailey, *Passiflora tripartita* var. *mollissima* (Kunth) Holm-Nielsen & P. Jørgensen
Notes	Now considered a hybrid between *Passiflora mollissima* (Kunth) L.H. Bailey (whose name has since been changed to *P. tripartita* var. *mollissima* (Kunth) Holm-Nielsen & P. Jørgensen) and an additional species.
Origin	South America
Common Name	banana poka
References	326, 342

AGENT	
Species	*Pyrausta perelegans* Hampson
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	Hawaii USA
Year	1991
Source	Ex. Venezuela
Established	Yes
Abundance	Limited
General Impact	None
Notes	Insect populations too low to have any significant impact.
Limiting Factors	Parasitism; Predation (only minor impact on efficacy)
Research Organization	USDA-FS, HDOA
References	221, 326, 596, 1146, 1151, 1153, 1861

PASSIFLORACEAE
Passiflora tarminiana (continued)

AGENT	
Species	*Scea necyria* (Felder & Rogenhofer)
Past Names/Synonyms	*Cyanotricha necyria* Felder
Classification	(Lepidoptera: Notodontidae)

RELEASE	
Country	Hawaii USA
Year	1988
Source	Ex. Colombia, Ecuador
Established	No
Notes	Predation, parasitism, and lack of sufficient nectar for adults in release area may have contributed to establishment failure.
Limiting Factors	Predation; Parasitism
Research Organization	USDA-FS, HDOA
References	221, 596, 614, 762, 1146, 1152, 1153, 1861

TABLE 1

PASSIFLORACEAE
Passiflora tarminiana *(continued)*

AGENT

Species	*Septoria passiflorae* Sydenham
Classification	(Dothideomycetes: Capnodiales)

RELEASE

Country	Hawaii USA
Year	1996
Source	Ex. Colombia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Provides substantial reduction of biomass and early defoliation in wet and windy areas. However, regrowth can be vigorous and weed has continued to spread in many regions, especially those with dry climates or acid rain. Recent surveys on KA did not yield this pathogen, though it could still be present at higher elevations not visited.
Limiting Factors	Climate
Research Organization	HDOA, State (52)
References	326, 385, 596, 1006, 1146, 1826, 1828

PLANTAGINACEAE

WEED

Family	Plantaginaceae
Species	*Linaria dalmatica* subsp. *dalmatica* (L.) Mill.
Past Names/Synonyms	*Linaria genistifolia* (L.) Mill. subsp. *dalmatica* (L.) Maire & Petitm., *Linaria dalmatica* (L.) Mill.
Incorrect Past Names/Synonyms	*Linaria genistifolia* (L.) Mill.
Notes	Dalmatian and yellow toadflax can both be highly variable in North America, which is compounded by their ability to hybridize. The taxonomic status of this group of species and their hybrids remains uncertain. The editors of the current catalogue follow the interpretation that *Linaria genistifolia* (L.) Mill. is distinct from *L. dalmatica* (L.) Mill. and that *L. dalmatica* consists of two subspecies, of which only one (*L. dalmatica* subsp. *dalmatica*) is invasive and weedy in North America.
Origin	Eurasia
Common Name	Dalmatian toadflax, broad-leaved toadflax
References	1534, 1687, 1820

PLANTAGINACEAE
Linaria dalmatica subsp. *dalmatica* (continued)

AGENT

Species	*Brachypterolus pulicarius* (L.)
Classification	(Coleoptera: Kateridae)
Notes	It was initially believed different biotypes of *Brachypterolus pulicarius* had evolved sufficiently to be suited differently to *Linaria vulgaris* and *L. dalmatica*. Studies have since found no evidence to suggest that genetic variability between the host races has advanced to the point of speciation. *B. pulicarius* prefers and performs better on *L. vulgaris*; the use of *L. dalmatica* is incidental.
References	861

RELEASE

Country	United States of America
Year	1992
Source	Ex. Unknown via Canada
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

PLANTAGINACEAE; *Linaria dalmatica* subsp. *dalmatica*
Brachypterolus pulicarius (continued)

Country	United States of America (continued)
Notes	Initially found as an unintentional introduction on *Linaria vulgaris* in NY in 1919, from where it spread throughout the USA where it has been reported on both *L. vulgaris* and *L. dalmatica*. A population found feeding exclusively on *L. dalmatica* in Canada was subsequently redistributed to *L. dalmatica* and *L. vulgaris* in the USA. The two populations are not genetically different and are likely moving between the two *Linaria* species on their own so are indistinguishable for establishmnet, abundance and efficacy. Though widespread in USA, prefers *Linaria vulgaris*. Even beetles collected from *L. dalmatica* preferred *L. vulgaris* in trials. Found in only limited amounts on *L. dalmatica* throughout USA, except portions of ID OR WA where much more abundant. At high densities, stunts height and causes increased branching. Overall impact to flowering and seed production minimal at most sites.
Research Organization	State (7)
References	39, 332, 335, 861, 1105, 1127, 1364, 1365, 1366, 1689, 1697, 1991

TABLE 1

TABLE 1

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica *(continued)*

AGENT

Species	*Calophasia lunula* (Hufnagel)
Classification	(Lepidoptera: Noctuidae)

RELEASE

Country	Canada
Year	1962
Source	Ex. Switzerland
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Larval feeding decreases leaf area but does not disrupt photosynthetic capacity sufficiently to have much impact. Parasitism may decrease populations in some areas. Establishment limited by cold climates.
Limiting Factors	Climate; Parasitism
Other Species Attacked	In North America, caterpillars are known to feed and develop on snapdragons, including non-native, ornamental, and one native species, *Antirrhinum virga* A. Gray.
Research Organization	AAFC
References	438, 441, 731, 737, 1192, 1689, 1922, 1991

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica; Calophasia lunula *(continued)*

RELEASE

Country	Canada
Year	1989
Source	Ex. Former Yugoslavia
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Larval feeding decreases leaf area but does not disrupt photosynthetic capacity sufficiently to have much impact. Parasitism may decrease populations in some areas. Establishment limited by cold climates.
Limiting Factors	Climate; Parasitism
Other Species Attacked	In North America, caterpillars are known to feed and develop on snapdragons, including non-native, ornamental, and one native species, *Antirrhinum virga* A. Gray.
Research Organization	AAFC
References	117, 432, 438, 441, 1190, 1192, 1689, 1991

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica; Calophasia lunula *(continued)*

RELEASE	
Country	United States of America
Year	1968
Source	Ex. Switzerland via Canada (ON)
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Redistributed from *Linaria vulgaris* in Canada. Populations limited throughout much of range, moderate in ID and abundant in WA. High densities can lead to patch defoliation. Overall, larval feeding typically decreases leaf area but does not disrupt photosynthetic capacity sufficiently to have significant impact on target weeds. Establishment limited by cold climates.
Limiting Factors	Climate
Other Species Attacked	In North America, caterpillars are known to feed and develop on snapdragons, including non-native, ornamental, and one native species, *Antirrhinum virga* A. Gray.
Research Organization	USDA (7), State (6,7,9,13,15)
References	39, 332, 334, 335, 1192, 1201, 1364, 1365, 1366, 1689, 1991

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica *(continued)*

AGENT	
Species	*Eteobalea intermediella* Riedl
Classification	(Lepidoptera: Cosmopterigidae)

RELEASE	
Country	Canada
Year	1991
Source	Ex. Serbia
Established	No
Notes	Initially established on *Linaria dalmatica* in BC and AB propagation plots, however these populations have since disappeared.
Research Organization	AAFC
References	117, 437, 438, 441, 1248

RELEASE	
Country	United States of America
Year	1996
Source	Ex. Former Yugoslavia
Established	No
Research Organization	State (7), USDA (14)
References	1105, 1365, 1366, 1688, 1991

TABLE 1

TABLE 1

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica *(continued)*

AGENT	
Species	*Eteobalea serratella* Treitschke
Classification	(Lepidoptera: Cosmopterigidae)

RELEASE	
Country	United States of America
Year	1996
Source	Ex. Italy
Established	No
Research Organization	State (7), USDA (14)
References	1105, 1365, 1366, 1688, 1991

AGENT	
Species	*Mecinus janthiniformis* Toševski & Caldara
Past Names/Synonyms	*Mecinus janthinus* Germar pars
Classification	(Coleoptera: Curculionidae)
Notes	The agent released against *Linaria dalmatica* and *L. vulgaris* in North America under the name *Mecinus janthinus* Germar has since been identified as two distinct species, with *Mecinus janthiniformis* Toševski & Caldara usually preferentially attacking *L. dalmatica* and *M. janthinus* preferring *L. vulgaris*. Recently, a population of *M. janthiniformis* has been found attacking hybrids of *L. dalmatica* and *L. vulgaris* in North America.
References	215, 441, 1688, 1821

PLANTAGINACEAE; *Linaria dalmatica* subsp. *dalmatica*
Mecinus janthiniformis *(continued)*

RELEASE	
Country	Canada
Year	1992
Source	Ex. Republic of Macedonia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Rapid buildup of outbreak-level populations in BC led to substantial damage (i.e., significant reduction in stem height), reductions in *Linaria dalmatica* density, and greater fragmentation of *L. dalmatica* stands. Some AB populations more recently reached outbreak levels, although colder overwinter temperatures and possible release of the wrong *Mecinus* species are thought to be involved with poor or delayed success. Parasitism is thought to effect populations at some sites in BC.
Limiting Factors	Climate; Parasitism
Research Organization	AAFC
References	433, 437, 438, 441, 1190, 1193, 1820, 1821, 1871

PLANTAGINACEAE; *Linaria dalmatica* subsp. *dalmatica*
Mecinus janthiniformis (continued)

RELEASE	
Country	United States of America
Year	post 1996
Source	Ex. Republic of Macedonia via Canada
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released as early as 1997 though unclear which *Mecinus* species (or both) was present in initial redistributions from Canada. Though initially slow to build at some sites, populations reached outbreak levels at many locations in subsequent years leading to reductions in *Linaria dalmatica* populations throughout much of its established range. Combination of adult and larval feeding reduces stem length, both above ground and root biomass, seed production, and primary physiological functioning.
Research Organization	State (7), USDA (14)
References	618, 663, 710, 900, 956, 1105, 1365, 1366, 1615, 1689, 1690, 1820, 1821, 1907, 1946, 1991, 2021

PLANTAGINACEAE
Linaria dalmatica subsp. *dalmatica* (continued)

AGENT	
Species	*Mecinus janthinus* Germar
Classification	(Coleoptera: Curculionidae)
Notes	The agent released against *Linaria dalmatica* and *L. vulgaris* in North America under the name *Mecinus janthinus* Germar has since been identified as two distinct species, with *Mecinus janthiniformis* Toševski & Caldara usually preferentially attacking *L. dalmatica* and *M. janthinus* preferring *L. vulgaris*.
References	215, 441, 1821

RELEASE	
Country	Canada
Year	1991
Source	Ex. France, Germany (Rhine Valley)
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Found present on *Linaria dalmatica* during recent molecular studies, though populations limited and with unknown impact.
Research Organization	AAFC
References	432, 437, 438, 441, 618, 1820, 1821

TABLE 1

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica; Mecinus janthinus *(continued)*

RELEASE	
Country	United States of America
Year	1996
Source	Ex. France, Germany (Rhine Valley); Ex. France, Germany (Rhine Valley) via Canada
Established	No
Notes	Released in 1996 from the Rhine Valley and as early as 1997 from the Rhine Valley via Canada, though is unclear which *Mecinus* species (or both) was present in initial redistributions from Canada. Despite being released numerous times on *Linaria dalmatica*, has not been collected from this species to date. Prefers *L. vulgaris*.
Limiting Factors	Specificity
Research Organization	State (7), USDA (14)
References	437, 618, 710, 1366, 1820, 1821, 1946

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica *(continued)*

AGENT	
Species	*Rhinusa antirrhini* (Paykull)
Past Names/Synonyms	*Gymnetron antirrhini* (Paykull)
Incorrect Past Names/Synonyms	*Gymnaetron antirrhini* (Paykull)
Classification	(Coleoptera: Curculionidae)
Notes	It is believed two “strains” of this species exist in Canada, with the intentionally introduced population preferring *Linaria dalmatica* over *L. vulgaris*, attacking even the broad-leaved form of *L. dalmatica*. Conversely, the adventive population prefers *L. vulgaris* over *L. dalmatica*. One may in fact be an unnamed sibling species.
References	213, 214, 1690

RELEASE	
Country	Canada
Year	1993
Source	Ex. Former Yugoslavia
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued on next page)

PLANTAGINACEAE
Linaria dalmatica subsp. *dalmatica; Rhinusa antirrhini* (continued)

RELEASE

Country	Canada (continued)
Notes	This strain intentionally introduced in 1993, though a different strain already introduced inadvertently prior to 1917. Decreases seed production. Though unknown how this affects *Linaria dalmatica* populations, similar attack rates by the *L. vulgaris* strain on *L. vulgaris* do not provide control. Competition between *Rhinusa antirrhini* and *Brachypterolus pulicarius* prevents additive impact in many locations. Parasitism may also limit impact. However, localized populations have established well in BC and are spreading. Impact has yet to be investigated.
Limiting Factors	Parasitism; Interspecific competition
Research Organization	AAFC
References	117, 432, 438, 441, 784, 1689, 1922

RELEASE

Country	United States of America
Year	1996
Source	Ex. Former Yugoslavia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	An unintentional introduction referred to as the vulgaris biotype was found on *Linaria vulgaris* in 1909 and *L. dalmatica* (narrow-leaved form) by 1957. This additional strain (dalmatica biotype) was intentionally released against *L. dalmatica* in 1996. Unknown if releases were successful.
Research Organization	State (13)
References	1365, 1366, 1689

PLANTAGINACEAE
Linaria dalmatica subsp. *dalmatica* (continued)

AGENT

Species	*Rhinusa linariae* (Panzer)
Past Names/Synonyms	*Gymnetron linariae* Panzer
Classification	(Coleoptera: Curculionidae)
References	213, 214, 441

RELEASE

Country	Canada
Year	1996
Source	Ex. Europe (central, southern), Russia (southern)
Established	No
Research Organization	AAFC
References	117, 438, 441, 1190, 1922

RELEASE

Country	United States of America
Year	1996
Source	Ex. Germany (Rhine Valley)
Established	No
Notes	Confirmed established at only one *Linaria dalmatica* site in WY. Status unknown.
Research Organization	State (7), USDA (14)
References	306, 334, 335, 710, 1105, 1365, 1366, 1689, 1752, 1991

TABLE 1

PLANTAGINACEAE *(continued)*

WEED	
Family	Plantaginaceae
Species	*Linaria vulgaris* Mill.
Notes	Yellow and Dalmatian toadflax can both be highly variable in North America, which is compounded by their ability to hybridize. The taxonomic status of this group of species and their hybrids remains uncertain.
Origin	Eurasia
Common Name	yellow toadflax, common toadflax, butter-and-eggs

AGENT	
Species	*Brachypterolus pulicarius* (L.)
Classification	(Coleoptera: Kateridae)
Notes	It was initially believed different biotypes of *Brachypterolus pulicarius* had evolved sufficiently to be suited differently to *Linaria vulgaris* and *L. dalmatica*. Studies have since found no evidence to suggest that genetic variability between the host races has advanced to the point of speciation. *B. pulicarius* prefers and performs better on *L. vulgaris*; the use of *L. dalmatica* is incidental.
References	861

PLANTAGINACEAE
Linaria vulgaris; Brachypterolus pulicarius *(continued)*

RELEASE	
Country	United States of America
Year	1997
Source	Ex. Unknown via Canada
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially found as an unintentional introduction on *Linaria vulgaris* in NY in 1919, from where it spread throughout the USA where it has been reported on both *L. vulgaris* and *L. dalmatica*. A population found feeding exclusively on *L. dalmatica* in Canada was subsequently redistributed to *L. dalmatica* and *L. vulgaris* in the USA. The two populations are not genetically different and are likely moving between the two *Linaria* species on their own so are indistinguishable for establishmnet, abundance and efficacy. Widespread and abundant, preferring *Linaria vulgaris* over *L. dalmatica*. Can delay flowering and reduce seed production of *L. vulgaris* by 80 to 90% at some locations. However, overall impact minimal.
Research Organization	State (7)
References	39, 332, 861, 1127, 1364, 1365, 1366, 1689, 1697, 1991

PLANTAGINACEAE
Linaria vulgaris *(continued)*

AGENT

Species	*Calophasia lunula* (Hufnagel)
Classification	(Lepidoptera: Noctuidae)

RELEASE

Country	Canada
Year	1962
Source	Ex. Switzerland
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Larval feeding decreases leaf area but does not disrupt photosynthetic capacity sufficiently to have much impact. Parasitism may decrease populations in some areas. Establishment limited by cold climates.
Limiting Factors	Climate; Parasitism
Other Species Attacked	In North America, caterpillars are known to feed and develop on snapdragons, including non-native, ornamental, and one native species, *Antirrhinum virga* A. Gray.
Research Organization	AAFC
References	393, 439, 731, 737, 1190, 1192, 1689, 1991

RELEASE

Country	Canada
Year	1989
Source	Ex. Former Yugoslavia
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Regional

(continued at top of next column)

PLANTAGINACEAE
Linaria vulgaris; Calophasia lunula *(continued)*

Country	Canada (continued)
Notes	Larval feeding decreases leaf area but does not disrupt photosynthetic capacity sufficiently to have much impact. Parasitism may decrease populations in some areas. Establishment limited by cold climates.
Limiting Factors	Climate; Parasitism
Other Species Attacked	In North America, caterpillars are known to feed and develop on snapdragons, including non-native, ornamental, and one native species, *Antirrhinum virga* A. Gray.
Research Organization	AAFC
References	117, 439, 1190, 1192, 1689, 1991

RELEASE

Country	United States of America
Year	1968
Source	Ex. Switzerland via Canada (ON)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Populations limited throughout range. Overall, larval feeding may decrease leaf area but does not disrupt photosynthetic capacity sufficiently to have significant impact on target weeds. Establishment limited by cold climates.
Limiting Factors	Climate
Other Species Attacked	In North America, caterpillars are known to feed and develop on snapdragons, including non-native, ornamental, and one native species, *Antirrhinum virga* A. Gray.
Research Organization	State (6,7,15), USDA (14)
References	39, 332, 334, 335, 1364, 1365, 1366, 1689, 1991

TABLE 1

PLANTAGINACEAE
Linaria vulgaris *(continued)*

AGENT	
Species	*Eteobalea intermediella* Riedl
Classification	(Lepidoptera: Cosmopterigidae)

RELEASE	
Country	United States of America
Year	1997
Source	Ex. Former Yugoslavia
Established	No
Research Organization	State (7)
References	1105, 1365, 1366, 1688

AGENT	
Species	*Eteobalea serratella* Treitschke
Classification	(Lepidoptera: Cosmopterigidae)

RELEASE	
Country	Canada
Year	1992
Source	Ex. Italy
Established	No
Notes	Initially believed to have established in limited numbers, but subsequently considered failed.
Research Organization	AAFC
References	439, 1190, 1248

RELEASE	
Country	United States of America
Year	1996
Source	Ex. Italy
Established	No
Research Organization	State (7)
References	1105, 1365, 1366, 1688

PLANTAGINACEAE
Linaria vulgaris *(continued)*

AGENT	
Species	*Mecinus janthiniformis* Toševski & Caldara
Past Names/Synonyms	*Mecinus janthinus* Germar pars
Classification	(Coleoptera: Curculionidae)
Notes	The agent released against *Linaria dalmatica* and *L. vulgaris* in North America under the name *Mecinus janthinus* Germar has since been identified as two distinct species, with *Mecinus janthiniformis* Toševski & Caldara usually preferentially attacking *L. dalmatica* and *M. janthinus* preferring *L. vulgaris*. Recently, a population of *M. janthiniformis* has been found attacking hybrids of *L. dalmatica* and *L. vulgaris* in North America.
References	215, 441, 1688, 1821

RELEASE	
Country	Canada
Year	2000
Source	Ex. Republic of Macedonia
Established	No
Notes	Redistributed from *Linaria dalmatica* to *L. vulgaris*, but not recovered during subsequent site visits. Molecular studies underway which may identify populations of *Mecinus janthiniformis* on *L. vulgaris*.
Research Organization	AAFC
References	437, 439, 618, 1185, 1190, 1820

PLANTAGINACEAE
Linaria vulgaris; Mecinus janthiniformis *(continued)*

RELEASE	
Country	United States of America
Year	post 1996
Source	Ex. Republic of Macedonia via Canada
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Released as early as 1997 though unclear which *Mecinus* species (or both) was present in initial redistributions from Canada. Found present on *Linaria vulgaris* during recent molecular studies, though populations limited and with unknown impact.
Research Organization	State (7), USDA (14)
References	1366, 1820, 1821, 1946

AGENT	
Species	*Mecinus janthinus* Germar
Classification	(Coleoptera: Curculionidae)
Notes	The agent released against *Linaria dalmatica* and *L. vulgaris* in North America under the name *Mecinus janthinus* Germar has since been identified as two distinct species, with *Mecinus janthiniformis* Toševski & Caldara usually preferentially attacking *L. dalmatica* and *M. janthinus* preferring *L. vulgaris*.
References	215, 441, 1821

PLANTAGINACEAE
Linaria vulgaris; Mecinus janthinus *(continued)*

RELEASE	
Country	Canada
Year	1991
Source	Ex. France, Germany (Rhine Valley)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Densities have remained low with little to no apparent impact on *Linaria vulgaris* at many sites, though formal evaluation has been limited. Parasitism and cold climates at release sites (leading to insufficient development time) may contribute to low populations and impact. Incorrect host/agent matching with the *Mecinus janthinus/janthiniformis* complex likely also contributed to lower establishment rates. However, at one AB site, *L. vulgaris* has declined to very low density, with the few remaining stems heavily infested with *M. janthinus*.
Limiting Factors	Climate; Parasitism
Research Organization	AAFC
References	432, 437, 439, 618, 1190, 1193, 1820, 1821

TABLE 1

TABLE 1

PLANTAGINACEAE
Linaria vulgaris; Mecinus janthinus *(continued)*

RELEASE	
Country	United States of America
Year	1997
Source	Ex. France, Germany (Rhine Valley); Ex. France, Germany (Rhine Valley) via Canada
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Released in 1997 from the Rhine Valley and as early as 1997 from the Rhine Valley via Canada, though is unclear which *Mecinus* species (or both) was present in initial redistributions from Canada. Populations of this species on Linaria vulgaris far more limited than *Mecinus janthiniformis* on *L. dalmatica*. Recent increased efforts on *M. janthinus* redistribution have led to establishment in few western states where weevil populations now increasing and having significant impact locally.
Research Organization	State (7), USDA (14)
References	39, 334, 437, 618, 710, 876, 1365, 1366, 1630, 1688, 1820, 1821, 1946, 1991

PLANTAGINACEAE
Linaria vulgaris *(continued)*

AGENT	
Species	*Rhinusa linariae* (Panzer)
Past Names/Synonyms	*Gymnetron linariae* Panzer
Classification	(Coleoptera: Curculionidae)
References	213, 214, 441

RELEASE	
Country	Canada
Year	1996
Source	Ex. Europe (central, southern), Russia (southern)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Because populations are slow to build, redistributions made every 2-4 years. Adult foliage feeding and larval galling reduce plant nutrient reserves. However, populations too low for significant impact.
Research Organization	AAFC
References	117, 438, 439, 1190, 1922

PLANTAGINACEAE
Linaria vulgaris; Rhinusa linariae *(continued)*

RELEASE	
Country	United States of America
Year	1996
Source	Ex. Germany (Rhine Valley)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	State (7), USDA (14)
References	335, 1365, 1689

RELEASE	
Country	United States of America
Year	2008
Source	Ex. Europe (central, southern), Russia (southern) via Canada (BC)
Established	No
Research Organization	BCME, USDA (14), CDA
References	89, 1190

POACEAE

TABLE 1

WEED	
Family	Poaceae
Species	*Arundo donax* L.
Origin	Mediterranean Europe, Asia
Common Name	giant reed, carrizo cane

AGENT	
Species	*Rhizaspidiotus donacis* Leonardi
Classification	(Hemiptera: Diaspididae)

RELEASE	
Country	Mexico
Year	2011
Source	Ex. France, Spain
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Several unique genotypes were intentionally introduced from Spain and France in order to better match the different invaded climates and different genetic clones of *Arundo donax*. Well established at release site along Rio Grande between USA and Mexico, but too early post release to determine abundance and impact.
Research Organization	USDA (18,17)
References	650, 651, 652, 1255

POACEAE
Arundo donax; Rhizaspidiotus donacis *(continued)*

RELEASE	
Country	United States of America
Year	2010
Source	Ex. France, Spain
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Several unique genotypes were intentionally introduced from Spain and France in order to better match the different invaded climates and different genetic clones of *Arundo donax*. Well established at the release site along Rio Grande between USA and Mexico, but too early post release to determine abundance and impact.
Research Organization	USDA (18,17)
References	650, 651, 652, 1255

AGENT	
Species	*Tetramesa romana* Walker
Classification	(Hymenoptera: Eurytomidae)

RELEASE	
Country	Mexico
Year	2009
Source	Ex. France, Spain
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Regional

(continued at top of next column)

POACEAE
Arundo donax; Tetramesa romana *(continued)*

Country	Mexico (continued)
Notes	Several unique genotypes were intentionally introduced from Spain and France in order to better match the different invaded climates and different genetic clones of *Arundo donax*. Impact under evaluation but appears similar to native range in Europe. Well established along Rio Grande and tributaries; highest impact closest to river or water source.
Research Organization	USDA (18,17)
References	651, 653, 1255

RELEASE	
Country	United States of America
Year	2009
Source	Ex. France, Spain
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Several unique genotypes were intentionally introduced from Spain and France in order to better match the different invaded climates and different genetic clones of *Arundo donax*. Impact under evaluation but appears similar to native range in Europe. In TX well established along Rio Grande and tributaries; highest impact closest to river or water source. Establishment confirmed in CA.
Research Organization	USDA (18,17)
References	651, 653, 1255, 2024

POLYGONACEAE

WEED

Family	Polygonaceae
Species	*Emex australis* Steinh.
Origin	southern Africa
Common Name	three cornered Jacks, doublegee, spiny emex, emex

AGENT

Species	*Apion frumentarium* (L.)
Past Names/Synonyms	*Apion miniatum* Germar
Classification	(Coleoptera: Brentidae)

RELEASE

Country	Australia
Year	1998
Source	Ex. Israel
Established	No
Research Organization	CSIRO
References	1633, 2047, 2048

AGENT

Species	*Lixus linearis* Olivier
Past Names/Synonyms	*Lixus cribricollis* Boheman
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Australia
Year	1980
Source	Ex. Morocco
Established	No
Research Organization	CSIRO, VIC State, WA State
References	935, 1633, 2047

POLYGONACEAE
Emex australis *(continued)*

AGENT

Species	*Perapion antiquum* (Gyllenhal)
Past Names/Synonyms	*Apion antiquum* Gyllenhal
Classification	(Coleoptera: Brentidae)

RELEASE

Country	Australia
Year	1974
Source	Ex. Republic of South Africa (Frankskraal, Ladismith, Grahamstown)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Different populations collected and released according to ecoclimatic similarity. For this population, large numbers released at numerous sites. Established at three sites only. Though populations persist, no control of weed achieved due to high mortality of adults over summer period in absence of growing host plants.
Limiting Factors	Agent-host synchronization
Research Organization	CSIRO
References	935, 947, 2047

RELEASE

Country	Australia
Year	1975
Source	Ex. Republic of South Africa via Hawaii USA
Established	No

(continued on next page)

TABLE 1

TABLE 1

POLYGONACEAE
Emex australis; Perapion antiquum *(continued)*

Country	Australia (continued)
Notes	Establishment failure likely due to small release number and inability of adults to survive in absence of growing host plants over relatively long summer period.
Limiting Factors	Small release size; Agent-host synchronization
Research Organization	CSIRO
References	944, 2047

RELEASE

Country	Australia
Year	1984
Source	Ex. Republic of South Africa (Oliphants River)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Though populations persist, no control of weed achieved due to high mortality of adults over summer period in absence of growing host plants.
Limiting Factors	Agent-host synchronization
Research Organization	VIC State, WA State
References	191, 603, 1570, 2047

POLYGONACEAE
Emex australis; Perapion antiquum *(continued)*

RELEASE

Country	Australia
Year	1987
Source	Ex. Republic of South Africa
Established	No
Notes	Releases initially survived at summer irrigated site, however impact limited the following winter and population died out when summer irrigation ceased and host plants grew less over long summer period.
Limiting Factors	Agent-host synchronization
Research Organization	WA State, CSIRO
References	568, 939, 2047

RELEASE

Country	Hawaii USA
Year	1957
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Control substantial on MA, incomplete on OA, failed to establish on MO. On HA, control varying from complete (1200 m and above) to partial (above 600 m) to no control (below 150 m).
Limiting Factors	Elevation
Research Organization	HDOA
References	44, 325, 406, 602, 612, 762, 1024, 1149

POLYGONACEAE
Emex australis (continued)

AGENT	
Species	*Perapion neofallax* (Warner)
Past Names/Synonyms	*Apion neofallax* Warner
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Hawaii USA
Year	1962
Source	Ex. Morocco
Established	No
Research Organization	HDOA
References	326, 408, 612, 1024, 1149

AGENT	
Species	*Perapion violaceum* (Kirby)
Past Names/Synonyms	*Apion violaceum* Kirby, *Apion violaceum* var. *harcyniae* Hübenthal
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Hawaii USA
Year	1962
Source	Ex. Portugal
Established	No
Research Organization	HDOA
References	326, 408, 612, 1024, 1149

POLYGONACEAE *(continued)*

WEED	
Family	Polygonaceae
Species	*Emex spinosa* (L.) Campd.
Origin	northern Africa, western Europe, western Asia
Common Name	lesser Jacks, emex

AGENT	
Species	*Apion frumentarium* (L.)
Past Names/Synonyms	*Apion miniatum* Germar
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Australia
Year	2004
Source	Ex. Israel
Established	No
Notes	Released at 5 sites but failed to establish.
Research Organization	CSIRO
References	1989

TABLE 1

POLYGONACEAE
Emex spinosa *(continued)*

AGENT	
Species	*Perapion antiquum* (Gyllenhal)
Past Names/Synonyms	*Apion antiquum* Gyllenhal
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Australia
Year	1974
Source	Ex. Republic of South Africa (Frankskraal, Ladismith, Grahamstown)
Established	Yes
Abundance	Limited
General Impact	None
Notes	Large numbers released at numerous sites using colonies collected from and released at ecoclimatically similar areas. Established at one site only. Though populations persist, no control of weed achieved due to high mortality of adults over summer period in absence of growing host plants.
Limiting Factors	Agent-host synchronization
Research Organization	CSIRO
References	935, 2047

RELEASE	
Country	Hawaii USA
Year	1957
Source	Ex. Republic of South Africa
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

POLYGONACEAE
Emex spinosa; Perapion antiquum *(continued)*

Country	Hawaii USA (continued)
Notes	Control substantial on MA, incomplete on OA, failed to establish on MO. On HA, control varying from complete (1200 m and above) to partial (above 600 m) to no control (below 150 m).
Limiting Factors	Elevation
Research Organization	HDOA
References	44, 325, 406, 602, 612, 762, 1024

AGENT	
Species	*Perapion neofallax* (Warner)
Past Names/Synonyms	*Apion neofallax* Warner
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Hawaii USA
Year	1962
Source	Ex. Morocco
Established	No
Research Organization	HDOA
References	326, 408, 612, 1024, 1149

POLYGONACEAE
Emex spinosa *(continued)*

AGENT	
Species	*Perapion violaceum* (Kirby)
Past Names/Synonyms	*Apion violaceum* Kirby, *Apion violaceum* var. *harcyniae* Hübenthal
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Hawaii USA
Year	1962
Source	Ex. Portugal
Established	No
Research Organization	HDOA
References	326, 408, 612, 1024, 1149

POLYGONACEAE *(continued)*

WEED	
Family	Polygonaceae
Species	*Fallopia japonica* (Houtt.) Ronse Decraene var. *japonica*
Origin	Asia
Common Name	Japanese knotweed

AGENT	
Species	*Aphalara itadori* Shinji
Classification	(Hemiptera: Psyllidae)

RELEASE	
Country	England
Year	2010
Source	Ex. Japan (southern)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Evidence of successful overwintering, but too early to confirm establishment.
Research Organization	IIBC
References	1647, 1648, 1649

RELEASE	
Country	Wales
Year	2011
Source	Ex. Japan (southern)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	IIBC
References	1647, 1648, 1649

TABLE 1

POLYGONACEAE *(continued)*

WEED	
Family	Polygonaceae
Species	*Persicaria perfoliata* (L.) H. Gross
Past Names/Synonyms	*Polygonum perfoliatum* L.
Origin	Asia
Common Name	mile-a-minute weed
AGENT	
Species	*Rhinoncomimus latipes* Korotyaev
Classification	(Coleoptera: Curculionidae)
RELEASE	
Country	United States of America
Year	2004
Source	Ex. China
Established	Yes
Abundance	Too early post release
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Additional time needed before overall impact can be fully assessed, but initial findings encouraging. Populations have increased considerably and rapidly dispersed from some sites; in NJ, weevil has already spread to all known weed infestations. Decreases plant density, cover, and seed production when attacking plants earlier in the year, less impact if attacking later. Greatest reduction in plant density and biomass occurs in communities with competing vegetation.
Research Organization	USDA FS, State (45)
References	599, 851, 852, 853, 854, 855, 860, 1049

POLYGONACEAE *(continued)*

WEED	
Family	Polygonaceae
Species	*Rumex* spp.
Notes	Includes *Rumex conglomeratus* Murray, *Rumex crispus* L., *Rumex obtusifolius* L., and *Rumex pulcher* L.
Origin	Europe, Asia, northern Africa
Common Name	docks
AGENT	
Species	*Pyropteron doryliformis* (Ochsenheimer)
Past Names/Synonyms	*Synansphecia doryliformis* (Ochsenheimer), *Chamaesphecia doryliformis* (Ochsenheimer)
Classification	(Lepidoptera: Sesiidae)
References	1537, 1743
RELEASE	
Country	Australia
Year	1989
Source	Ex. Morocco
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Development of an eggstick machine allowed for the dissemination of nearly 31 million eggs from 1994-1999. Widely established and typically abundant throughout *Rumex* spp. infestations. Decreases plant densities significantly. Impact/abundance sometimes differ by species; most effective on *R. crispus* and *R. obtusifolius*, followed by *R. pulcher* then *R. conglomeratus*.
Research Organization	CSIRO, WA State
References	187, 572, 886, 1278, 1632, 1743

PONTEDERIACEAE

WEED

Family	Pontederiaceae
Species	*Eichhornia crassipes* (Mart.) Solms
Origin	South America
Common Name	water hyacinth, waterhyacinth, Majavani, keladi bunting, phak top chawaa, sawah, ècèng, etjeng padi, luc bình, beda bin, ye padauk

AGENT

Species	*Cercospora piaropi* Tharp
Past Names/Synonyms	*Cercospora rodmanii* Conway
Classification	(Dothideomycetes: Capnodiales)
Notes	Historically two species of *Cercospora* were recognized in discussions regarding fungal biological control of *Eichhornia crassipes* (Mart.) Solms: *C. piaropi* Tharp and *C. rodmanii* Conway. Recent studies suggest the pathogens may be the same, and *C. rodmanii* should be recognized as a later synonym for the currently accepted *C. piaropi*. Though disagreements and difficulties remain in this taxonomic group, the editors of this catalogue support the idea that the *Cercospora* pathogens utilized for biological of *E. crassipes* are the same. *Cercospora piaropi* is among the most widespread and commonly found pathogens of *E. crassipes* worldwide. Consequently, only those countries where this species has been utilized/distributed intentionally are listed in this catalogue.
References	987, 1284, 1789

PONTEDERIACEAE
Eichhornia crassipes; Cercospora piaropi *(continued)*

TABLE 1

RELEASE

Country	Republic of South Africa
Year	1992
Source	Ex. USA (FL)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Found to be present in 1986, though not introduced intentionally. A second population was intentionally introduced (under the name *Cercospora rodmanii* Conway) in 1987. Both populations can no longer be differentiated in South Africa. Severe infections can lead to death of attacked leaves. Although it occurs extensively, there has been no significant decline in weed populations.
Research Organization	ARC-PPRI
References	992, 1280, 1283, 1284, 1789, 2006

AGENT

Species	*Cornops aquaticum* (Brüner)
Classification	(Orthoptera: Acrididae)

RELEASE

Country	Republic of South Africa
Year	2011
Source	Ex. Brazil, Trinidad, Venezuela, Mexico
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ARC-PPRI
References	297, 801, 992

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes (continued)

AGENT

Species	*Eccritotarsus catarinensis* (Carvalho)
Classification	(Hemiptera: Miridae)

RELEASE

Country	Benin
Year	1999
Source	Ex. Brazil via Republic of South Africa
Established	No
Research Organization	IITA, ARC-PPRI
References	13, 15, 17, 298, 802, 1345

RELEASE

Country	Ghana
Year	2009
Source	Ex. Brazil via Republic of South Africa
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Research Organization	ARC-PPRI
References	21, 22, 800, 937, 1784

RELEASE

Country	Malawi
Year	1996
Source	Ex. Brazil via Republic of South Africa
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ARC-PPRI, IIBC, MFD
References	13, 806, 936, 1496

PONTEDERIACEAE
Eichhornia crassipes; Eccritotarsus catarinensis (continued)

RELEASE

Country	People's Republic of China
Year	2000
Source	Ex. Brazil via Republic of South Africa
Established	No
Notes	For unknown reasons, did not establish its population after 4 months.
Research Organization	CAAS-BCI, ARC-PPRI
References	504, 802

RELEASE

Country	Republic of South Africa
Year	1996
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Five to six years after release, populations were generally low and their impact slight. Alone the agent is typically not sufficient to reduce all aspects of water hyacinth vigor, especially at very high nutrient concentrations. However, more recently, several outbreaks of *Eccritotarsus catarinensis* have been seen, resulting in mats collapsing. More effective in low nutrient water, in conjunction with other agents, and sites where winter temperatures are not too low.
Limiting Factors	Habitat; Climate
Research Organization	ARC-PPRI
References	208, 294, 295, 296, 297, 801, 802, 806, 992, 1784

PONTEDERIACEAE
Eichhornia crassipes; Eccritotarsus catarinensis *(continued)*

RELEASE	
Country	Republic of South Africa
Year	2007
Source	Ex. Peru
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Field establishment not yet confirmed.
Research Organization	ARC-PPRI
References	800, 1784

RELEASE	
Country	Zambia
Year	1997
Source	Ex. Brazil via Republic of South Africa
Established	No
Research Organization	ARC-PPRI, ECZ
References	249, 799, 802, 806, 936

RELEASE	
Country	Zimbabwe
Year	1999
Source	Ex. Brazil via Republic of South Africa
Established	No
Research Organization	ARC-PPRI, PPRIZ
References	242, 279, 802, 806, 936

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT	
Species	*Megamelus scutellaris* Berg
Classification	(Hemiptera: Delphacidae)

RELEASE	
Country	United States of America
Year	2010
Source	Ex. Argentina
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Initially believed to have failed establishment in FL but subsequently found at original release sites. Too early post release to determine overall impact. Establishment in CA unknown.
Research Organization	USAE, USDA (4), State (14,36)
References	230, 237, 604, 1512, 1800

RELEASE	
Country	United States of America
Year	2012
Source	Ex. Argentina, Paraguay
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Establishment success looks promising, though additional time needed to confirm.
Research Organization	USDA (4)
References	1759

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes (continued)

AGENT

Species *Neochetina bruchi* Hustache
Classification (Coleoptera: Erirhinidae)

RELEASE

Country Australia
Year 1990
Source Ex. Argentina via USA (FL)
Established Yes
Abundance Variable
General Impact Variable
Notes Variable population levels provide successful control in some catchments. No control where seasonal floods flush weed and agent to sea, thus limiting the time for agent population increase. Less effective where pesticide use continues and in cool temperate regions.
Limiting Factors Climate; Other control methods; Flooding
Research Organization CSIRO
References 937, 946, 2040

RELEASE

Country Benin
Year 1992
Source Ex. Argentina via USA (FL) via Australia
Established Yes
Abundance Limited
General Impact Medium
Geographical Scale of Impact Localized
(continued at top of next column)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi (continued)

Country Benin (continued)
Notes *Neochetina eichhorniae* became the dominant species and has helped reduce the weed overall from a serious pest to a moderate pest. *N. bruchi*, while still found attacking plants, remained confined to the release localities and in limited numbers.
Research Organization IITA
References 13, 17, 298, 879, 946, 1346, 1883

RELEASE

Country Burkina Faso
Year 1998
Source Ex. Argentina via USA (FL) via Australia via Benin
Established Yes
Abundance Unknown
General Impact Heavy
Geographical Scale of Impact Unknown
Notes Anecdotal evidence suggests a substantial reduction of water hyacinth
Research Organization IITA
References 95, 443, 946, 1409

RELEASE Cote d'Ivoire
Country 1998
Year Ex. Argentina via USA (FL) via Australia
Source via Benin
Yes
Established Unknown
Abundance Unknown
General Impact Unknown
Geographical Scale of Impact (continued on next page)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi (continued)

Country	Cote d'Ivoire (continued)
Notes	Spread to the Cote d'Ivoire side of shared lagoon system by 1997 following release on the Ghana side in 1994. Introduced intentionally from Benin in 1998, though status of introduced population unknown.
Research Organization	IITA
References	95, 939, 946

RELEASE

Country	Cuba
Year	1995
Source	Ex. Argentina via USA (FL) via Honduras
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	236, 576, 670, 946, 1044

RELEASE

Country	Egypt
Year	2000
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	*Neochetina* spp. reduced water hyacinth by 90% within one year in Beheira; in Alexandria reduction slower due to water pollution.
Research Organization	ARCE
References	21, 389, 562, 946

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi (continued)

RELEASE

Country	Ghana
Year	1994
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Caused significant damage initially. Infested waters in Western seasonally flood, washing away weevil-infested plants. Water hyacinth rebounds annually from seed sprout, while weevil populations remain limited.
Limiting Factors	Flooding
Research Organization	EPA, IITA
References	21, 22, 448, 450, 946, 1494

RELEASE

Country	Honduras
Year	1989
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	EAP
References	236, 576, 936, 1356

TABLE 1

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	India
Year	1984
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	In combination with *Neochetina eichhorniae*, provided excellent control in 1980s. There have since been some resurgence problems due in part to eutrophication of water bodies. Efficacy now variable.
Research Organization	IIHR
References	907, 1032, 1439, 1542, 1693

RELEASE	
Country	Indonesia
Year	1996
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though widespread, populations low and offers no overall control to weed. Predation limits population levels.
Limiting Factors	Predation
Research Organization	GTZ, NIHORT
References	936, 946, 969, 1809

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Kenya
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	By 1998, had not started affecting the growth of the weed significantly on Lake Naivasha. Additional introductions subsequently made which proved more effective.
Research Organization	IITA, KARI
References	625, 630, 894, 946, 1370

RELEASE	
Country	Kenya
Year	1997
Source	Ex. Argentina via USA (FL) via Australia; Ex. Argentina via USA (FL) via Australia via Benin via Uganda; Ex. Argentina via USA (FL) via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

Country	Kenya (continued)
Notes	On Lake Victoria, estimated 75% of mats on Kenyan shore had sunk within 2 years of the release of both *Neochetina* spp. Entire Lake Victoria infestation considered under substantial control, possibly aided by wind and wave action and weather events. On Lake Naivasha, the additional introductions now widespread and significantly impact water hyacinth, reducing vigor and mat thickness, though other factors such as relatively lower water temperatures may also contribute. *Neochetina eichhorniae* more common than *N. bruchi* on Lake Victoria; the opposite is true for Lake Naivasha.
Research Organization	KARI, CSIRO, ARC-PPRI, NARO
References	242, 625, 630, 894, 946, 1247, 1353, 1370, 1371, 1990

RELEASE

Country	Malawi
Year	1995
Source	Ex. Argentina via USA (FL) via Zimbabwe
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	*Neochetina* spp. have had some success, along with *Orthogalumna terebrantis*, though water hyacinth remains a problem.
Research Organization	IITA, IIBC, MFD
References	139, 881, 882, 946, 1496

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE

Country	Malaysia
Year	1992
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established only in low numbers, insufficient to control weed.
Research Organization	DOAM, MARDI, PLANTI
References	55, 56, 57, 59, 71, 946, 2040

RELEASE

Country	Mali
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Benin via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	UGL
References	9, 13, 14, 279, 946, 1987

TABLE 1

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Mexico
Year	1994
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	*Neochetina* spp. in combination provide excellent control in some water bodies, but have limited impact in others unless additional agents/control methods utilized.
Research Organization	IMTA
References	11, 236, 699, 1161, 1163, 1164

RELEASE	
Country	Mozambique
Year	1972
Source	Ex. Unknown
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1494, 1495

RELEASE	
Country	Niger Republic
Year	2011
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	IITA, BMA
References	14, 946

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Nigeria
Year	1995
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Intentionally released in northwestern Nigeria beginning in 1995, though found already present in southern Nigeria in 1994 from populations naturally spreading from Benin. In Lake Kainji, 90 percent of plants infested within 2 years of release. By 2001, water hyacinth infestations visibly reduced compared to 1995 observations. Formal evaluation lacking throughout Nigeria.
Research Organization	GTZ, NIHORT, IITA
References	21, 388, 946

RELEASE	
Country	Panama
Year	1977
Source	Ex. Argentina via USA (FL)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	PCC
References	103, 936, 946, 1434

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Papua New Guinea
Year	1993
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread throughout country. In combination with *Neochetina eichhorniae* has provided very successful control.
Research Organization	CSIRO, PNGDAL
References	936, 939, 946, 949, 950, 1400, 1403, 2040

RELEASE	
Country	People's Republic of China
Year	1996
Source	Ex. Argentina via USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Very effective at reducing cover in some regions, but less effective in others where weed still remains significant problem. Hampered by cold.
Limiting Factors	Climate
Research Organization	CAAS-BCI
References	265, 298, 504, 920, 2061

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Philippines
Year	1992
Source	Ex. Argentina via USA (FL) via Australia via Thailand
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC, GTZ, BPI
References	936, 946, 1329

RELEASE	
Country	Republic of Congo
Year	1999
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Established and spread rapidly, up to 800 km following release. As of 2005, though widespread, impacts only beginning. Additional agents may be warranted.
Research Organization	CSIRO, IITA, MFE
References	937, 1177, 1345

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE

Country	Republic of South Africa
Year	1990
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Well established at a few sites, where it causes moderate damage. Not as abundant or widespread as *Neochetina eichhorniae*. Flooding, low winter temperatures, and high water nutrient levels limit weevil populations.
Limiting Factors	Flooding; Habitat; Climate
Research Organization	ARC-PPRI
References	208, 273, 297, 800, 801, 946, 992

RELEASE

Country	Republic of South Africa
Year	1996
Source	Ex. Argentina via USA (FL) via Zimbabwe
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

Country	Republic of South Africa (continued)
Notes	Following low establishment rates from first release, this second introduction made. The two populations subsequently had opportunity to intermix and are no longer differentiated. Well established at a few sites, where it causes moderate damage. Not as abundant or widespread as *Neochetina eichhorniae*. Flooding, low winter temperatures, and high water nutrient levels limit weevil populations.
Limiting Factors	Flooding; Habitat; Climate
Research Organization	ARC-PPRI
References	208, 800, 801, 946, 992

RELEASE

Country	République Togolaise
Year	2001
Source	Ex. Argentina via USA (FL) via Australia via Benin via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Little to no efforts have been made to monitor impact.
Research Organization	UGL
References	14, 95, 279, 946, 1987

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Rwanda
Year	2000
Source	Ex. Argentina via USA (FL) via Australia via Benin via Uganda
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Established in Eastern though failed in Northern due to cold conditions. Insufficient numbers released; resulting impact not large enough to control weed.
Limiting Factors	Small release size; Climate
Research Organization	NARO, ISAR
References	10, 279, 617, 946, 1254

RELEASE	
Country	South Sudan
Year	1979
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Contributes to control, but majority of impact due to *Neochetina eichhorniae*. Less abundant than *N. eichhorniae* and *Niphograpta albiguttalis*, but more efficient than *N. eichhorniae* in checking growth of plant, while *N. albiguttalis* not effective.
References	21, 109, 110, 536, 892, 946, 1940

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Sri Lanka
Year	2005
Source	Ex. Argentina via USA (FL) via Australia via Thailand
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Establishment slow compared to *Neochetina eichhorniae*.
Research Organization	PPS
References	82, 418

RELEASE	
Country	Sudan
Year	1979
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Released into South Sudan beginning in 1979, which at the time was part of Sudan but which has since gained independence. Naturally spread (as intended) throughout the Nile system into present-day Sudan by 1982. This species contributes to control, but majority of impact due to *Neochetina eichhorniae*. Less abundant than *N. eichhorniae* and *Niphograpta albiguttalis*, but more efficient than *N. eichhorniae* in checking growth of plant, while *N. albiguttalis* not effective.
Research Organization	UKS
References	21, 109, 110, 536, 892, 946, 1940

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Tanzania
Year	1995
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Both *Neochetina* weevils responsible for significant reduction in water hyacinth extent. Weed now considered under substantial control on Lake Victoria, possibly aided by wind and wave action and weather events. On rivers in Tanga Region, weevils reduced amount of manual removal required to keep river channels open.
Research Organization	IITA, MAT, PPD
References	21, 23, 28, 946, 1136, 1141, 1337, 1990

RELEASE	
Country	Thailand
Year	1991
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established and widespread in almost all areas of the country. With *Neochetina eichhorniae* provides excellent control.
Research Organization	NBCRC, CSIRO
References	524, 936, 946, 1328, 1329, 1939, 1998, 2040

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Uganda
Year	1993
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Both *Neochetina* species widespread throughout Uganda. Dispersed rapidly in Northern administrative region where reduced cover and biomass of plants. Significant reduction in extent of weed on Lake Victoria shorelines evident by 1998 with many mats having sunk. Control possibly aided by wind and wave action and weather events. Presently, only small remnants of water hyacinth plants found in Ugandan waters of Lake Victoria except near wastewater outflows where insect populations negatively impacted by high toxicity.
Research Organization	NARO, CSIRO, GTZ, IITA, CSC
References	23, 242, 298, 946, 1136, 1371, 1380, 1494, 1990

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	United States of America
Year	1974
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Well established throughout Gulf Coast states but usually dominated by *Neochetina eichhorniae*. Damage between species difficult to differentiate, but likely complement each other. Weevils credited with reducing waterhyacinth abundance to 1/3 original levels in Gulf Coast states though other factors also important for reducing weed. Waterhyacinth still remains a problem in this region. Though well established in CA, cold temperatures limit overwintering success and impact.
Other Species Attacked	Nontarget damage not recorded specifically from this species but because damage is difficult to differentiate from that of *Neochetina eichhorniae*, nontarget impacts from that species likely applies. Namely, spillover attack observed on the native *Pontederia cordata* L. and other native species intermixed with waterhyacinth, including *Canna* spp., though this attack is insignificant and temporary.
Research Organization	USAE, USDA (3,4,7,13), State (14,18)
References	19, 130, 222, 235, 236, 238, 242, 288, 298, 334, 335, 1179, 1503, 1512, 1726, 1900

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Vietnam
Year	1996
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	VNBCRC
References	219, 936, 946

RELEASE	
Country	Zambia
Year	1997
Source	Ex. Argentina via USA (FL) via Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	*Eichhornia crassipes* has declined markedly in areas of *Neochetina* spp. release, however it is unknown if this is due to the weevils (whose abundance is limited) or to other factors such as water level manipulation and control of nutrient loading in infested waters.
Research Organization	ARC-PPRI, ECZ
References	249, 946, 963

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Zimbabwe
Year	1990
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released as mix of both *Neochetina* species first sourced from Florida USA then later from Benin. Weevils found established away from release sites of both introductions; it is assumed both introductions established and are no longer differentiated in the field. Following successful establishment along Manyame River system, widespread herbicide use led to crash in weed and *Neochetina* spp. populations. Weevil populations increased again, while weed held in check. Though physical and chemical control also contributed to overall dramatic decline of water hyacinth, much credit given to biological control. Weed considered under control in most lakes, with exception of eutrophic water bodies. High herbicide use can cause fungal outbreaks on weevil populations.
Limiting Factors	Disease (corresponding to high herbicide use)
Research Organization	PPRIZ
References	255, 256, 259, 260, 263, 418, 936, 946, 1295

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

RELEASE	
Country	Zimbabwe
Year	1993
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released as mix of both *Neochetina* species first sourced from Florida USA then later from Benin. Weevils found established away from release sites of both introductions; it is assumed both introductions established and are no longer differentiated in the field. Following successful establishment along Manyame River system, widespread herbicide use led to crash in weed and *Neochetina* spp. populations. Weevil populations increased again, while weed held in check. Though physical and chemical control also contributed to overall dramatic decline of water hyacinth, much credit given to biological control. Weed considered under control in most lakes, with exception of eutrophic water bodies. High herbicide use can cause fungal outbreaks on weevil populations.
Limiting Factors	Disease (corresponding to high herbicide use)
Research Organization	IITA
References	12, 256, 259, 260, 263, 418, 936, 946, 1295

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Neochetina eichhorniae* Warner
Classification	(Coleoptera: Erirhinidae)

RELEASE

Country	Australia
Year	1975
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	Widely established on mainland; failed on Norfolk Is. Good control at large infestations and infestations on permanent waters. No control where seasonal floods flush weed and agent to sea thus limiting the time for agent population increase. Less effective where pesticide use continues and in cool temperate regions.
Limiting Factors	Climate; Other control methods; Flooding
Research Organization	CSIRO
References	236, 937, 2037, 2039, 2040

RELEASE

Country	Benin
Year	1991
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Variable

(continued at top of next column)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

Country	Benin (continued)
Notes	More dominant than *Neochetina bruchi*. Caused substantial reduction in weed coverage at some localities; at other sites with shallow banks impact slow or ineffective. Overall, weed has been reduced from serious to moderate pest.
Research Organization	IITA, GTZ, BDF
References	13, 14, 17, 298, 878, 946, 1346, 1883

RELEASE

Country	Benin
Year	2011
Source	Ex. Argentina via USA (FL) via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially released in 1991, cultures of this same stock were maintained in a laboratory and utilized to make a second release in 2011. Status unknown.
Research Organization	IITA
References	14, 18, 946

RELEASE

Country	Burkina Faso
Year	1998
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Unknown
Notes	Anecdotal evidence suggests a substantial reduction of water hyacinth.
Research Organization	IITA
References	95, 443, 946, 1409

TABLE 1

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Cote d'Ivoire
Year	1998
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread to the Cote d'Ivoire side of shared lagoon system by 1997 following release on the Ghana side in 1994. Introduced intentionally from Benin in 1998, though status of introduced population unknown.
Research Organization	IITA
References	95, 939, 946

RELEASE	
Country	Egypt
Year	2000
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	*Neochetina* spp. reduced water hyacinth by 90% within one year in Beheira; in Alexandria reduction slower due to water pollution.
Research Organization	ARCE
References	21, 389, 562, 946

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Fiji
Year	1977
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially slow to spread, but eventually distributed throughout range of weed. Providing good to excellent control. Impact likely lower where seasonal floods flush out weed and agent, thus limiting the time for agent population increase.
Limiting Factors	Flooding
Research Organization	KRS
References	236, 288, 960, 1402, 1691

RELEASE	
Country	Ghana
Year	1994
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Caused significant damage initially. Infested waters in Western Region seasonally flood, washing away weevil-infested plants. Water hyacinth rebounds annually from seed sprout, while weevil populations remain limited. Both *Neochetina* spp. similar in abundance in Western.
Limiting Factors	Flooding
Research Organization	EPA, IITA
References	21, 22, 448, 450, 946, 1494

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Honduras
Year	1990
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	EAP
References	576, 936, 1356

RELEASE	
Country	India
Year	1983
Source	Ex. Argentina via USA (FL); Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Variable
Notes	In combination with *Neochetina bruchi*, provided excellent control in 1980s. There have since been some resurgence problems due in part to eutrophication of water bodies. Efficacy now variable.
Research Organization	IIHR
References	906, 908, 1032, 1439, 1542, 1693

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Indonesia
Year	1979
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though widespread, populations low and offers no overall control to weed. Predation limits population levels.
Limiting Factors	Predation
Research Organization	UKS
References	936, 946, 969, 1939

RELEASE	
Country	Kenya
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	By 1998, had not started affecting the growth of the weed significantly on Lake Naivasha. Additional introductions subsequently made which proved more effective.
Research Organization	IITA, KARI
References	625, 630, 894, 946, 1370

TABLE 1

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Kenya
Year	1997
Source	Ex. Argentina via USA (FL) via Republic of South Africa; Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	On Lake Victoria, estimated 75% of mats on Kenyan shore had sunk within 2 years of the release of both *Neochetina* spp. Entire Lake Victoria infestation considered under substantial control, possibly aided by wind and wave action and weather events. On Lake Naivasha, the additional releases now widespread and significantly impact water hyacinth, reducing vigor and mat thickness, though other factors such as relatively lower water temperatures may also contribute. *Neochetina eichhorniae* more common than *N. bruchi* on Lake Victoria; the opposite is true for Lake Naivasha.
Research Organization	KARI, CSIRO, ARC-PPRI, NARO
References	242, 625, 630, 894, 946, 1247, 1353, 1370, 1371, 1990

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Malawi
Year	1995
Source	Ex. Argentina via USA (FL) via Zimbabwe
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	*Neochetina* spp. have had some success, along with *Orthogalumna terebrantis*, though water hyacinth remains a problem.
Research Organization	IITA, IIBC, MFD
References	139, 881, 882, 946, 1496

RELEASE	
Country	Malaysia
Year	1983
Source	Ex. Argentina via USA (FL) via Thailand
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Intentionally introduced, though separate population of unintentional individuals migrating from Thailand subsequently established in same regions and populations are no longer differentiated. Though widespread throughout range, established only in low numbers; insufficient to control weed.
References	55, 56, 57, 71, 944

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Mali
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Benin via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	UGL
References	9, 13, 14, 279, 946, 1987

RELEASE	
Country	Mexico
Year	1976
Source	Ex. Argentina via USA
Established	Yes
Abundance	High
General Impact	Variable
Notes	Approved and intentionally released, though was already present inadvertently since 1967. Intentional and inadvertent populations subsequently not differentiated in the literature. *Neochetina* spp. in combination provide excellent control in some water bodies, but have limited impact in others unless additional agents/control methods utilized.
Research Organization	IMTA
References	11, 103, 236, 699, 1161, 1163, 1164, 1368

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Mozambique
Year	1972
Source	Ex. Unknown
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Intentionally introduced in 1972 into the Cahora Bassa, though the origin of release material is unknown. Also spread naturally from rivers in South Africa. Overall status of either population unknown.
References	1494, 1495

RELEASE	
Country	Myanmar
Year	1980
Source	Ex. Argentina via USA (FL) via Thailand
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC, AC
References	936, 1326, 1327, 1329, 1939

RELEASE	
Country	Nauru
Year	2008
Source	Ex. Argentina via USA (FL) via Australia via Fiji
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	418, 1401

TABLE 1

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Niger Republic
Year	2011
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Status of this intentionally introduced population unknown. Different population spread naturally from releases on Niger River in Nigeria in 1993.
Research Organization	IITA, BMA
References	14, 18, 946

RELEASE	
Country	Nigeria
Year	1993
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Variable

(continued at top of next column)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

Country	Nigeria (continued)
Notes	Intentionally released in northwestern Nigeria beginning in 1993 and southwestern Nigeria in 1996, though found already present in southern Nigeria in 1994 from populations naturally spreading from Benin. Intentional and naturally spread populations subsequently not differentiated in the literature. Dispersed and established rapidly; within 2 years, recovered from sites as far as 200 km from closest release point along River Niger. By 2001, water hyacinth infestations visibly reduced compared to 1995 observations. In southwestern states, *Neochetina eichhorniae* widespread but not effectively controlling the weed. Formal evaluation lacking throughout Nigeria.
Research Organization	NASENI, NIHORT, CSIRO
References	9, 21, 388, 946, 1499, 1510

RELEASE	
Country	Papua New Guinea
Year	1985
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread throughout country. In combination with *Neochetina bruchi* has provided very successful control.
Research Organization	CSIRO, PNGDAL
References	936, 939, 949, 950, 1077, 1400, 1403, 1939, 2040

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	People's Republic of China
Year	1996
Source	Ex. Argentina via USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Very effective at reducing cover in many regions. Less effective in other regions, especially those further north with cold winters, where weed still remains significant problem.
Limiting Factors	Climate
Research Organization	CAAS-BCI
References	265, 298, 418, 504, 920, 2061

RELEASE	
Country	Philippines
Year	1992
Source	Ex. Argentina via USA (FL) via Thailand
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC, GTZ, BPI
References	936, 1329

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Republic of Congo
Year	1999
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Established and spread rapidly, up to 800 km following release. As of 2005, though widespread, impacts only beginning. Additional agents may be warranted.
Research Organization	CSIRO, IITA, MFE
References	937, 1177, 1345

RELEASE	
Country	Republic of South Africa
Year	1974
Source	Ex. Argentina; Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Variable
Notes	These first introductions had low establishment and efficacy. Second and (accidental) third introductions increased success, though were no longer differentiated in the literature. *Neochetina eichhorniae* is now the most widespread and abundant of *Eichhornia crassipes* agents in South Africa. Control success variable by site; very successful in some areas while ineffective in others. Flooding, low winter temperatures, and high water nutrient levels limit weevil populations.
Limiting Factors	Flooding; Habitat; Climate
Research Organization	ARC-PPRI
References	103, 208, 273, 297, 801, 1340

TABLE 1

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	High
General Impact	Variable
Notes	The first introductions had low establishment and efficacy. Second and (accidental) third introductions increased success, though were no longer differentiated in the literature. *Neochetina eichhorniae* is now the most widespread and abundant of *Eichhornia crassipes* agents in South Africa. Control success variable by site; very successful in some areas while ineffective in others. Flooding, low winter temperatures, and high water nutrient levels limit weevil populations.
Limiting Factors	Flooding; Habitat; Climate
Research Organization	ARC-PPRI
References	208, 273, 297, 801, 946, 1340

RELEASE	
Country	République Togolaise
Year	2001
Source	Ex. Argentina via USA (FL) via Australia via Benin via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Little to no efforts have been made to monitor impact.
Research Organization	UGL
References	14, 95, 279, 946, 1987

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Rwanda
Year	2000
Source	Ex. Argentina via USA (FL) via Australia via Benin via Uganda
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Established in Eastern though failed in Northern due to cold conditions. Insufficient numbers released; resulting impact not large enough to control weed.
Limiting Factors	Small release size; Climate
Research Organization	NARO, ISAR
References	10, 279, 617, 946, 1254

RELEASE	
Country	Solomon Islands
Year	1982
Source	Ex. Argentina via USA (FL) via Australia
Established	No
Notes	Initially believed to have established, but subsequently considered failed because no adults observed since early 1983. Failure likely due to small release size and/or chemical contamination of the release site.
Limiting Factors	Small release size; Other control methods
Research Organization	MAL
References	1864, 1940

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Solomon Islands
Year	1988
Source	Ex. Argentina via USA (FL) via Australia via Fiji
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Limited control. Does not impact weed ecology in short river systems where infestations occur.
Research Organization	MAL
References	427, 1403, 1438, 1864, 1940

RELEASE	
Country	South Sudan
Year	1979
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released into Sudan in 1978. South Sudan has since gained independence from Sudan. Releases into regions falling with South Sudan borders did not occur until 1979. This species credited with majority of damage to water hyacinth, though *Neochetina bruchi* contributes somewhat and *Niphograpta albiguttalis* slightly. Program considered a success; since 1982 all control activities have stopped.
References	21, 109, 110, 536, 892, 946, 1940

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Sri Lanka
Year	1988
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Populations vary depending on location but were never high enough to exert control of water hyacinth infestations. Mechanical removal of plants, wave/wind action, eutrophication all decrease agent populations and efficacy.
Limiting Factors	Other control methods; Land use
Research Organization	NBCRC
References	911, 936, 946, 1588, 1939

RELEASE	
Country	Sudan
Year	1978
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Credited with majority of damage to water hyacinth, though *Neochetina bruchi* contributes somewhat and *Niphograpta albiguttalis* slightly. Program considered a success; since 1982 all control activities have stopped.
Research Organization	UKS
References	21, 109, 110, 536, 892, 946, 1940

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Tanzania
Year	1995
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Both *Neochetina* weevils responsible for significant reduction in water hyacinth extent. Weed now considered under substantial control on Lake Victoria, possibly aided by wind and wave action and weather events. On rivers in Tanga Region, weevils reduced amount of manual removal required to keep river channels open.
Research Organization	IITA, MAT, PPD
References	21, 23, 28, 946, 1136, 1141, 1337, 1990

RELEASE	
Country	Thailand
Year	1979
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established and widespread in almost all areas of the country. With *Neochetina bruchi* provides excellent control.
Research Organization	NBCRC
References	524, 936, 946, 1326, 1329, 1939, 1998, 2040

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Uganda
Year	1993
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Both *Neochetina* species widespread throughout Uganda. Dispersed rapidly in Northern administrative region where reduced cover and biomass of plants. Significant reduction in extent of weed on Lake Victoria shorelines evident by 1998 with many mats having sunk. Control possibly aided by wind and wave action and weather events. Presently, only small remnants of water hyacinth plants found in Ugandan waters of Lake Victoria except near wastewater outflows where insect populations negatively impacted by high toxicity.
Research Organization	NARO, CSIRO, GTZ, CSC, IITA
References	23, 242, 298, 946, 1136, 1371, 1380, 1494, 1990

RELEASE	
Country	United States of America
Year	1972
Source	Ex. Argentina
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

Country	United States of America (continued)
Notes	Established throughout Gulf Coast states, usually along with and dominating *Neochetina bruchi*. Damage between species difficult to differentiate, but likely complement each other. Weevils credited with reducing waterhyacinth abundance to 1/3 original levels in Gulf Coast states though other factors also important for reducing weed. Waterhyacinth still remains a problem in this region.
Other Species Attacked	Spillover attack observed on the native *Pontederia cordata* L. and other native species intermixed with waterhyacinth, including *Canna* spp., though this attack is insignificant and temporary.
Research Organization	USDA (3,4,7,13), State (3,14,18), USAE
References	20, 130, 235, 236, 238, 242, 288, 298, 685, 700, 705, 1512, 1726

RELEASE

Country	Vanuatu
Year	2004
Source	Ex. Argentina via USA (FL) via Australia via Fiji
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Providing good to excellent control at few sites where established. Water hyacinth itself only localized in Vanuatu.
Research Organization	SPC, DLQS
References	204, 418, 427, 1402,

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE

Country	Vietnam
Year	1984
Source	Ex. Argentina via USA (FL) via Thailand
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC, VNBCRC
References	936, 1327, 1328, 1329, 1939

RELEASE

Country	Zambia
Year	1971
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	103, 312, 799

RELEASE

Country	Zambia
Year	1996
Source	Ex. Argentina via USA (FL) via Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	*Eichhornia crassipes* has declined markedly in areas of *Neochetina* spp. release, however it is unknown if this is due to the weevils (whose abundance is limited) or to other factors such as water level manipulation and control of nutrient loading in infested waters.
Research Organization	ARC-PPRI, ECZ
References	249, 799, 946, 963

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Zimbabwe
Year	1990
Source	Ex. South America via USA (FL)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released as mix of both *Neochetina* species first sourced from Florida USA then later from Benin. Weevils found established away from release sites of both introductions; it is assumed both introductions established and are no longer differentiated in the field. Following successful establishment along Manyame River system, widespread herbicide use led to crash in weed and *Neochetina* spp. populations. Weevil populations increased again, while weed held in check. Though physical and chemical control also contributed to overall dramatic decline of water hyacinth, much credit given to biological control. Weed considered under control in most lakes, with exception of eutrophic water bodies. High herbicide use can cause fungal outbreaks on weevil populations.
Limiting Factors	Disease (corresponding to high herbicide use)
Research Organization	PPRIZ
References	255, 256, 259, 260, 263, 418, 936, 946, 1295

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

RELEASE	
Country	Zimbabwe
Year	1993
Source	Ex. Argentina via USA (FL) via Australia via Benin
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released as mix of both *Neochetina* species first sourced from Florida USA then later from Benin. Weevils found established away from release sites of both introductions; it is assumed both introductions established and are no longer differentiated in the field. Following successful establishment along Manyame River system, widespread herbicide use led to crash in weed and *Neochetina* spp. populations. Weevil populations increased again, while weed held in check. Though physical and chemical control also contributed to overall dramatic decline of water hyacinth, much credit given to biological control. Weed considered under control in most lakes, with exception of eutrophic water bodies. High herbicide use can cause fungal outbreaks on weevil populations.
Limiting Factors	Disease (corresponding to high herbicide use)
Research Organization	IITA
References	12, 256, 259, 260, 263, 418, 936, 946, 1295

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT	
Species	*Niphograpta albiguttalis* (Warren)
Past Names/Synonyms	*Epipagis albiguttalis* (Warren), *Sameodes albiguttalis* (Warren)
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	Australia
Year	1977
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established through natural dispersal. Damage spatially and temporally patchy; the weed frequently outgrows damage making this agent less effective overall.
Research Organization	CSIRO
References	937, 2037, 2040

RELEASE	
Country	Benin
Year	1993
Source	Ex. Argentina via USA (FL) via Australia
Established	No
Research Organization	IITA
References	13, 17, 298, 945, 1346, 1883

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

RELEASE	
Country	Ghana
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Republic of South Africa
Established	No
Research Organization	EPA
References	21, 450, 945

RELEASE	
Country	Kenya
Year	1997
Source	Ex. Argentina via USA (FL) via Australia via Republic of South Africa
Established	No
Notes	Introduced onto Lake Naivasha but failed to establish.
Research Organization	KARI, ARC-PPRI
References	630, 894, 945, 1136, 1247, 1494

RELEASE	
Country	Malawi
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Republic of South Africa
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	IIBC, MFD
References	936, 945, 1496

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

RELEASE	
Country	Malaysia
Year	1996
Source	Ex. Argentina via USA (FL) via Australia via Thailand
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established only in low numbers, insufficient to control weed.
Research Organization	MARDI, DOAM
References	56, 59, 71, 945

RELEASE	
Country	Panama
Year	1977
Source	Ex. Argentina via USA (FL)
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	First release in 1977 failed to establish due to ant predation; the fate of the second release in 1978 unknown.
Limiting Factors	Predation
Research Organization	PCC
References	936, 945, 1434

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

RELEASE	
Country	Papua New Guinea
Year	1994
Source	Ex. Argentina via USA (FL) via Australia
Established	No
Research Organization	CSIRO, PNGDAL
References	949, 950, 1400, 2040

RELEASE	
Country	Republic of South Africa
Year	1990
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Rare
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Can withstand severe winters which has led to its distribution across South Africa. However, its requirement for young and actively growing plants, which are not always found in *Eichhornia crassipes* mats, results in a patchy distribution both spatially and temporally. Consequently considered rare over the majority of the country. Where large populations occur, can be very effective locally. Parasitism may limit populations in some areas, though this has not been studied explicitly.
Limiting Factors	Plant phenology; possibly Parasitism
Research Organization	ARC-PPRI
References	273, 297, 800, 801, 945, 992

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

RELEASE	
Country	South Sudan
Year	1980
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Though widespread, does not contribute successfully to control. Majority of impact attributed to *Neochetina eichhorniae*.
References	109, 110, 536, 892, 945, 1940

RELEASE	
Country	Sudan
Year	1979
Source	Ex. Argentina via USA (FL)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Released into South Sudan beginning in 1979, which at the time was part of Sudan but which has since gained independence. Naturally spread (as intended) throughout the Nile system into present-day Sudan by 1982. Though widespread, does not contribute successfully to control. Majority of impact attributed to *Neochetina eichhorniae*.
Research Organization	UKS
References	109, 110, 536, 892, 945, 1940

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

RELEASE	
Country	Thailand
Year	1995
Source	Ex. Argentina via USA (FL) via Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC
References	936, 1329, 1998, 2040

RELEASE	
Country	United States of America
Year	1977
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Larval tunneling destroys apical meristem; affected plants often die or lose buoyancy and sink. Establishes quickly, creates a great deal of damage, and then often disappears.
Research Organization	USAE, USDA (3,4,7,13), State (14)
References	233, 235, 236, 238, 242, 288, 302, 1578, 1726

RELEASE	
Country	Zambia
Year	1971
Source	Ex. Trinidad via India
Established	No
Research Organization	IIBC
References	103, 799, 936, 945

TABLE 1

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

RELEASE	
Country	Zambia
Year	1997
Source	Ex. Argentina via USA (FL) via Australia via Republic of South Africa
Established	No
Research Organization	ARC-PPRI, ECZ
References	249, 799, 936, 945

RELEASE	
Country	Zimbabwe
Year	1994
Source	Ex. Argentina via USA (FL) via Australia
Established	No
Research Organization	PPRIZ, CSIRO
References	256, 279, 418, 945

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT	
Species	*Orthogalumna terebrantis* Wallwork
Classification	(Acari: Galumnidae)

RELEASE	
Country	India
Year	1986
Source	Ex. South America via USA (FL)
Established	Yes
Abundance	High
General Impact	None
Notes	High populations cause browning of leaves but damage confined to older leaves and older or shaded plants. Does not control the weed by itself.
Research Organization	IIHR, ICAR, KAU
References	909, 931, 1542, 1693

RELEASE	
Country	Kenya
Year	1997
Source	Ex. Unknown via Republic of South Africa
Established	No
Notes	Introduced onto Lake Naivasha but failed to establish.
Research Organization	KARI, ARC-PPRI
References	801, 894, 1136, 1247, 1494

PONTEDERIACEAE
Eichhornia crassipes; Orthogalumna terebrantis *(continued)*

RELEASE	
Country	Zambia
Year	1971
Source	Ex. South America via USA (FL)
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely established, does not provide substantial control on its own.
Research Organization	IIBC
References	103, 345, 799, 963, 1159

AGENT	
Species	*Xubida infusella* (Walker)
Past Names/Synonyms	*Acigona infusella* (Walker)
Incorrect Past Names/Synonyms	*Xubida infusellus* (Walker)
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	Australia
Year	1981
Source	Ex. Brazil
Established	No
Notes	Recoveries made over period of 13 months following release but not thereafter; agent since believed to have died out.
Research Organization	CSIRO
References	937, 1604, 2038, 2040

PONTEDERIACEAE
Eichhornia crassipes; Xubida infusella *(continued)*

RELEASE	
Country	Australia
Year	1996
Source	Ex. Argentina
Established	Yes
Abundance	Limited
General Impact	None
Notes	Established at only one site in QLD despite being widely released in tropics and sub tropics. No impact.
Research Organization	CSIRO
References	841

RELEASE	
Country	Papua New Guinea
Year	1997
Source	Ex. Argentina via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Recovered at one site in NCD, but establishment not confirmed.
Research Organization	CSIRO, PNGDAL
References	937, 939, 949, 950, 952, 1400

RELEASE	
Country	Thailand
Year	1997
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC
References	936, 937, 945, 1996

TABLE 1

TABLE 1

PROTEACEAE

WEED

Family	Proteaceae
Species	*Hakea gibbosa* (Sm.) Cav.
Origin	Australia
Common Name	rock hakea, hairy needlebush

AGENT

Species	*Aphanasium australe* (Boisduval)
Classification	(Coleoptera: Cerambycidae)

RELEASE

Country	Republic of South Africa
Year	2003
Source	Ex. Australia
Established	Unknown
Abundance	Unknown
General Impact	Compromised
Notes	Establishment unknown but unlikely because one release site was burned while the *Hakea gibbosa* at the other was chopped down by the landowner.
Limiting Factors	Land use
Research Organization	ARC-PPRI
References	632

PROTEACEAE
Hakea gibbosa *(continued)*

AGENT

Species	*Erytenna consputa* Pascoe
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Republic of South Africa
Year	1979
Source	Ex. Australia
Established	No
Research Organization	ARC-PPRI
References	659

RELEASE

Country	Republic of South Africa
Year	2003
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Two sites lost to fire and mechanical disturbance. At remaining site, annual fruit loss due to larval damage over a 4-year period had increased steadily to 15.4%. Over the same period, the average number of mature fruits recorded per plant increased 3-fold, indicating negative impact of *Erytenna consputa* on *Hakea gibbosa* seed production is not as pronounced as that on *H. sericea*.
Limiting Factors	Land use
Research Organization	ARC-PPRI
References	659

PROTEACEAE *(continued)*

WEED	
Family	Proteaceae
Species	*Hakea sericea* Schrad. & J.C. Wendl.
Origin	Australia
Common Name	silky hakea, needlebush

AGENT	
Species	*Aphanasium australe* (Boisduval)
Classification	(Coleoptera: Cerambycidae)

RELEASE	
Country	Republic of South Africa
Year	2001
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though it has been over 10 years since release, populations are still limited. Larvae take up to two years to mature and many of the attacked plants are mature and large; both factors indicate a long time will be required before populations are high and impact is significant. Still increasing.
Research Organization	ARC-PPRI
References	656, 658, 659

PROTEACEAE
Hakea sericea *(continued)*

AGENT	
Species	*Carposina autologa* Meyrick
Classification	(Lepidoptera: Carposinidae)

RELEASE	
Country	Republic of South Africa
Year	1972
Source	Ex. Australia
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Initially poorly established but new redistribution methods have increased populations. Development time long and hindered greatly by the pathogen *Colletotrichum acutatum* f. sp. *hakeae* as well as inability to distinguish between healthy and previously attacked fruits for oviposition. Not as common as *Erytenna consputa*, though populations still increasing. Often destroys fewer seeds than *E. consputa*, but reduces seed output by >50% at some sites. Does not kill existing trees and regenerating seedlings still exceed the parent population in existing stands in most cases. Limited following fires as this agent is slow to colonize recovering burned regions. Best in combination with measures that kill parent plants.
Limiting Factors	Fire; Simultaneous attack of weed by pathogens
Research Organization	ARC-PPRI
References	51, 655, 658, 659, 992, 1000, 1341

TABLE 1

TABLE 1

PROTEACEAE
Hakea sericea *(continued)*

AGENT	
Species	*Cydmaea binotata* Lea
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	1979
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Only established at a few locations; abundance limited and impact trivial.
Research Organization	ARC-PPRI
References	655, 659, 992, 1000

PROTEACEAE
Hakea sericea *(continued)*

AGENT	
Species	*Dicomada rufa* Blackburn
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	2006
Source	Ex. Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Numerous sites lost to clearing or fire. Though established at half of remaining sites, abundance, dispersal and impact are unknown.
Limiting Factors	Land use
Research Organization	ARC-PPRI
References	658, 659, 992

PROTEACEAE
Hakea sericea *(continued)*

AGENT	
Species	*Erytenna consputa* Pascoe
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	1972
Source	Ex. Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Despite establishing, populations from this release performed poorly in their new habitat, due to host plant incompatibility.
Limiting Factors	Host plant incompatibility
Research Organization	ARC-PPRI
References	51, 655, 658, 659, 992, 1000, 1341, 1343

PROTEACEAE
Hakea sericea; Erytenna consputa *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1975
Source	Ex. Australia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Releases consisted of larger colonies (than previous releases) and from inland localities in Australia that better matched host plant forms and climate in South Africa. Now the most widespread and abundant of established agents. Though it destroys most of the seeds produced by *Hakea sericea*, it does not kill existing trees and regenerating seedlings still exceed the parent population in existing stands in most cases. Limited following fires as this agent is slow to colonize recovering burned regions. Best in combination with measures that kill parent plants, such as the pathogens.
Limiting Factors	Fire
Research Organization	ARC-PPRI
References	51, 655, 659, 992, 1000, 1001, 1343

TABLE 1

TABLE 1

RANUNCULACEAE

WEED	
Family	Ranunculaceae
Species	*Clematis vitalba* L.
Origin	Europe
Common Name	old man's beard

AGENT	
Species	*Didymella clematidis* Woudenberg, Spiers & Gruyter
Past Names/Synonyms	*Phoma clematidina* (Thüm.) Boerema pars
Classification	(Dothideomycetes: Pleosporales)
Notes	This agent was released under the belief it was a strain of *Phoma clematidina* (Thüm.) Boerema from the USA. However later molecular work showed that what were believed to be a few different strains of this species worldwide are actually different species. This strain was subsequently described as the new species *Didymella clematidis* Woudenberg, Spiers & Gruyter.
References	987, 2036

RANUNCULACEAE
Clematis vitalba; Didymella clematidis *(continued)*

RELEASE	
Country	New Zealand
Year	1996
Source	Ex. USA
Established	No
Notes	Originally established and dispersed well but recent analyses indicate it has disappeared. Possibly displaced by less virulent or even endophytic strain of *Phoma clematidina* already established in New Zealand prior to this release.
Limiting Factors	Possibly excluded by endophytes
Research Organization	HFRI, MWLR
References	665, 761, 1057, 1064, 2036

AGENT	
Species	*Monophadnus spinolae* (Klug)
Classification	(Hymenoptera: Tenthredinidae)

RELEASE	
Country	New Zealand
Year	1998
Source	Ex. Austria
Established	No
Notes	Only a limited number of releases were made as mass-rearing proved difficult.
Research Organization	MWLR
References	665, 761, 1064, 1447

RANUNCULACEAE
Clematis vitalba *(continued)*

AGENT	
Species	*Phytomyza vitalbae* Kaltenbach
Classification	(Diptera: Agromyzidae)

RELEASE	
Country	New Zealand
Year	1996
Source	Ex. Germany, Switzerland
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed throughout country. While some damaging outbreaks have been seen, anecdotal evidence suggests overall impact limited by parasitism.
Limiting Factors	Parasitism
Other Species Attacked	Spillover feeding has been documented on the native *Clematis foetida* Raoul and *C. forsteri* J.F. Gmel
Research Organization	MWLR
References	665, 761, 816, 1057, 1064, 1446, 1447

ROSACEAE

WEED	
Family	Rosaceae
Species	*Acaena anserinifolia* (J.R. Forst. & G. Forst.) Armstr.
Origin	New Zealand
Common Name	piripiri

AGENT	
Species	*Ucona acaenae* Smith
Past Names/Synonyms	*Antholcus varinervis* Spinola pars
Classification	(Hymenoptera: Tenthredinidae)
Notes	Though released into New Zealand under the name *Antholcus varinervis* Spinola, it was later determined the insect did not fit the official description of the species of the same name. It was subsequently determined to be a new species and assigned the name *Ucona acaenae* Smith.

RELEASE	
Country	New Zealand
Year	1936
Source	Ex. Chile
Established	No
Notes	Target native to New Zealand.
Research Organization	CI, DSIR
References	720, 1246, 1695

TABLE 1

TABLE 1

ROSACEAE *(continued)*

WEED	
Family	Rosaceae
Species	*Rubus alceifolius* Poir.
Origin	southeastern Asia
Common Name	giant bramble

AGENT	
Species	*Cibdela janthina* (Klug)
Classification	(Hymenoptera: Argidae)

RELEASE	
Country	La Réunion
Year	2008
Source	Ex. Indonesia (Sumatra)
Established	Yes
Abundance	Too early post release
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Well established and spreading on the western coast, providing good control of weed under 1000 m of elevation.
Limiting Factors	Elevation
References	1079, 1080

ROSACEAE *(continued)*

WEED	
Family	Rosaceae
Species	*Rubus argutus* Link
Past Names/Synonyms	*Rubus penetrans* Bailey
Incorrect Past Names/Synonyms	*Rubus lucidus* Rydberg
Origin	eastern USA
Common Name	prickly Florida blackberry

AGENT	
Species	*Chlamisus gibbosa* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Hawaii USA
Year	1969
Source	Ex. USA (MO)
Established	No
Research Organization	HDOA
References	401, 612, 1318

ROSACEAE
Rubus argutus *(continued)*

AGENT	
Species	*Croesia zimmermani* Clarke
Incorrect Past Names/Synonyms	*Apotoforma* sp.
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Hawaii USA
Year	1964
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Foliar damage can be extensive, though insect populations fluctuate. In combination with *Schreckensteinia festaliella*, can provide partial control in some open areas but impact is less in forested regions.
Limiting Factors	Parasitism
Other Species Attacked	Also attacks the native *Rubus hawaiensis* A. Gray and *R. macraei* A. Gray.
Research Organization	HDOA
References	410, 411, 412, 612, 613, 635, 762, 1212, 1318, 1457, 2068

ROSACEAE
Rubus argutus *(continued)*

AGENT	
Species	*Pennisetia marginata* (Harris)
Past Names/Synonyms	*Bembecia marginata* (Harris)
Classification	(Lepidoptera: Sesiidae)

RELEASE	
Country	Hawaii USA
Year	1963
Source	Ex. USA (OR)
Established	No
Research Organization	HDOA
References	409, 612, 635, 1318

RELEASE	
Country	Hawaii USA
Year	1966
Source	Ex. USA (OR)
Established	No
Research Organization	HDOA
References	412, 635, 1318, 1322

TABLE 1

ROSACEAE
Rubus argutus *(continued)*

AGENT	
Species	*Priophorus morio* (Lepeletier)
Classification	(Hymenoptera: Tenthredinidae)

RELEASE	
Country	Hawaii USA
Year	1966
Source	Ex. USA (CA, OR, WA)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Dispersed throughout range of weed but population limited by virus probably introduced with the insect. Overall impact minimal.
Limiting Factors	Disease
Other Species Attacked	Also found attacking the native *Rubus hawaiensis* A. Gray and *R. macraei* A. Gray.
Research Organization	HDOA
References	412, 1150, 1318, 1322, 1457

ROSACEAE
Rubus argutus; Priophorus morio *(continued)*

RELEASE	
Country	Hawaii USA
Year	1968
Source	Ex. USA (CA)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Utilized on different islands than original release, though current status largely not differentiated in the literature. Dispersed throughout range of weed but population limited by virus probably introduced with the insect. Disease-free population released on KA initially abundant and effective but decreased when virus arrived 2 years later. Overall impact minimal.
Limiting Factors	Disease
Other Species Attacked	Also found attacking the native *Rubus hawaiensis* A. Gray and *R. macraei* A. Gray.
Research Organization	HDOA
References	405, 1150, 1318, 1457

ROSACEAE
Rubus argutus (continued)

AGENT	
Species	*Schreckensteinia festaliella* Hübner
Classification	(Lepidoptera: Schreckensteiniidae)

RELEASE	
Country	Hawaii USA
Year	1963
Source	Ex. California, USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Damage can be extensive, though insect populations fluctuate. In combination with *Croesia zimmermani*, can provide partial control in some open areas but impact is less in forested regions.
Other Species Attacked	Also found attacking the native *Rubus hawaiensis* A. Gray and *R. macraei* A. Gray.
Research Organization	HDOA
References	409, 411, 412, 612, 613, 635, 762, 1318, 1457

ROSACEAE (continued)

WEED	
Family	Rosaceae
Species	*Rubus constrictus* Lefevre & P. J. Mull.
Origin	Europe
Common Name	blackberry, murra

AGENT	
Species	*Phragmidium violaceum* (Schultz) G. Winter
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Chile
Year	1973
Source	Ex. Germany
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Established and spread rapidly. Provides effective control by hastening normal defoliation such that stems do not lignify properly, facilitating invasion by secondary pathogens and frost damage. Weed being replaced. *Rubus constrictus* is more susceptible than *R. ulmifolius*.
Research Organization	UACH
References	84, 1377, 1379

TABLE 1

TABLE 1

ROSACEAE *(continued)*

WEED

Family	Rosaceae
Species	*Rubus fruticosus* L. agg.
Notes	Group of closely related species whose frequent interspecific hybridization and high phenotypic plasticity make taxonomic designations difficult. For convenience these are dealt with herein under the name *Rubus fruticosus* aggregate. *Phragmidium violaceum* strains work better on some taxa than others.
Origin	Asia, Europe
Common Name	European blackberry, blackberry

AGENT

Species	*Phragmidium violaceum* (Schultz) G. Winter
Classification	(Pucciniomycetes: Pucciniales)

RELEASE

Country	Australia
Year	1991
Source	Ex. France
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Strain F15, introduced legally. Genetic evidence suggests genes from F15 were incorporated in the rust population in WA following these 1991 releases.
Research Organization	VIC State
References	185, 189, 886, 1261, 1264, 1265

ROSACEAE
Rubus fruticosus; Phragmidium violaceum (continued)

RELEASE

Country	Australia
Year	2004
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Strain F15. Genetic screening following releases in the 2000s indicates alleles of strain F15 incorporated into existing rust population at four representative sites in NSW and VIC. Disease intensity varies by *Rubus* species, location and time, rarely exceeding 40% of leaves on infected stems. Only under ideal conditions (sufficient rainfall and humidity and mild maximum temperatures) is there significant reduction in daughter plant production and total biomass.
Limiting Factors	Climate
Research Organization	CSIRO
References	185, 558, 647, 648, 1261, 1264, 1265

ROSACEAE
Rubus fruticosus; Phragmidium violaceum *(continued)*

RELEASE	
Country	Australia
Year	2004
Source	Ex. France
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Eight strains released legally. Genetic screening following releases indicates alleles of these strains incorporated into existing rust population at four representative sites in NSW and VIC. Disease intensity varies by *Rubus* species, location and time, rarely exceeding 40% of leaves on infected stems. Only under ideal conditions (sufficient rainfall and humidity and mild maximum temperatures) is there significant reduction in daughter plant production and total biomass.
Limiting Factors	Climate
Research Organization	CSIRO
References	648, 1261, 1264, 1265

ROSACEAE *(continued)*

WEED	
Family	Rosaceae
Species	*Rubus ulmifolius* Schott
Origin	Europe, northern Africa
Common Name	zarzamora, blackberry

AGENT	
Species	*Phragmidium violaceum* (Schultz) G. Winter
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Chile
Year	1973
Source	Ex. Germany
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	No control resulted despite widespread establishment. *Rubus constrictus* is more susceptible than *R. ulmifolius*.
Research Organization	UACH
References	84, 1377, 1379

TABLE 1

TABLE 1

RUBIACEAE

WEED

Family	Rubiaceae
Species	*Galium spurium* L.
Notes	*Galium spurium* and the closely related *G. aparine* L. are often confused in literature and field records. It is *G. spurium* that is more abundant and troublesome in arable lands on the Canadian prairies.
Origin	Eurasia
Common Name	false cleavers

AGENT

Species	*Cecidophyes rouhollahi* Craemer
Classification	(Acari: Eriophyidae)

RELEASE

Country	Canada
Year	2003
Source	Ex. France (southern)
Established	No
Notes	Biomass and seed production on infested plants were reduced by about 30% in release plots, but mites not sufficiently cold hardy to survive over winter.
Limiting Factors	Climate
Research Organization	ARC, USDA-ARS
References	1183, 1184, 1698, 1707

SALVINIACEAE

WEED

Family	Salviniaceae
Species	*Salvinia molesta* D.S. Mitch.
Incorrect Past Names/Synonyms	*Salvinia auriculata* Aubl.
Origin	Brazil
Common Name	salvinia, water fern, Kariba weed, African payal, giant salvinia

AGENT

Species	*Cyrtobagous salviniae* Calder & Sands
Past Names/Synonyms	*Cyrtobagous singularis* Hustache pars, *Cyrtobagous* sp.
Classification	(Coleoptera: Erirhinidae)
Notes	When first collected from salvinia in southeastern Brazil it was thought to be a biotype of *Cyrtobagous singularis* adapted to *Salvinia molesta*. Detailed comparative studies following releases in Australia helped researchers determined that it was a new, undescribed species, later to be named *Cyrtobagous salviniae*. Two ecotypes of this species are known: the larger Brazilian ecotype was intentionally released in Australia and from there to numerous other countries, including Florida USA. The second, smaller ecotype was adventively introduced to Florida.

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Australia
Year	1980
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Very successful control in coastal and elevated sites in tropical, sub-tropical, and temperate areas. Effective in multi-layered mats of salvinia if integrated with other control methods to reduce mat thickness. Less effective following flooding events which flush the weed and insects to sea.
Limiting Factors	Flooding
Research Organization	CSIRO
References	574, 575, 938, 939, 1589, 1591, 1626

RELEASE	
Country	Botswana
Year	1984
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Reduced salvinia to a marginal infestation between 1985-1989. Wherever new infestations are found, or old areas recolonized, insect redistributed and keeps the weed in check.
Research Organization	DWAB
References	113, 578, 627, 938, 1042

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Cote d'Ivoire
Year	1998
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	ARC-PPRI
References	272, 505, 800, 939, 948, 1498

RELEASE	
Country	Fiji
Year	1991
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Providing effective control such that the weed now only occurs in remnant populations.
Research Organization	KRS
References	938, 944, 1050

TABLE 1

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Ghana
Year	1996
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Caused marked suppression of *Salvinia molesta* within 3 months of release; complete control achieved same year.
Research Organization	EPA
References	21, 272, 449, 450

RELEASE	
Country	India
Year	1983
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Successfully controlled the weed in Bangalore, Karnataka within 14 months following release. Up to 99% infestations suppressed in Kerala where majority of waterways have since remained free of serious accumulations of this weed.
Research Organization	IIHR, KAU
References	904, 933, 1542

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Indonesia
Year	1999
Source	Ex. Brazil via Unknown
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	BIOTROP
References	948, 1811

RELEASE	
Country	Kenya
Year	1990
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Salvinia declined rapidly within 18 months after introduction. Since then it has subsisted only as small, isolated or rare patches of weed; no longer regarded as a problem.
Research Organization	CSIRO, ACIAR, KARI, IIBC
References	877, 894, 1494, 1587

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Malaysia
Year	1989
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Controlled the weed at the two release sites in 14 months. Redistribution required.
Research Organization	MARDI, PLANTI, DOAM
References	55, 56, 944, 948

RELEASE	
Country	Mali
Year	2004
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa via Ghana
Established	No
Research Organization	UGL
References	21, 272, 1987

RELEASE	
Country	Mali
Year	2007
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	UGL
References	21, 272, 1987

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Mauritania
Year	2000
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Within 1 year of second release, weevils had established and were recovered up to 50 km from the release sites. At most sites, the infestation reduced from 100% to less than 5%. Within 2 years, salvinia no longer considered a problem on the lower Senegal River.
Research Organization	ARC-PPRI
References	272, 505, 506, 1498

RELEASE	
Country	Mauritania
Year	2002
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa via Cote d'Ivoire
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released again as tremendous success from first release not yet documented. Within 1 year, weevils had established and were recovered up to 50 km from the release sites. At most sites, the infestation reduced from 100% to less than 5%. Within 2 years, salvinia no longer considered a problem on the lower Senegal River.
Research Organization	FAO
References	272, 505, 506, 939, 1498

TABLE 1

TABLE 1

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Namibia
Year	1984
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Rapid establishment and successful control at release locations on border of Namibia and Botswana within one to two years. Remains active in the eastern Caprivi wetlands; wherever new infestations found, insect redistributed and keeps weed in check.
Research Organization	DWAN
References	113, 578, 627, 1042, 1620

RELEASE	
Country	Papua New Guinea
Year	1982
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Excellent control achieved within two years of release. Remnant populations of weevils keep weed in check.
Research Organization	CSIRO, FAO
References	948, 1593, 1793, 1794

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Philippines
Year	1991
Source	Ex. Brazil via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	MAP
References	944, 948

RELEASE	
Country	Republic of Congo
Year	2000
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Dramatically reduced infestations of this species, typically in <2 years. Few salvinia plants remained.
Research Organization	ARC-PPRI, IITA
References	272, 1177

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Brazil via Australia via Namibia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Rapid establishment and successful control at various release sites within one to two years of release. Insects widely redistributed, bringing the weed under control throughout South Africa. When new infestations are identified today, this agent is immediately released and brings the infestations under control.
Research Organization	ARC-PPRI
References	272, 297, 992

RELEASE	
Country	République Togolaise
Year	2001
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa via Ghana
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	UGL
References	21, 272, 1987

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Senegal
Year	2000
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa
Established	No
Notes	Establishment failed as the starter colony had been released directly into the river at a site which was not protected and where the infested plants could not be confined. Subsequently not recovered.
Research Organization	ARC-PPRI
References	272, 506, 1498

RELEASE	
Country	Senegal
Year	2001
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Within 1 year of third release, weevils had established and were recovered up to 50 km from release sites. At most sites, infestation reduced from 100% to less than 5%. Within 2 years, salvinia no longer considered a problem on lower Senegal River.
Research Organization	ARC-PPRI
References	505, 506, 1498

TABLE 1

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	Senegal
Year	2002
Source	Ex. Brazil via Australia via Namibia via Republic of South Africa via Cote d'Ivoire
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Released again as tremendous success from second release not yet documented. Within 1 year of this third release, weevils had established and were recovered up to 50 km from release sites. At most sites, infestation reduced from 100% to less than 5%. Within 2 years, salvinia no longer considered a problem on lower Senegal River.
Research Organization	FAO
References	272, 505, 506, 939, 1498

RELEASE	
Country	Sri Lanka
Year	1986
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Excellent control, usually 12-24 months following release.
Research Organization	KU, DASL, CSIRO, ACIAR
References	948, 1588, 1590

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

RELEASE	
Country	United States of America
Year	2001
Source	Ex. Brazil via Australia
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Insects spread slowly but steadily following release. Biomass and surface coverage reduced more than 99% at release sites in LA and TX. Localized extinctions caused by drought conditions most limiting factor in LA and TX. Additional time needed in CA and AZ but impact between substantial and complete, though this river system requires additional releases annually to replenish populations flushed downstream due to yearly flooding events. A different population (FL ecotype) earlier found inadvertently present on *Salvinia minima* and subsequently redistributed to *S. molesta*. Accidental FL ecotype subsequently found to be more effective than Brazilian ecotype during trials; future releases of this species recommended to be of FL ecotype.
Limiting Factors	Drought; Flooding
Research Organization	USDA (3,4)
References	264, 1313, 1512, 1798, 1800, 1801, 1802, 1804, 1805

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae (continued)

RELEASE

Country	Zambia
Year	1990
Source	Ex. Brazil via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Provides excellent control except where nutrient levels are excessively high due to sewage effluent. At most locations, weed no longer considered a problem.
Research Organization	CSIRO, ACIAR
References	505, 715, 800, 941, 1587

RELEASE

Country	Zimbabwe
Year	1992
Source	Ex. Brazil via Australia via Botswana
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Observed on Lake Kariba in 1991, but a population imported from Botswana intentionally introduced to other parts of Lake in 1992. Both populations subsequently not differentiated in the literature. Brought about up to 99% control in different river systems within 2 years. *Salvinia molesta* no longer considered problematic in Zimbabwe.
Research Organization	PPRIZ
References	262, 418, 578, 800, 938

SALVINIACEAE
Salvinia molesta (continued)

AGENT

Species	*Cyrtobagous singularis* Hustache
Classification	(Coleoptera: Erirhinidae)

RELEASE

Country	Botswana
Year	1971
Source	Ex. Trinidad
Established	No
Notes	No insects recovered despite multiple releases.
Research Organization	IIBC
References	101, 103, 312, 313, 528, 1535

RELEASE

Country	Botswana
Year	1976
Source	Ex. Trinidad
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though widely distributed, densities low and does not provide any control. Populations likely limited by preference for *Salvinia auriculata*.
Limiting Factors	Specificity
Research Organization	ARC-PPRI
References	103, 528, 948, 1174, 1535, 1619

TABLE 1

TABLE 1

SALVINIACEAE
Salvinia molesta; Cyrtobagous singularis *(continued)*

RELEASE	
Country	Fiji
Year	1979
Source	Ex. Trinidad
Established	Yes
Abundance	Moderate
General Impact	None
Notes	Initially thought not to have established but located in 1991. Not effective.
Research Organization	KRS
References	944, 1050

RELEASE	
Country	Namibia
Year	1972
Source	Ex. Trinidad
Established	No
Notes	No insects recovered despite multiple releases.
Research Organization	IIBC
References	101, 113, 528, 948, 1535

RELEASE	
Country	Namibia
Year	1976
Source	Ex. Trinidad
Established	No
Notes	Though widespread initially, densities low likely due to their preference for *Salvinia auriculata*. Since the introduction of the more specific control agent, *Cyrtobagous salviniae*, their numbers gradually declined until they were out-competed and are now considered to be extinct in Namibia.
Limiting Factors	Specificity; Interspecific competition
Research Organization	ARC-PPRI
References	103, 113, 528, 1535, 1619

SALVINIACEAE
Salvinia molesta; Cyrtobagous singularis *(continued)*

RELEASE	
Country	Zambia
Year	1971
Source	Ex. Trinidad
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established and spread along the Zambezi River and into Zimbabwe. Although the weed has declined in some areas, evidence suggests that other factors were responsible and this agent has not contributed significantly to control.
Research Organization	IIBC
References	101, 312, 800, 948, 1160, 1174, 1249

SALVINIACEAE
Salvinia molesta *(continued)*

AGENT	
Species	*Paulinia acuminata* (De Geer)
Classification	(Orthoptera: Pauliniidae)

RELEASE	
Country	Botswana
Year	1971
Source	Ex. Trinidad
Established	No
Notes	Salvinia mat on which insects were thriving was swept away in floods; permanent establishment failed.
Limiting Factors	Flooding
Research Organization	IIBC
References	101, 103, 113, 312, 313, 528, 1535

RELEASE	
Country	Botswana
Year	1975
Source	Ex. Trinidad; Ex. Trinidad via Zimbabwe
Established	No
Notes	Initially established but later died out.
Research Organization	ARC-PPRI
References	103, 113, 528

RELEASE	
Country	Fiji
Year	1975
Source	Ex. Trinidad via India
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Impact initially good but has since declined to no noticeable effect overall.
Research Organization	KRS
References	948, 960, 1050, 1691

SALVINIACEAE
Salvinia molesta; Paulinia acuminata *(continued)*

RELEASE	
Country	India
Year	1974
Source	Ex. Trinidad
Established	No
Notes	Believed to establish initially, albeit with poor performance. Has since been determined to have failed establishment.
Research Organization	IIBC, KAU
References	101, 114, 315, 904, 1033, 1542

RELEASE	
Country	Kenya
Year	1970
Source	Ex. Trinidad
Established	No
Notes	Not established following release on Lake Naivasha, possibly due to low night temperatures.
Limiting Factors	Climate
Research Organization	IIBC
References	101, 103, 311, 894, 948

RELEASE	
Country	Namibia
Year	1972
Source	Ex. Trinidad
Established	No
References	101, 113, 528, 1535

TABLE 1

TABLE 1

SALVINIACEAE
Salvinia molesta; Paulinia acuminata *(continued)*

RELEASE	
Country	Namibia
Year	1975
Source	Ex. Trinidad; Ex. Trinidad via Zimbabwe
Established	No
Notes	Initially established but later died out.
References	113, 528, 1535

RELEASE	
Country	Sri Lanka
Year	1973
Source	Ex. Trinidad via India
Established	No
General Impact	Compromised
Notes	Not established following draining of release canal.
Limiting Factors	Land use
Research Organization	DASL
References	101

RELEASE	
Country	Sri Lanka
Year	1978
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	1421

SALVINIACEAE
Salvinia molesta; Paulinia acuminata *(continued)*

RELEASE	
Country	Zambia
Year	1970
Source	Ex. Trinidad
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Populations increased on Lake Kariba release site initially, coinciding with decline in weed population. However, evidence suggests other factors could be responsible; amount attributable to this agent unknown. More recently populations typically low, though moderate at one site. At all locations, damage to weed occurs, however this damage does not kill the weed and plants keep growing.
Research Organization	IIBC
References	100, 101, 948, 1160

RELEASE	
Country	Zimbabwe
Year	1969
Source	Ex. Trinidad
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

SALVINIACEAE
Salvinia molesta; Paulinia acuminata *(continued)*

Country	Zimbabwe (continued)
Notes	Established during 1969 cage testing. Official approval for release was subsequently obtained and this population was intentionally released in 1971. Populations increased on Lake Kariba release site initially, coinciding with decline in weed population. However, evidence suggests other factors could be responsible; amount attributable to this agent unknown. More recently populations typically low, though moderate at one site. At all locations, damage to weed occurs, however this damage does not kill the weed and plants keep growing.
Research Organization	IIBC
References	100, 101, 948, 1160, 1249

RELEASE

Country	Zimbabwe
Year	1971
Source	Ex. Uruguay
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	This second release established on Lake Kariba but less successful than Trinidad population and rarely recovered in the field.
Research Organization	IIBC
References	101, 1249

SALVINIACEAE
Salvinia molesta *(continued)*

AGENT

Species	*Samea multiplicalis* (Guenée)
Classification	(Lepidoptera: Crambidae)

RELEASE

Country	Australia
Year	1981
Source	Ex. Brazil
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established and spread rapidly but has not provided control of the weed as the plant outgrows leaf damage caused by larvae.
Research Organization	CSIRO
References	574, 575, 938, 939, 1589, 1592

RELEASE

Country	Botswana
Year	1972
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	101, 313, 948

TABLE 1

TABLE 1

SALVINIACEAE
Salvinia molesta; Samea multiplicalis *(continued)*

RELEASE	
Country	Fiji
Year	1976
Source	Ex. Trinidad via India
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Impact initially good but has since declined to no noticeable effect overall.
Research Organization	KRS
References	938, 960, 1050, 1691

RELEASE	
Country	Zambia
Year	1970
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	101, 103, 311, 948, 1249

SCROPHULARIACEAE

WEED	
Family	Scrophulariaceae
Species	*Buddleja davidii* Franch.
Origin	Asia
Common Name	buddleia

AGENT	
Species	*Cleopus japonicus* Wingelmüller
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	New Zealand
Year	2006
Source	Ex. China
Established	Yes
Abundance	Moderate
General Impact	Too early post release
Notes	Established well at nearly all release sites. Though patchily distributed throughout both islands, dispersal and redistribution continuing and populations increasing. Feeding damage has been considerable, with complete defoliation of some plants within 1 km of release sites. Plants can recover from initial defoliation but sustained attack can decreases plant height by 19% which may lead to decreased competition with desirable vegetation. Evaluation ongoing.
Research Organization	Scion
References	1064, 1065, 1945

SOLANACEAE

WEED	
Family	Solanaceae
Species	*Solanum elaeagnifolium* Cav.
Origin	North America, South America
Common Name	silverleaf nightshade, satansbos

AGENT	
Species	*Frumenta nephelomicta* Meyrick
Classification	(Lepidoptera: Gelechiidae)

RELEASE	
Country	Republic of South Africa
Year	1978
Source	Ex. Mexico
Established	No
Notes	Small releases of eggs, all failed to establish.
Limiting Factors	Small release size
Research Organization	ARC-PPRI
References	1344, 1390, 1392, 1394

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Mexico
Established	No
Notes	Small releases of eggs, all failed to establish.
Limiting Factors	Small release size
Research Organization	ARC-PPRI
References	1340, 1344, 1390, 1392, 1394

SOLANACEAE
Solanum elaeagnifolium; Frumenta nephelomicta *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Mexico
Established	No
Notes	Large release of eggs (50,000) but drought conditions prevailed.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	1344, 1390, 1392, 1394

AGENT	
Species	*Frumenta* sp.
Past Names/Synonyms	*Frumenta* sp. A
Incorrect Past Names/Synonyms	*Frumenta nephelomicta* Meyrick
Classification	(Lepidoptera: Gelechiidae)
Notes	*Frumenta* sp. prob. *solanophaga*

RELEASE	
Country	Republic of South Africa
Year	1989
Source	Ex. USA (TX)
Established	No
Notes	Flower buds inoculated with first instar larvae at an experimental field site. Initially believed to have established but died out by 1993. Parasitism one important factor for failure.
Limiting Factors	Parasitism
Research Organization	ARC-PPRI
References	1384, 1390, 1392, 1394

TABLE 1

SOLANACEAE
Solanum elaeagnifolium *(continued)*

AGENT	
Species	*Leptinotarsa defecta* (Stål)
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Republic of South Africa
Year	1992
Source	Ex. USA (TX)
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Remains localized and relatively scarce at only a few release sites.
Research Organization	ARC-PPRI
References	831, 1340, 1392, 1393, 1395

SOLANACEAE
Solanum elaeagnifolium *(continued)*

AGENT	
Species	*Leptinotarsa texana* Schaeffer
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Republic of South Africa
Year	1992
Source	Ex. USA (TX)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread and abundant. High densities disperse en masse, stripping leaves, flowers and epidermal tissues, leaving only skeletonized stems and branches bearing the inedible fruits. Even at moderate densities, sustained feeding damage by adults and larvae severely stunt the vegetative growth and fruiting capacity.
Research Organization	PPRI, UCT
References	831, 992, 1340, 1392, 1393, 1395

SOLANACEAE *(continued)*

WEED	
Family	Solanaceae
Species	*Solanum mauritianum* Scop.
Origin	South America
Common Name	bugweed, tree tobacco, woolly nightshade

AGENT	
Species	*Anthonomus santacruzi* Hustache
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Republic of South Africa
Year	2008
Source	Ex. Argentina
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Preliminary results are promising, with signs of population persistence and increases already apparent at a few coastal release sites in KZN.
Research Organization	PPRI, UKZN
References	992, 1385, 1387, 1389, 1390

SOLANACEAE
Solanum mauritianum (continued)

TABLE 1

AGENT	
Species	*Gargaphia decoris* Drake
Classification	(Hemiptera: Tingidae)

RELEASE	
Country	New Zealand
Year	2010
Source	Ex. Brazil via Republic of South Africa
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Appears to be struggling to build damaging populations on North Island, possibly due to predation. Fate of South Island releases unknown.
Limiting Factors	Possibly Predation
Research Organization	MWLR
References	761, 1064, 1066, 1389, 1391

RELEASE	
Country	Republic of South Africa
Year	1999
Source	Ex. Argentina
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

TABLE 1

SOLANACEAE
Solanum mauritianum; Gargaphia decoris *(continued)*

Country	Republic of South Africa (continued)
Notes	High populations can debilitate *Solanum mauritianum* by causing substantial defoliation, reduced fruiting and even mortality. However, although large outbreaks and extensive damage have been observed in the field, to date these have been erratic and insufficient to inflict meaningful damage on the weed population. Impacted in some areas by predation. Agent populations decrease significantly in winter, presumably due to a reduction in host plant abundance and quality.
Limiting Factors	Predation
Research Organization	PPRI, UKZN
References	992, 1389, 1391

SOLANACEAE
Solanum mauritianum; Gargaphia decoris *(continued)*

RELEASE

Country	Republic of South Africa
Year	2002
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	This second release made in attempt to introduce additional genetic material. Both populations subsequently not differentiated. High populations can debilitate *Solanum mauritianum* by causing substantial defoliation, reduced fruiting and even mortality. However, although large outbreaks and extensive damage have been observed in the field, to date these have been erratic and insufficient to inflict meaningful damage on the weed population. Impacted in some areas by predation. Agent populations decrease significantly in winter, presumably due to a reduction in host plant abundance and quality.
Limiting Factors	Predation
Research Organization	PPRI, UKZN
References	992, 1389, 1391

SOLANACEAE *(continued)*

WEED	
Family	Solanaceae
Species	*Solanum sisymbriifolium* Lam.
Origin	South America
Common Name	wild tomato, dense-thorned bitter apple, sticky nightshade
AGENT	
Species	*Gratiana spadicea* (Klug)
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	Republic of South Africa
Year	1994
Source	Ex. Argentina, Brazil, Paraguay
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	High densities result in almost complete defoliation. Although established in a number of regions, beetle populations appear to persist in relatively low numbers, inflicting minimal damage to the weed. Low numbers are due to parasitism and predation, poor climatic matching (moisture stress), and phenological asynchrony. Where populations are able to build over the growing season, this occurs too late to influence the weed's reproductive output.
Limiting Factors	Parasitism; Predation; Climate; Agent-host synchronization
Research Organization	ARC-PPRI
References	210, 803, 982, 983, 1392

SOLANACEAE *(continued)*

WEED	
Family	Solanaceae
Species	*Solanum viarum* Dunal
Origin	South America
Common Name	tropical soda apple, sodom apple, yu-a, tutia de vibora, joa bravo, joa amarelo pequeno
AGENT	
Species	*Gratiana boliviana* Spaeth
Classification	(Coleoptera: Chrysomelidae)
RELEASE	
Country	United States of America
Year	2003
Source	Ex. Argentina, Paraguay
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Widespread and abundant in south and central FL, absent in northern FL. Larval and adult feeding causes defoliation and inhibits fruit production. In dense infestations up to 90% decline in plant density attributed to beetle within 3 years and weed is now limited on landscape. Confirmed established in TX, but has not been revisited since 2009 so current abundance/impact in TX unknown.
Limiting Factors	Climate
Research Organization	State (3,35)
References	369, 1230, 1231, 1232, 1410, 1411, 1581

TAMARICACEAE

TABLE 1

WEED

Family	Tamaricaceae
Species	*Tamarix* spp.
Notes	Spans several species including (among other less frequent species) *Tamarix parviflora* DC., *Tamarix canariensis* Willd., *Tamarix gallica* L., *Tamarix chinensis* Lour., *Tamarix ramosissima* Ledeb. and their hybrids. *T. chinensis*, *T. ramosissima* and their hybrids are by far the most common species invading the southwestern USA.
Origin	Eurasia, northern Africa
Common Name	saltcedar, tamarisk

TAMARICACEAE
***Tamarix* spp.** *(continued)*

AGENT

Species	*Diorhabda carinata* (Faldermann)
Past Names/Synonyms	*Diorhabda elongata* (Brullé) pars
Classification	(Coleoptera: Chrysomelidae)
Notes	Tamarisk leaf beetles were initially believed to be multiple species or subspecies that were later synonymized and differentiated only according to ecotype. These have recently been reassigned to five species, four of which have been introduced to the USA for tamarisk biological control. The different species of tamarisk leaf beetles are suited to different habitats/locations in the USA. Ecotype distinctions are retained here for the ease of combining information from different references. In 2009, a lawsuit was filed against USDA APHIS due to the possible negative impacts this biocontrol program could have on the endangered southwestern willow flycatcher by destroying some of the adventive tamarisk it utilizes where its natural habitat has been encroached. Redistributions of the tamarisk leaf beetles have been discontinued until this is resolved.
References	1644, 1822

TAMARICACEAE
Tamarix* spp.; *Diorhabda carinata *(continued)*

RELEASE	
Country	United States of America
Year	2006
Source	Ex. Uzbekistan
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Karshi ecotype, which typically does not require long daylight hours in order to avoid premature diapause. Localized initially but now rapidly expanding in west TX and into OK. Throughout its established range, this group of biocontrol agents limited by predation.
Limiting Factors	Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR
References	89, 390, 461, 462, 465, 1822

TAMARICACEAE
***Tamarix* spp.** *(continued)*

AGENT	
Species	*Diorhabda carinulata* (Desbrochers)
Past Names/Synonyms	*Diorhabda elongata* (Brullé) subsp. *deserticola* Chen, *Diorhabda elongata* (Brullé) pars
Classification	(Coleoptera: Chrysomelidae)
Notes	Tamarisk leaf beetles were initially believed to be multiple species or subspecies that were later synonymized and differentiated only according to ecotype. These have recently been reassigned to five species, four of which have been introduced to the USA for tamarisk biological control. The different species of tamarisk leaf beetles are suited to different habitats/locations in the USA. Ecotype distinctions are retained here for the ease of combining information from different references. In 2009, a lawsuit was filed against USDA APHIS due to the possible negative impacts this biocontrol program could have on the endangered southwestern willow flycatcher by destroying some of the adventive tamarisk it utilizes where its natural habitat has been encroached. Redistributions of the tamarisk leaf beetles have been discontinued until this is resolved.
References	1644, 1822

TABLE 1

TABLE 1

TAMARICACEAE
Tamarix* spp.; *Diorhabda carinulata *(continued)*

RELEASE	
Country	United States of America
Year	2001
Source	Ex. China (Fukang)
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Fukang ecotype. Heavy defoliation at most release sites, however spread from release sites varies by location. Very successful throughout NV where thousands of ha defoliated by 2006. Repeated defoliation led to death of 70% of plants within 5 years. Also highly defoliating regionally in WY and CO. Populations limited in OR where heavy defoliation only occurs locally. Flooding and heavy predation limit agent populations. Limited daylight hours send most populations of this species into early diapause, preventing their establishment at sites south of 38th parallel.
Limiting Factors	Daylight; Flooding; Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR, CDA
References	39, 88, 90, 92, 334, 461, 462, 465, 1094, 1644, 1822

TAMARICACEAE
Tamarix* spp.; *Diorhabda carinulata *(continued)*

RELEASE	
Country	United States of America
Year	2001
Source	Ex. Kazakhstan
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Chilik ecotype. Expanding rapidly from release sites. Populations experience heavy bird predation, but have still increased sufficiently to exert significant control of tamarisk, especially along Colorado River near Moab where extensive defoliation had occurred for at least 18 river miles by 2006 and Delta where 30 ha had been defoliated by 2003. Flooding limits agent populations. Limited daylight hours send populations into early diapause, preventing establishment of this species at sites south of 38th parallel.
Limiting Factors	Daylight; Flooding; Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR
References	88, 89, 461, 462, 465, 1644, 1822

TAMARICACEAE
Tamarix spp.; *Diorhabda carinulata* (continued)

RELEASE	
Country	United States of America
Year	2003
Source	Ex. China (Turpan)
Established	No
Notes	Turpan ecotype, which typically does not require long daylight hours in order to avoid premature diapause. Open field release in CO initially believed to have poorly established but since known to have failed due to flooding at release site. Fate of open field release in TX unknown, though assumed to have failed as well. Throughout its established range, this group of biocontrol agents limited by predation.
Limiting Factors	Flooding; Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR, CDA
References	89, 461, 462, 465, 1822

TAMARICACEAE
Tamarix spp. (continued)

AGENT	
Species	*Diorhabda elongata* (Brullé)
Classification	(Coleoptera: Chrysomelidae)
Notes	Tamarisk leaf beetles were initially believed to be multiple species or subspecies that were later synonymized and differentiated only according to ecotype. These have recently been reassigned to five species, four of which have been introduced to the USA for tamarisk biological control. The different species of tamarisk leaf beetles are suited to different habitats/locations in the USA. Ecotype distinctions are retained here for the ease of combining information from different references. In 2009, a lawsuit was filed against USDA APHIS due to the possible negative impacts this biocontrol program could have on the endangered southwestern willow flycatcher by destroying some of the adventive tamarisk it utilizes where its natural habitat has been encroached. Redistributions of the tamarisk leaf beetles have been discontinued until this is resolved.
References	1644, 1822

TABLE 1

TABLE 1

TAMARICACEAE
Tamarix* spp.; *Diorhabda elongata *(continued)*

RELEASE	
Country	United States of America
Year	2003
Source	Ex. Greece (Crete)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Crete ecotype, which typically does not require long daylight hours in order to avoid premature diapause. Well established at some sites where populations beginning to spread and increasing defoliation noticeably. Does well on *Tamarix parviflora*, the dominant species in northern and central CA. Initially believed to have survived in NM but has since died out. Failed or slow to increase at other sites. In general, establishment has had lower rate of success and lower rates of increase and dispersal than that of the Fukang/Chilik ecotypes established in northern regions. However, damage still sufficient to promise successful biological control. Flooding and predation limit population growth. 2007 releases occurring along the Rio Grande in TX; natural dispersal into bordering Mexico is likely.
Limiting Factors	Flooding; Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR
References	88, 89, 90, 461, 462, 465, 1822

TAMARICACEAE
Tamarix* spp.; *Diorhabda elongata *(continued)*

RELEASE	
Country	United States of America
Year	2005
Source	Ex. Greece (Mainland)
Established	No
Notes	Posidi Beach ecotype, which typically does not require long daylight hours in order to avoid premature diapause. Persisted ~3 years in TX then died out; never established in large numbers. Failure to survive in NM likely to due to site flooding. Though no longer established, it is believed *Diorhabda carinata* and *D. elongata* have hybridized in west TX.
Limiting Factors	Flooding; Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR
References	91, 461, 465, 1822

TAMARICACEAE
***Tamarix* spp.** *(continued)*

AGENT	
Species	*Diorhabda sublineata* (Lucas)
Past Names/Synonyms	*Diorhabda elongata* (Brullé) pars
Classification	(Coleoptera: Chrysomelidae)
Notes	Tamarisk leaf beetles were initially believed to be multiple species or subspecies that were later synonymized and differentiated only according to ecotype. These have recently been reassigned to five species, four of which have been introduced to the USA for tamarisk biological control. The different species of tamarisk leaf beetles are suited to different habitats/locations in the USA. Ecotype distinctions are retained here for the ease of combining information from different references. In 2009, a lawsuit was filed against USDA APHIS due to the possible negative impacts this biocontrol program could have on the endangered southwestern willow flycatcher by destroying some of the adventive tamarisk it utilizes where its natural habitat has been encroached. Redistributions of the tamarisk leaf beetles have been discontinued until this is resolved.
References	1644, 1822

TAMARICACEAE
Tamarix* spp.; *Diorhabda sublineata *(continued)*

RELEASE	
Country	United States of America
Year	2004
Source	Ex. Tunisia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Tunisian ecotype, which typically does not require long daylight hours in order to avoid premature diapause. The dominant species at the original release location was a hybrid between *Tamarisk canariensis*, *T. gallica*, *T. ramosissima* or *T. chinensis*, to which the beetles were not strongly attracted in outdoor-cage tests. Though they fed well in caged sleeves, once liberated they immediately dispersed in search of a better host, thus not establishing. Subsequent releases resulted in populations that expanded rapidly to extend nearly into NM by the end of 2012. Throughout its established range, this group of biocontrol agents limited by predation.
Limiting Factors	Specificity; Predation
Research Organization	USDA (7,9), USDA-APHIS-PPQ, State (24,40), USDI-BOR
References	89, 91, 461, 462, 465, 1822

TABLE 1

VERBENACEAE

TABLE 1

WEED	
Family	Verbenaceae
Species	*Lantana camara* L. sens. lat.
Past Names/Synonyms	*Lantana camara* subsp. *aculeata* Moldenke, *Lantana camara* var. *aculeata* (L.) Moldenke, *Lantana aculeata* L., *Lantana camara aculeata*
Notes	Comprises a complex of horticultural/ weedy hybrids and closely related species within the section *Camara*
Origin	Original parent species likely native to tropical Americas
Common Name	lantana, kauboica, tataramoa, bands, guphul, nagaairi, phullaki, putus, tantbi, vieille fille, chiponiwe (Shona), tick berry, bahug-bahug, sapinit, pha-ka-krong, talamoa, prickly lantana

AGENT	
Species	*Aceria lantanae* (Cook)
Past Names/Synonyms	*Eriophyes lantanae* Cook
Classification	(Acari: Eriophyidae)

RELEASE	
Country	Australia
Year	2012
Source	Ex. USA (FL), Cuba via Republic of South Africa
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	117

VERBENACEAE
Lantana camara; Aceria lantanae *(continued)*

RELEASE	
Country	Republic of South Africa
Year	2007
Source	Ex. USA (FL), Cuba
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Very abundant on certain varieties at some sites in KZN, MP and LP; scarce or absent on all varieties at other sites. On preferred varieties, stunts growth and reduces seed production by up to 90%. Does best in humid, frost-free areas. Generally scarce in EC and GP, though occasionally abundant until frost.
Limiting Factors	Specificity; Climate
Research Organization	ARC-PPRI
References	108, 992, 1294, 1698, 1848, 1849, 1850

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Aconophora compressa* Walker
Classification	(Hemiptera: Membracidae)

RELEASE	
Country	Australia
Year	1995
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Variable
Notes	Widely established on coastal and sub-coastal eastern Australia. Populations peak in winter and spring, causing branch death and reduced flowering and seeding. Susceptible to heat waves that reduce populations during hot summer months. Formal evaluation of overall impact lacking.
Limiting Factors	Climate
Other Species Attacked	Has been found feeding on several introduced species growing adjacent to large infestations, including species within and outside the Verbenaceae. However, populations usually cannot be sustained and damage is typically negligible. Feeds more regularly on *Citharexylum spinosum* L., causing significant leaf-drop and a large production of honey-dew, leading to problems for residents who possess these trees. It has not been released in any other country due to its lack of specificity.
Research Organization	QLD State
References	414, 418, 422, 429, 1143, 1426

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Aerenicopsis championi* Bates
Classification	(Coleoptera: Cerambycidae)

RELEASE	
Country	Australia
Year	1995
Source	Ex. Mexico
Established	No
Notes	Establishment failure due to rearing difficulties and small release numbers.
Limiting Factors	Small release size
Research Organization	QLD State
References	414, 422, 429

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 612, 1464, 1940, 1951

RELEASE	
Country	Hawaii USA
Year	1955
Source	Ex. Mexico
Established	No
Notes	After a generation in the field following one release, agent never seen again.
Research Organization	HDOA
References	326, 398, 406, 408, 409, 412, 612, 635, 762, 1940, 1951

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Alagoasa parana* Samuelson
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1981
Source	Ex. Brazil
Established	No
General Impact	Compromised
Notes	One QLD population initially established but later died out due to fire. Since been determined that long, vulnerable larval stage, inability to increase populations rapidly, and poor suitably for many lantana-invaded habitats made this species unlikely to succeed.
Limiting Factors	Land use; Climate
Research Organization	CSIRO
References	414, 422, 429, 1994

RELEASE	
Country	Australia
Year	1998
Source	Ex. Brazil
Established	No
Notes	Establishment failure likely due to rearing difficulties and small release numbers.
Limiting Factors	Small release size
Research Organization	QLD State
References	414, 418, 422, 429

VERBENACEAE
Lantana camara; Alagoasa parana *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1985
Source	Ex. Brazil via Australia
Established	No
Notes	Agents were sourced from Australia prior to the Australian population dying out in the field.
Research Organization	ARC-PPRI
References	280, 429, 992

AGENT	
Species	*Apion* sp. A
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 612, 1464, 1940

AGENT	
Species	*Apion* sp. B
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	612, 1464, 1940

VERBENACEAE
Lantana camara (continued)

AGENT	
Species	*Autoplusia illustrata* Guenée
Classification	(Lepidoptera: Noctuidae)

RELEASE	
Country	Australia
Year	1976
Source	Ex. Costa Rica
Established	No
Research Organization	QLD State, NSW State
References	414, 418, 422, 429, 1976

RELEASE	
Country	Republic of South Africa
Year	1978
Source	Ex. Colombia via Australia
Established	No
Notes	Establishment failure due to small number released and the mechanical destruction of site within few days of release.
Limiting Factors	Small release size; Other control methods
Research Organization	ARC-PPRI
References	277, 280, 992

VERBENACEAE
Lantana camara (continued)

AGENT	
Species	*Calycomyza lantanae* (Frick)
Past Names/Synonyms	*Phytobia lantanae* Frick
Classification	(Diptera: Agromyzidae)

RELEASE	
Country	Australia
Year	1974
Source	Ex. Trinidad
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed throughout range of weed. Populations fluctuate seasonally, peaking in summer and autumn in warm, moist areas but waning over winter and in temperate areas. Populations significantly reduced by cool sub-tropical winters. Even at high densities causes only minor damage.
Limiting Factors	Climate
Research Organization	CSIRO
References	314, 414, 418, 422, 429, 1783

RELEASE	
Country	Fiji
Year	1996
Source	Ex. Trinidad via Australia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	No major surveys have been conducted.
Research Organization	KRS
References	418, 429, 431, 1050

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara; Calycomyza lantanae *(continued)*

RELEASE

Country	Republic of South Africa
Year	1982
Source	Ex. Trinidad via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed throughout the range of lantana, populations limited by parasitism. Not having significant impact on the weed. No longer differentiated from second release.
Limiting Factors	Parasitism
Research Organization	ARC-PPRI
References	65, 66, 280, 1340, 1849

RELEASE

Country	Republic of South Africa
Year	1989
Source	Ex. USA (FL, TX)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	This second release made in order to increase genetic diversity. The two introductions initially differentiated based on location, but as populations spread rapidly throughout the country, they likely interspersed and are no longer differentiated in the literature. Though widely distributed throughout the range of lantana, populations limited by parasitism. Not having significant impact on the weed.
Limiting Factors	Parasitism
Research Organization	ARC-PPRI
References	65, 66, 280, 1340, 1849

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Charidotis pygmaea* Klug
Classification	(Coleoptera: Chrysomelidae)

RELEASE

Country	Australia
Year	1994
Source	Ex. Brazil
Established	No
Notes	Establishment failure likely due to heat stress and dry conditions, and not well suited to *Lantana camara* as it was collected from *L. fucata*.
Limiting Factors	Climate; Specificity
Research Organization	QLD State
References	414, 418, 425, 429

RELEASE

Country	Fiji
Year	1995
Source	Ex. Brazil via Australia
Established	No
Research Organization	KRS
References	429, 431, 1050

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Coelocephalapion camarae* Kissinger
Classification	(Coleoptera: Brentidae)

RELEASE	
Country	Republic of South Africa
Year	2007
Source	Ex. Mexico
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Abundance and impact differ by elevation and lantana variety. At one release site, up to 9% of petioles galled by 2009. Populations likely increasing on some varieties as releases are ongoing. More time needed for overall impact and distribution to become evident.
Limiting Factors	Specificity; Possibly Elevation
Research Organization	ARC-PPRI
References	787, 788, 789, 990, 992, 1849

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Cremastobombycia lantanella* Busck
Classification	(Lepidoptera: Gracillariidae)

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though present on all major islands, of only minor importance.
Research Organization	HDOA
References	326, 612, 635, 762, 1755, 1940

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara (continued)

AGENT	
Species	*Crocidosema lantana* Busck
Past Names/Synonyms	*Epinotia lantana* (Busck)
Classification	(Lepidoptera: Tortricidae)

RELEASE	
Country	Australia
Year	1914
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established wherever lantana occurs, but more common in warmer coastal areas. Can be seasonally abundant. Does not appear to have significant impact on plant; seed production remains high.
Limiting Factors	Climate
Research Organization	QLD State
References	414, 422, 429, 753, 1783, 1940, 1989

RELEASE	
Country	Federated States of Micronesia
Year	1948
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	In conjunction with *Lantanophaga pusillidactyla* reduces fruit production by up to 80%, leading to partial or seasonal control.
References	429, 481, 482, 1548, 1627, 1940

VERBENACEAE
Lantana camara; Crocidosema lantana (continued)

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread and important initially; more recently contributing to only partial control, possibly as a result of parasitism.
Limiting Factors	Parasitism; Predation
Research Organization	HDOA
References	413, 431, 612, 635, 762, 1755, 1940, 2068

RELEASE	
Country	Marshall Islands
Year	1948
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 698, 1940

VERBENACEAE
Lantana camara; Crocidosema lantana *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced in 1984, though now believed this species already present accidentally prior to 1961. Both populations not differentiated in the literature. Though widely distributed throughout South Africa, populations typically low, due at least in part to parasitism. Contributes to the damage of lantana flowers throughout its range, although insufficient to reduce the plant's weed status.
Research Organization	ARC-PPRI
References	62, 65, 66, 429, 635, 992, 1340

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Diastema tigris* Guenée
Classification	(Lepidoptera: Noctuidae)

RELEASE	
Country	Australia
Year	1965
Source	Ex. Panama via Hawaii USA
Established	No
Notes	Establishment failure due to rearing difficulties and small release numbers.
Limiting Factors	Small release size
Research Organization	QLD State
References	326, 414, 418, 422, 429, 1989

RELEASE	
Country	Federated States of Micronesia
Year	1955
Source	Ex. Panama via Hawaii USA
Established	No
Research Organization	UOG
References	326, 429, 431, 482, 1627, 1940

RELEASE	
Country	Fiji
Year	1954
Source	Ex. Panama via Hawaii USA
Established	No
Notes	Released in small numbers and did not establish.
Limiting Factors	Small release size
Research Organization	KRS
References	326, 429, 431, 1375, 1376, 1547, 1548

TABLE 1

VERBENACEAE
Lantana camara; Diastema tigris *(continued)*

RELEASE	
Country	Fiji
Year	1971
Source	Ex. Trinidad via India
Established	No
Research Organization	KRS
References	937

RELEASE	
Country	Ghana
Year	1971
Source	Ex. Trinidad via India
Established	No
Research Organization	IIBC
References	312, 1618

RELEASE	
Country	Hawaii USA
Year	1954
Source	Ex. Panama
Established	No
Research Organization	HDOA
References	326, 612, 635, 762, 1023, 1950

RELEASE	
Country	Hawaii USA
Year	1962
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 408, 431, 635, 762

VERBENACEAE
Lantana camara; Diastema tigris *(continued)*

RELEASE	
Country	India
Year	1971
Source	Ex. Trinidad
Established	No
Research Organization	CPPTI
References	114, 1312, 1542, 1548, 1607

RELEASE	
Country	Mauritius
Year	1967
Source	Ex. Trinidad
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Established near release site, at least initially. Not encountered recently.
Research Organization	IIBC
References	429, 586, 668

RELEASE	
Country	St Helena
Year	1971
Source	Ex. Trinidad via India
Established	No
Research Organization	IIBC
References	312, 429, 1548

RELEASE	
Country	Tanzania
Year	1967
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	308, 429, 668, 1940

VERBENACEAE
Lantana camara; Diastema tigris *(continued)*

RELEASE	
Country	Tanzania
Year	1968
Source	Ex. Trinidad via Uganda
Established	No
Notes	Agents sourced from laboratory colonies as this species failed to establish in the field in Uganda.
Research Organization	IIBC
References	309, 429, 668, 1940

RELEASE	
Country	Uganda
Year	1963
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	667, 668, 1940

RELEASE	
Country	Zambia
Year	1970
Source	Ex. Trinidad
Established	No
Research Organization	IIBC
References	311, 429, 1117

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Ectaga garcia* Becker
Classification	(Lepidoptera: Oecophoridae)

RELEASE	
Country	Australia
Year	1993
Source	Ex. Brazil
Established	No
Notes	Establishment failure likely due to small release numbers, and not well suited to *Lantana camara* as it was collected from *L. fucata*.
Limiting Factors	Small release size; Specificity
Research Organization	QLD State
References	414, 415, 418, 429, 430

AGENT	
Species	*Eutreta xanthochaeta* Aldrich
Past Names/Synonyms	*Eutreta sparsa* Wiedemann pars
Classification	(Diptera: Tephritidae)
Notes	Though described in early literature as *Eutreta sparsa* Wiedemann, it was subsequently determined to be a new species *Eutreta xanthochaeta* Aldrich.

RELEASE	
Country	Australia
Year	1914
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	QLD State
References	414, 714, 1783, 1989

TABLE 1

VERBENACEAE
Lantana camara; Eutreta xanthochaeta *(continued)*

RELEASE	
Country	Australia
Year	1971
Source	Ex. Mexico via Hawaii USA
Established	No
Notes	Establishment failure likely due to small release numbers, and possibly not well suited to the *Lantana camara* growing in Australia.
Limiting Factors	Small release size; Specificity
Research Organization	CSIRO
References	414, 418, 429, 714, 1783

RELEASE	
Country	Australia
Year	1977
Source	Ex. Mexico via Hawaii USA
Established	No
Notes	Establishment failure likely due to small release numbers, and possibly not well suited to the *Lantana camara* growing in Australia.
Limiting Factors	Small release size; Specificity
Research Organization	CSIRO
References	414, 418, 429

VERBENACEAE
Lantana camara; Eutreta xanthochaeta *(continued)*

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Widespread but of only minor importance overall; can be somewhat damaging in drier parts of the islands, but lantana tends to outgrow galls in wetter regions.
Limiting Factors	Climate
Research Organization	HDOA
References	413, 431, 612, 635, 1755, 1940

RELEASE	
Country	Republic of South Africa
Year	1983
Source	Ex. Mexico via Hawaii USA
Established	No
Notes	Establishment failure likely due to small release size and incompatibility with the varieties on which the insect was released.
Limiting Factors	Specificity; Small release size
Research Organization	ARC-PPRI
References	280, 992, 1124

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Falconia intermedia* (Distant)
Classification	(Hemiptera: Miridae)

RELEASE

Country	Australia
Year	2000
Source	Ex. Jamaica via Republic of South Africa
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Established only on the Atherton Tableland in north QLD and only on specific plant varieties. Causes obvious damage locally but overall impact has not been quantified. Species does best in warm moist locations; unlikely to thrive in summer drought regions where lantana defoliates seasonally.
Limiting Factors	Specificity; Climate
Research Organization	QLD State
References	414, 418, 422, 429

RELEASE

Country	Republic of South Africa
Year	1999
Source	Ex. Jamaica
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized

(continued at top of next column)

VERBENACEAE
Lantana camara; Falconia intermedia *(continued)*

Country	Republic of South Africa (continued)
Notes	Initially established at 41% of release sites, doing best in moist/warm climates. Populations rapidly built up at those sites, reduced flowering by ~80%, and defoliated some sites completely during the first 3 years. At temperate sites, impacts were moderate and waned over time. Nearly all populations have since crashed; this agent is currently only found at a few localized locations where damage is moderate. The crash was attributed in small part to predation and in large part to an induction of resistance in lantana.
Limiting Factors	Host plant resistance; Predation
Other Species Attacked	Temporary spillover onto indigenous *Lippia* species has been observed when high population densities were reached on adjacent lantana.
Research Organization	ARC-PPRI
References	67, 790, 992, 1849

AGENT

Species	*Hepialus* sp.
Classification	(Lepidoptera: Hepialidae)

RELEASE

Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 612, 1464, 1940

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Hypena laceratalis* Walker
Incorrect Past Names/Synonyms	*Hypena strigata* (Fabricius), *Hypena jussalis* Walker, *Hypena strigalis*
Classification	(Lepidoptera: Erebidae)

RELEASE	
Country	Australia
Year	1965
Source	Ex. Kenya, Zimbabwe via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed throughout range of weed. Populations fluctuate seasonally, peaking in summer and autumn in warm, moist areas but waning over winter and in temperate areas. Even at high densities causes only minor damage. Damage did not increase with introduction of African population.
Research Organization	QLD State
References	414, 422, 429, 714, 1783, 1940

RELEASE	
Country	Federated States of Micronesia
Year	1958
Source	Ex. Kenya, Zimbabwe via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	None
Notes	Overall impact insignificant; populations low and likely hindered by parasitism.
Limiting Factors	Parasitism
Research Organization	UOG
References	429, 481, 482, 1302, 1627, 1940

VERBENACEAE
Lantana camara; Hypena laceratalis *(continued)*

RELEASE	
Country	Fiji
Year	1960
Source	Ex. Kenya, Zimbabwe via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Minor damage only; populations low and likely hindered by parasitism.
Limiting Factors	Parasitism
Research Organization	KRS
References	429, 1547, 1548, 1940

RELEASE	
Country	Guam
Year	1967
Source	Ex. Kenya, Zimbabwe via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	None
Notes	Initially thought not to have established but recorded in 1988. Overall impact insignificant.
Research Organization	GDA, UOG
References	429, 481, 482, 1300, 1317, 1940

VERBENACEAE
Lantana camara; Hypena laceratalis *(continued)*

RELEASE	
Country	Hawaii USA
Year	1957
Source	Ex. Kenya, Zimbabwe
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Highly defoliating initially, especially in drier regions and during winter months where it led to partial control on OA and partial to significant control on HA, MA, MO and KA. Damage has decreased since 1969, possibly from unfavorable weather or parasitism.
Limiting Factors	Parasitism
Research Organization	HDOA
References	181, 397, 398, 399, 413, 612, 635, 762, 1023, 1775, 1940

RELEASE	
Country	Hawaii USA
Year	1965
Source	Ex. Philippines
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

VERBENACEAE
Lantana camara; Hypena laceratalis *(continued)*

Country	Hawaii USA (continued)
Notes	This second release no longer differentiated from first. Highly defoliating initially, especially in drier regions and during winter months where it led to partial control on OA and partial to significant control on HA, MA, MO and KA. Damage has decreased since 1969, possibly from unfavorable weather or parasitism.
Limiting Factors	Parasitism
Research Organization	HDOA
References	181, 413, 612, 635, 762, 1940

RELEASE	
Country	Mauritius
Year	pre 1960
Source	Ex. Unknown
Established	Yes
Abundance	High
General Impact	Variable
Notes	Introduced intentionally from unknown sources, though the species may be native to Mauritius. Remains unclear if the intentional introduction was due to the mistaken belief the introduced species was a different organism (similar to the situation in South Africa) or if it was unknown to already be present on Mauritius. Along with *Teleonemia scrupulosa* and *Salbia haemorrhoidalis*, commonly found and causes extensive damage to lantana in drier areas and periods.
Limiting Factors	Climate
References	429, 668, 715, 1677

TABLE 1

VERBENACEAE
Lantana camara; Hypena laceratalis *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1961
Source	Ex. Kenya, Zimbabwe via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Introduced in belief it was *Hypena jussalis*. In 1962 found to be *H. strigata* (now referred to as *H. laceratalis*) which is indigenous to South Africa. Introduced and native populations subsequently not differentiated as native population was already widespread. Though now widely distributed throughout the range of lantana, populations typically low due to disease and high rates of parasitism. Overall impact minor, even when populations build to high levels locally.
Limiting Factors	Parasitism; Disease
Other Species Attacked	Also attacks native *Lippia* and *Priva* spp.
Research Organization	ARC-PPRI
References	62, 66, 280, 1399

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Lantanophaga pusillidactyla* (Walker)
Past Names/Synonyms	*Platyptilia pusillidactyla* Walker
Classification	(Lepidoptera: Pterophoridae)

RELEASE	
Country	Federated States of Micronesia
Year	1948
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	In conjunction with *Crocidosema lantana* reduces fruit production by up to 80%, leading to partial or seasonal control.
References	429, 481, 482, 1302, 1548, 1627, 1940

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Despite being widespread throughout the islands, of only minor importance.
Research Organization	HDOA
References	413, 431, 612, 635, 1755, 2067

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

RELEASE	
Country	Hong Kong
Year	1933
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Intentionally introduced, though the agent was already established inadvertently prior to 1900. Populations subsequently not differentiated. Current overall status unknown.
References	429, 635, 1940

RELEASE	
Country	Palau
Year	1960
Source	Ex. Mexico via Hawaii USA via Federated States of Micronesia (Pohnpei)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Initially thought not to have established, but located later in small numbers at one site where it causes only minor damage.
References	429, 481, 482, 1627, 1940

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Mexico via Hawaii USA
Established	No
Notes	Failure to establish likely due to small release number and adverse climatic conditions. An adventive population already present since at least 1904.
Limiting Factors	Small release size; Climate
Research Organization	ARC-PPRI
References	280, 1340

AGENT	
Species	*Leptobyrsa decora* Drake
Classification	(Hemiptera: Tingidae)

RELEASE	
Country	Australia
Year	1969
Source	Ex. Colombia, Peru
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized

(continued on next page)

TABLE 1

VERBENACEAE
Lantana camara; Leptobyrsa decora *(continued)*

Country	Australia (continued)
Notes	Established only on the Atherton Tableland in north QLD, likely due to climatic conditions that constrain species to tropics and to open sunny areas; does poorly in closed canopy or high rainfall. In late summer can reach high numbers that cause obvious damage locally by reducing number of leaves and reproductive output. Widespread releases in NSW all failed, most likely due to high predation combined with long non-reproductive period over cooler months.
Limiting Factors	Climate; Predation
Research Organization	CSIRO, QLD State, NSW State
References	414, 418, 422, 429, 714, 717, 1783, 1940

RELEASE

Country	Cook Islands
Year	1972
Source	Ex. Colombia, Peru via Australia via Fiji
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	DAC
References	312, 429, 431, 1940

VERBENACEAE
Lantana camara; Leptobyrsa decora *(continued)*

RELEASE

Country	Fiji
Year	1971
Source	Ex. Colombia, Peru via Australia via Hawaii USA
Established	No
Research Organization	IIBC
References	312, 429, 960, 1940

RELEASE

Country	Fiji
Year	1976
Source	Ex. Colombia, Peru via Australia
Established	No
Research Organization	KRS
References	429, 431, 960

RELEASE

Country	Ghana
Year	1971
Source	Ex. Colombia, Peru via Australia
Established	No
Research Organization	IIBC
References	312, 1618

RELEASE

Country	Guam
Year	1971
Source	Ex. Colombia, Peru via Australia via Hawaii USA
Established	No
Research Organization	UOG
References	429, 482, 1300, 1317, 1940

VERBENACEAE
Lantana camara; Leptobyrsa decora *(continued)*

RELEASE	
Country	Hawaii USA
Year	1970
Source	Ex. Colombia, Peru via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Firmly established on MA and KA but abundance variable on HA. Throughout range may cause severe defoliation in drier areas, but less effective in wetter regions; usually ineffective overall.
Limiting Factors	Climate
Research Organization	HDOA
References	181, 326, 402, 413, 431, 612, 762, 1940

RELEASE	
Country	Palau
Year	1977
Source	Ex. Colombia, Peru via Australia via Hawaii USA
Established	No
Research Organization	UOG
References	429, 431, 481, 482, 1627, 1940

RELEASE	
Country	Republic of South Africa
Year	1972
Source	Ex. Colombia, Peru via Australia
Established	No
Research Organization	ARC-PPRI
References	268, 280, 992

VERBENACEAE
Lantana camara; Leptobyrsa decora *(continued)*

RELEASE	
Country	Tonga
Year	1969
Source	Ex. Unknown
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 1940

RELEASE	
Country	Zambia
Year	1970
Source	Ex. Colombia, Peru via Australia
Established	No
Research Organization	CSIRO
References	311, 429, 717, 1117, 1940

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Longitarsus bethae* Savini & Escalona
Past Names/Synonyms	*Longitarsus* sp.
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Republic of South Africa
Year	2007
Source	Ex. Mexico
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Initially established well at two sites in KZN which have since been compromised. Establishment recorded in MP and KZN (and tenuously in other provinces); does best in moderately moist soils. Additional time is needed before determining overall impact and abundance.
Limiting Factors	Soil
Research Organization	ARC-PPRI
References	992, 1668, 1670, 1671, 1849

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Neogalea sunia* (Guenée)
Past Names/Synonyms	*Catabena esula* (Druce), *Neogalea esula* (Druce)
Classification	(Lepidoptera: Noctuidae)

RELEASE	
Country	Australia
Year	1957
Source	Ex. USA (CA) via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established and can become locally abundant, but generally ineffective due to low population levels restricted by parasitism.
Limiting Factors	Parasitism
Research Organization	QLD State
References	414, 418, 429, 714, 753, 1783, 1940, 1989

RELEASE	
Country	Federated States of Micronesia
Year	1955
Source	Ex. USA (CA) via Hawaii USA
Established	No
Research Organization	UOG
References	429, 431, 482, 635, 1627

VERBENACEAE
Lantana camara; Neogalea sunia (continued)

RELEASE

Country	Hawaii USA
Year	1955
Source	Ex. USA (CA)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Causes widespread defoliation in some areas, though damage is seasonal and largely occurs in dry areas; insect heavily parasitized.
Limiting Factors	Climate; Parasitism
Research Organization	HDOA
References	402, 407, 413, 612, 635, 762, 1023, 1951

RELEASE

Country	Republic of South Africa
Year	1962
Source	Ex. USA (CA) via Hawaii USA via Trinidad
Established	No
Notes	Laboratory cultures in South Africa (and presumably subsequent releases) wiped out by disease.
Limiting Factors	Disease
Research Organization	ARC-PPRI
References	267, 280, 992, 1399

VERBENACEAE
Lantana camara; Neogalea sunia (continued)

RELEASE

Country	Republic of South Africa
Year	1968
Source	Ex. USA (CA) via Hawaii USA via Australia
Established	No
Notes	Establishment failure likely due to small release size.
Limiting Factors	Small release size
Research Organization	ARC-PPRI
References	267, 268, 992

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Octotoma championi* Baly
Incorrect Past Names/Synonyms	*Octotoma* sp. probably *plicatula* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)
Notes	Although it was recorded that *Octotoma* sp. "probably" *plicatula* was released on Hawaii, this species does not feed upon *Lantana camara*. It is therefore more likely that *O. championi*, which closely resembles *O. plicatula*, was released.

RELEASE

Country	Australia
Year	1975
Source	Ex. Costa Rica
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established only at few locations in NSW, QLD, Norfolk Island. Populations too low to be effective.
Limiting Factors	Climate
Research Organization	QLD State, NSW State
References	414, 418, 422, 429, 1976

RELEASE

Country	Fiji
Year	1976
Source	Ex. Costa Rica via Australia
Established	No
Research Organization	KRS
References	429, 431, 1050

VERBENACEAE
Lantana camara; Octotoma championi *(continued)*

RELEASE

Country	Hawaii USA
Year	1954
Source	Ex. Honduras
Established	No
Notes	Failure likely due to only 6 individuals being released.
Limiting Factors	Small release size
Research Organization	HDOA
References	326, 612, 1023, 1381, 1950

RELEASE

Country	Republic of South Africa
Year	1978
Source	Ex. Costa Rica via Australia
Established	No
Research Organization	ARC-PPRI
References	268, 280, 992

RELEASE

Country	Republic of South Africa
Year	1995
Source	Ex. Costa Rica via Australia
Established	No
Notes	Persisted in low numbers for the following two seasons, but subsequently not recovered.
Research Organization	ARC-PPRI
References	65, 66

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Octotoma gundlachi* Suffrain
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Hawaii USA
Year	1953
Source	Ex. Cuba
Established	No
Research Organization	HDOA
References	761

AGENT	
Species	*Octotoma scabripennis* Guérin-Méneville
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1966
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

Country	Australia (continued)
Notes	Rare in north QLD and south of Sydney; common from central QLD south to central NSW where present in large numbers during favorable seasons, frequently alongside *Uroplata girardi*. Together cause severe defoliation and reduced flowering in late summer and autumn but do not permanently suppress the weed. Ineffective on Norfolk Island.
Research Organization	CSIRO, QLD State, NSW State
References	414, 418, 422, 429, 713, 714, 715, 1783, 1940

RELEASE	
Country	Australia
Year	1974
Source	Ex. El Salvador
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Rare in north QLD and south of Sydney; common from central QLD south to central NSW where present in large numbers during favorable seasons, frequently alongside *Uroplata girardi*. Together cause severe defoliation and reduced flowering in late summer and autumn but do not permanently suppress the weed.
Research Organization	CSIRO
References	414, 418, 422, 429, 715

TABLE 1

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

RELEASE	
Country	Cook Islands
Year	1973
Source	Ex. Mexico via Hawaii USA via Australia via India
Established	No
Research Organization	DAC
References	429, 431, 1940

RELEASE	
Country	Fiji
Year	1971
Source	Ex. Mexico via Hawaii USA via Australia
Established	No
Research Organization	IIBC
References	312, 431, 960, 1940

RELEASE	
Country	Fiji
Year	1976
Source	Ex. Mexico via Hawaii USA via Australia
Established	No
Research Organization	QLD State
References	431, 960

RELEASE	
Country	Fiji
Year	1993
Source	Ex. Mexico via Hawaii USA via Australia
Established	No
Research Organization	KRS
References	431, 1050, 1868

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

RELEASE	
Country	Ghana
Year	1971
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Established but ineffective probably as a result of predation and parasitism.
Limiting Factors	Predation; Parasitism
Research Organization	IIBC
References	312, 313, 314, 1618, 1940

RELEASE	
Country	Ghana
Year	1973
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Additional introduction in order to bolster success. Established and sometimes common in one area, but no marked control. Populations limited by predation and parasitism.
Limiting Factors	Predation; Parasitism
Research Organization	IIBC
References	314, 315, 316, 317, 318, 429, 1618, 1940

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

RELEASE	
Country	Guam
Year	1971
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	UOG
References	429, 482, 1300, 1317, 1940

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	635, 1464, 1951

RELEASE	
Country	Hawaii USA
Year	1953
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Causes significant defoliation in some areas (especially dry regions) but populations limited in other areas. Defoliation complements effects of other biocontrol agents, resulting in partial to significant control in both dry and wet areas.
Limiting Factors	Climate
Research Organization	HDOA
References	399, 409, 410, 411, 413, 612, 635, 762, 1940, 1949, 1951

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

RELEASE	
Country	Hawaii USA
Year	1974
Source	Ex. El Salvador via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Progeny of this release no longer differentiated in literature from 1953 release. Causes significant defoliation in some areas (especially dry regions) but populations limited in other areas. Defoliation complements effects of other biocontrol agents, resulting in partial to significant control in both dry and wet areas.
Limiting Factors	Climate
Research Organization	HDOA
References	413, 612, 635, 762, 1169, 1940

RELEASE	
Country	India
Year	1972
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Established in North India but not effective.
Research Organization	FRI
References	1312, 1542, 1940

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

RELEASE

Country	New Caledonia
Year	1977
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes only minor damage.
Research Organization	RSTO
References	286, 429, 698

RELEASE

Country	Niue
Year	1994
Source	Ex. Mexico via Hawaii USA via Australia
Established	No
Research Organization	SPC
References	1403, 1868, 1940

RELEASE

Country	Republic of South Africa
Year	1971
Source	Ex. Mexico via Hawaii USA via Australia
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

VERBENACEAE
Lantana camara; Octotoma scabripennis *(continued)*

RELEASE

Country	Republic of South Africa (continued)
Notes	Populations vary from rare to abundant. Restricted to the warm, moist eastern parts of the range of lantana in South Africa. Can occasionally completely defoliate whole stands. Along with *Teleonemia scrupulosa* and *Uroplata girardi* (which has since been largely replaced by *Ophiomyia camarae*) could reduce the rates of growth and reproduction of lantana. However attack is frequently temporary and plants can recover. Consequently, overall impact is typically low to moderate. Does not appear to prefer certain varieties of lantana.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	65, 268, 269, 280, 992, 1849

RELEASE

Country	Solomon Islands
Year	1993
Source	Ex. Mexico via Hawaii USA via Australia via Fiji
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	SPC
References	429, 431, 1868, 1940

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Ophiomyia camarae* Spencer
Classification	(Diptera: Agromyzidae)

RELEASE

Country	Australia
Year	2007
Source	Ex. USA (FL) via Republic of South Africa
Established	Yes
Abundance	Moderate
General Impact	Too early post release
Notes	Intermixed with material released earlier and no longer differentiated. Spreading central to northern QLD with releases ongoing through 2012. Impact under evaluation.
Research Organization	QLD State
References	414, 418, 428, 1669

RELEASE

Country	Republic of South Africa
Year	2001
Source	Ex. USA (FL)
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

VERBENACEAE
Lantana camara; Ophiomyia camarae *(continued)*

Country	Republic of South Africa (continued)
Notes	Populations dense at humid, low elevation sites while sparse at high elevations. Establishment failed at sites above 900m which are characterized by cold and dry winters that cause leaf abscission. High populations decrease lantana growth and reproduction by half. Parasitoids present, but unclear if these significantly impact *Ophiomyia camarae* populations. Exhibits lantana varietal preferences in the field. This agent is believed to outcompete *Uroplata girardi* in coastal regions of KZN.
Limiting Factors	Climate; Specificity; Possibly Parasitism
Other Species Attacked	Recorded utilizing less than 1% of native *Lippia* spp. leaves while the agent was at outbreak population density in the field; however, this damage could have been due to an indigenous insect instead.
Research Organization	ARC-PPRI
References	786, 1669, 1673, 1674, 1849

RELEASE

Country	Uganda
Year	2008
Source	Ex. USA (FL) via Republic of South Africa
Established	No
Research Organization	ARC-PPRI
References	1669, 1849

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Ophiomyia lantanae* (Froggatt)
Past Names/Synonyms	*Agromyza lantanae* Froggatt
Classification	(Diptera: Agromyzidae)

RELEASE	
Country	Australia
Year	1914
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	QLD State
References	414, 714, 1989

RELEASE	
Country	Australia
Year	1917
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established throughout range of weed in Australia. Can damage up to 85% of seeds, however fruit attack frequently does not decrease seed viability. Seed dispersal by birds may be reduced slightly due to attack
Research Organization	QLD State
References	180, 414, 422, 429, 714, 753, 1989

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

RELEASE	
Country	Cook Islands
Year	1972
Source	Ex. Mexico via Hawaii USA via Australia
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	DAC
References	429, 431, 930, 1940

RELEASE	
Country	Federated States of Micronesia
Year	1948
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Well established in Chuuk, but not observed in recent years on other islands.
Research Organization	UOG
References	429, 481, 482, 1308, 1548, 1627, 1940

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

RELEASE

Country	Fiji
Year	1911
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Originally reported lantana difficult to find near Suva, but now considered unlikely to have been due to this insect. Though widespread throughout country, fruit attack frequently does not decrease seed viability; seed dispersal by birds may be reduced slightly due to attack.
Research Organization	DAF
References	180, 418, 429, 977, 1351, 1373, 1547, 1548, 1611, 1683, 1685, 1918

RELEASE

Country	French Polynesia
Year	1916
Source	Ex. Mexico via Hawaii USA via New Caledonia
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	53, 666, 706, 1236, 1351, 1715

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

RELEASE

Country	Guam
Year	1971
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Contributes to control, often found infesting more than 50% of berries.
Research Organization	UOG
References	429, 481, 482, 1300, 1317, 1940

RELEASE

Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread, fruit attack frequently does not decrease seed viability; seed dispersal by birds may be reduced slightly due to attack.
Limiting Factors	Parasitism
Research Organization	HDOA
References	180, 326, 413, 612, 635, 1464, 1918, 1940

TABLE 1

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

RELEASE	
Country	Hong Kong
Year	1933
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 635, 1716, 1940

RELEASE	
Country	India
Year	1921
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	None
Notes	Believed to have been unintentionally introduced to India before this deliberate release. Both populations subsequently not distinguished in the literature. Initially believed to have failed establishment but located 13 years after release. Now widespread throughout country. Attacks high percentage of fruits, but ineffective as germination is not affected.
Research Organization	DAIN
References	1312, 1542, 1548, 1607, 1747, 1940

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

RELEASE	
Country	Kenya
Year	1958
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Following release it was found already present in Kenya. Intentional and unintentional populations subsequently not differentiated. Though widespread throughout country, impact is minor as fruit attack frequently does not kill the embryo in the seeds.
References	429, 667, 668

RELEASE	
Country	New Caledonia
Year	1911
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Less important than *Teleonemia scrupulosa*, but contributes to limiting spread of the weed.
References	429, 698, 1464, 1548, 1832, 1940

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1961
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced in 1961. Following release it was found that a species already present in the country had been wrongly identified as *Ophiomyia rhodesiensis* and was in fact *O. lantanae*. Intentional and unintentional populations were subsequently not differentiated as the unintentional population was already widespread. Now widely established and abundant, despite parasitism. Contributes to seed destruction but unlikely to impact spread of the weed, though additional study is warranted. Shows no preference for different lantana varieties.
Limiting Factors	Parasitism
Research Organization	ARC-PPRI
References	65, 66, 267, 271, 280, 1399

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Orthezia insignis* Browne
Classification	(Hemiptera: Ortheziidae)
Notes	Though it was used intentionally in Hawaii, it is polyphagous and very damaging to many plant species and should not be considered for additional use as a biocontrol agent.
References	429

RELEASE	
Country	Hawaii USA
Year	pre 1902
Source	Ex. Unknown
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Unrecorded introduction probably brought from Sri Lanka to MA by ranchmen, then subsequently distributed to other islands. Though widely distributed, damage is localized and insufficient to control weed.
Other Species Attacked	Feeds on many nontarget plant species.
Research Organization	Private
References	1312, 1464, 1546, 1940

RELEASE	
Country	India
Year	1921
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	High
General Impact	None

(continued on nex page)

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara; Orthezia insignis *(continued)*

Country	India (continued)
Notes	First identified in India in 1915, a second population intentionally introduced in 1921. Both populations subsequently not differentiated in the literature. At one point agent was targeted for eradication once its polyphagous nature determined, but efforts failed and agent now firmly established in India. Does not control weed.
Other Species Attacked	Feeds on several desirable nontarget species.
Research Organization	MGI
References	1034, 1312, 1546

AGENT

Species	*Parevander xanthomelas* (Guérin-Méneville)
Past Names/Synonyms	*Evander xanthomelas* (Guérin-Méneville)
Classification	(Coleoptera: Cerambycidae)

RELEASE

Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 612, 1464, 1940

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Passalora lantanae* (Chupp) U. Braun & Crous var. *lantanae*
Past Names/Synonyms	*Mycovellosiella lantanae* (Chupp) Deighton var. *lantanae*
Classification	(Dothideomycetes: Capnodiales)

RELEASE

Country	Republic of South Africa
Year	2002
Source	Ex. USA (FL)
Established	No
Notes	Isolates C442, C470, C493. Although symptoms were observed on lantana within the first 3 months of release, did not persist possibly because it could not bridge the dry winter season.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	470, 472, 992, 1849

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Plagiohammus spinipennis* (Thomson)
Classification	(Coleoptera: Cerambycidae)

RELEASE	
Country	Australia
Year	1967
Source	Ex. Mexico via Hawaii USA
Established	No
Notes	Initially believed to have established at only one NSW site at perpetually low levels. Recent surveys failed to detect insect. Establishment failure likely due to incompatibility of *Lantana camara* variety.
Limiting Factors	Specificity
Research Organization	CSIRO
References	414, 418, 422, 429, 719

RELEASE	
Country	Guam
Year	1973
Source	Ex. Mexico via Hawaii via Australia
Established	No
Research Organization	UOG
References	429, 482, 1300, 1317, 1940

VERBENACEAE
Lantana camara; Plagiohammus spinipennis *(continued)*

RELEASE	
Country	Hawaii USA
Year	1960
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Damage can be severe in some high rainfall areas, leading to partial control; ineffective in drier areas.
Limiting Factors	Parasitism; Climate
Research Organization	HDOA
References	326, 400, 401, 407, 408, 409, 411, 412, 413, 612, 762, 1940

RELEASE	
Country	Palau
Year	1977
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	UOG
References	429, 431, 481, 482, 1627

RELEASE	
Country	Republic of South Africa
Year	1973
Source	Ex. Mexico via Hawaii USA via Australia
Established	No
Notes	Despite multiple releases, persisted only at a garden in the PPRI laboratories in GP without spreading elsewhere. Has since been deemed an unsuccessful establishment.
Research Organization	ARC-PPRI
References	267, 268, 280, 992

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Prospodium tuberculatum* (Spegazzini) Arthur
Classification	(Pucciniomycetes: Pucciniales)

RELEASE	
Country	Australia
Year	2001
Source	Ex. Brazil
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Specific to the common pink flowering variety. Though causes chlorosis and premature abscission of leaves, does not seem to have significant impact on lantana. Formal evaluation lacking.
Research Organization	QLD State
References	414, 418, 422, 429, 1817

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Pseudopyrausta santatalis* (Barnes & McDunnough)
Incorrect Past Names/Synonyms	*Pseudopyrausta acutangulalis* (Snellen), *Blepharomastix acutangulalis* (Snellen)
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	Federated States of Micronesia
Year	1955
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	UOG
References	326, 429, 431, 482, 1627

RELEASE	
Country	Fiji
Year	1954
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	KRS
References	326, 429, 1375, 1376, 1547, 1548

RELEASE	
Country	Hawaii USA
Year	1953
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 406, 612, 762, 1940, 1949, 1950

VERBENACEAE
Lantana camara; Pseudopyrausta santatalis *(continued)*

RELEASE	
Country	Hawaii USA
Year	1965
Source	Ex. Mexico
Established	No
Research Organization	HDOA
References	326, 411, 612, 635, 762

AGENT	
Species	*Salbia haemorrhoidalis* Guenée
Past Names/Synonyms	*Syngamia haemorrhoidalis* (Guenée)
Classification	(Lepidoptera: Crambidae)

RELEASE	
Country	Australia
Year	1958
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Well established in warm tropical areas causing some damage in conjunction with other agents; alone typically exerts little control on lantana. Populations hindered by parasitism.
Limiting Factors	Parasitism
Research Organization	QLD State
References	414, 418, 422, 429, 635, 714, 753, 1783, 1940, 1989

VERBENACEAE
Lantana camara; Salbia haemorrhoidalis *(continued)*

RELEASE	
Country	Federated States of Micronesia
Year	1958
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread and common but impact minimal.
Research Organization	UOG
References	429, 481, 482, 635, 1302, 1627

RELEASE	
Country	Fiji
Year	1958
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Well established causing some damage in conjunction with other agents; alone typically exerts little control.
Research Organization	KRS
References	429, 635, 1376, 1547, 1548

RELEASE	
Country	Guam
Year	1958
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	No
Research Organization	QLD State
References	429, 481, 482, 635, 1300, 1317

TABLE 1

VERBENACEAE
Lantana camara; Salbia haemorrhoidalis *(continued)*

RELEASE	
Country	Hawaii USA
Year	1956
Source	Ex. USA (FL), Cuba
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Caused severe defoliation in some areas initially, but effectiveness decreased after 1969, possibly due to unfavorable weather conditions (though not confirmed). Together with other agents contributes to partial to substantial control in dry regions.
Limiting Factors	Climate
Research Organization	HDOA
References	398, 406, 413, 612, 1023, 1940, 1952

RELEASE	
Country	India
Year	1971
Source	Ex. Trinidad
Established	No
Research Organization	CPPTI
References	1312, 1542, 1548, 1607

VERBENACEAE
Lantana camara; Salbia haemorrhoidalis *(continued)*

RELEASE	
Country	Kenya
Year	1958
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	No
Notes	Due to rearing difficulties, only four individuals were released and failed to establish. Limited surveys conducted recently failed to find this agent.
Limiting Factors	Small release size
Research Organization	IIBC
References	418, 635, 667, 668, 1940

RELEASE	
Country	Kenya
Year	1965
Source	Ex. Trinidad via Uganda
Established	No
Notes	Initially believed to have established, but has since believed to have failed. Limited surveys conducted recently failed to find this agent.
Research Organization	IIBC
References	418, 668, 1940

RELEASE	
Country	Mauritius
Year	1965
Source	Ex. Trinidad
Established	Yes
Abundance	High
General Impact	Variable
Notes	Along with *Teleonemia scrupulosa* and *Salbia haemorrhoidalis*, commonly found and causes extensive damage to lantana in drier areas and periods.
Research Organization	IIBC
References	586, 668

VERBENACEAE
Lantana camara; Salbia haemorrhoidalis *(continued)*

RELEASE	
Country	Palau
Year	1960
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	No
References	429, 481, 482, 635, 1627

RELEASE	
Country	Republic of South Africa
Year	1962
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed in South Africa, populations typically low. Highest densities restricted to the moist and lower elevation sites in eastern inland and coastal regions. This is likely related to plant variety, as this species has a strong association with certain lantana varieties. At high densities and during outbreaks, can contribute to the control of lantana. In most regions impact is minimal. Populations hindered by parasitism.
Limiting Factors	Parasitism; Specificity
Other Species Attacked	Reared from native *Lippia* species at some point, but not in most recent surveys.
Research Organization	ARC-PPRI
References	62, 66, 277, 280, 635, 786, 992, 993, 1341, 1399, 1849

VERBENACEAE
Lantana camara; Salbia haemorrhoidalis *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. USA (FL), Cuba via Hawaii USA
Established	No
Notes	Establishment failure likely due to very small number of individuals released.
Limiting Factors	Small release size
Research Organization	ARC-PPRI
References	277, 993, 1341, 1848

RELEASE	
Country	Tanzania
Year	1967
Source	Ex. Trinidad via Uganda
Established	No
Research Organization	IIBC
References	309, 429, 668

RELEASE	
Country	Uganda
Year	1964
Source	Ex. Trinidad
Established	Yes
Abundance	Rare
General Impact	None
Notes	Recovered at one site but rare, likely due in part to parasitism. Failed at second site due to defoliation by *Teleonemia scrupulosa*.
Limiting Factors	Parasitism; Interspecific competition
Research Organization	IIBC
References	667, 668

TABLE 1

VERBENACEAE
Lantana camara; Salbia haemorrhoidalis *(continued)*

RELEASE

Country	Zambia
Year	1970
Source	Ex. Trinidad via India via Pakistan
Established	No
Notes	Initially observed breeding in field, but has since believed to have failed establishment.
Research Organization	IIBC
References	311, 429, 1117

AGENT

Species	*Septoria* sp.
Classification	(Dothideomycetes: Capnodiales)

RELEASE

Country	Hawaii USA
Year	1997
Source	Ex. Ecuador
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Initially well established at release sites where credited with decreasing infestations of lantana; subsequently not monitored so current abundance not known. Though a *Septoria* sp. was recently isolated from lantana at release site in KA, not yet been genetically analyzed to confirm it was same species released.
Research Organization	HDOA
References	325, 326, 1006, 1823, 1826, 1827

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Strymon bazochii* (Godart)
Past Names/Synonyms	*Thecla bazochii* (Godart), *Thecla agra* (Hewitson), *Strymon bazochii gundlachianus* (Bates)
Classification	(Lepidoptera: Lycaenidae)

RELEASE

Country	Australia
Year	1914
Source	Ex. Mexico via Hawaii USA
Established	No
Notes	Establishment failure likely due to the small numbers of individuals released.
Limiting Factors	Small release size
Research Organization	QLD State
References	414, 418, 714, 1940, 1989

RELEASE

Country	Fiji
Year	1923
Source	Ex. Mexico via Hawaii USA
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though initially considered widespread, populations later determined limited, likely due to egg parasitism. Provided only minor damage. Not observed during more recent field surveys.
Limiting Factors	Parasitism
Research Organization	DAF
References	418, 429, 977, 1373, 1547, 1548, 1683

VERBENACEAE
Lantana camara; Strymon bazochii *(continued)*

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though initially widespread and abundant, currently of only minor importance; impact limited by parasitism. Has since been found on other hosts.
Limiting Factors	Parasitism
Other Species Attacked	Observed feeding on numerous nontarget species of economic importance so not recommended for release in novel locations.
Research Organization	HDOA
References	413, 429, 612, 635, 1169, 1464, 1755, 1940, 2066

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Teleonemia elata* Drake
Classification	(Hemiptera: Tingidae)

RELEASE	
Country	Australia
Year	1969
Source	Ex. Brazil
Established	No
Notes	Establishment failure likely due to the small numbers of individuals released.
Limiting Factors	Small release size
Research Organization	CSIRO, QLD State
References	414, 418, 429, 714

RELEASE	
Country	Cook Islands
Year	1973
Source	Ex. Brazil via Australia
Established	No
Research Organization	DAC
References	429, 431, 1940

RELEASE	
Country	Republic of South Africa
Year	1972
Source	Ex. Brazil via Australia
Established	No
Notes	Establishment failure likely due to small release size.
Limiting Factors	Small release size
Research Organization	ARC-PPRI
References	267, 268, 280

TABLE 1

VERBENACEAE
Lantana camara; Teleonemia elata *(continued)*

RELEASE

Country	Uganda
Year	1972
Source	Ex. Brazil via Australia
Established	No
Notes	Agents were sourced from laboratory colonies in Australia as this species failed to establish in the field in Australia.
Research Organization	IIBC
References	313, 429

RELEASE

Country	Zambia
Year	1970
Source	Ex. Brazil via Australia
Established	No
Research Organization	CSIRO
References	311, 429, 1117, 1940

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Teleonemia harleyi* Froeschner
Classification	(Hemiptera: Tingidae)

RELEASE

Country	Australia
Year	1969
Source	Ex. Trinidad
Established	No
Notes	Initially believed to have established at low levels at only one site. Recent surveys failed to detect insect.
Research Organization	CSIRO
References	414, 422, 429, 714, 1783

AGENT

Species	*Teleonemia prolixa* (Stål)
Classification	(Hemiptera: Tingidae)

RELEASE

Country	Australia
Year	1974
Source	Ex. Brazil
Established	No
Notes	Establishment failure likely due to low numbers released and plant incompatibility.
Limiting Factors	Small release size; Specificity
Research Organization	CSIRO
References	414, 418, 429, 717

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Teleonemia scrupulosa* Stål
Past Names/Synonyms	*Teleonemia vanduzeei* Drake, *Teleonemia* sp.
Incorrect Past Names/Synonyms	*Teleonemia bifasciata* Champion, *Teleonemia lantanae* Distant
Classification	(Hemiptera: Tingidae)
Notes	Referred to as *Teleonemia bifasciata* Champion and *Teleonemia lantanae* Distant in some of the original Hawaii release records because authors erroneously assumed they were new species, when in fact they were *Teleonemia scrupulosa* Stål released there in 1902.
References	717

RELEASE	
Country	Ascension Island
Year	1973
Source	Ex. Mexico via Hawaii USA via Fiji via Australia via India via St Helena
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Causing widespread and severe damage.
Research Organization	IIBC
References	429, 431, 582, 584

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Australia
Year	1936
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Seasonally abundant and causes considerable damage to some varieties but not others. Effects increased following new introductions from different sources in 1969. Populations often limited by unfavorable climate and habitat; dry conditions and summer months preferred to moist and/or shady infestations. 1937 release on Norfolk Island failed but successful in 1948 and is partially successful in retarding growth.
Limiting Factors	Climate; Habitat; Specificity
Research Organization	CSIRO, QLD State, NSW State
References	414, 418, 422, 429, 635, 713, 717, 1783, 1940, 1989

RELEASE	
Country	Australia
Year	1969
Source	Ex. Brazil, Mexico, Paraguay, Trinidad, Venezuela
Established	Yes
Abundance	Variable
General Impact	Variable

(continued on next page)

TABLE 1

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

Country	Australia (continued)
Notes	Seasonally abundant and causes considerable damage to some varieties but not others. Effects increased following new introductions from different sources in 1969. Populations often limited by unfavorable climate and habitat; dry conditions and summer months preferred to moist and/or shady infestations.
Limiting Factors	Climate; Habitat; Specificity
Research Organization	CSIRO
References	414, 418, 422, 429, 713, 714, 717, 1940

RELEASE

Country	Federated States of Micronesia
Year	1948
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Rare on Pohnpei where damage is minimal. Abundant on Chuuk where damage is heavy. Drier climate of Chuuk believed to be more suitable to agent.
Limiting Factors	Climate
Research Organization	UOG
References	481, 482, 520, 1302, 1548, 1627

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE

Country	Federated States of Micronesia
Year	1962
Source	Ex. Mexico via Hawaii USA via Federated States of Micronesia via Palau
Established	No
Notes	Failure likely due to inability of agent to survive on lantana variety present on Yap.
Limiting Factors	Host plant incompatibility
Research Organization	UOG
References	481, 482, 1627

RELEASE

Country	Fiji
Year	1928
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Caused yellowing, loss of foliage and reduced flower production and seed set over considerable area near Suva in Rewa. Subsequently disappeared from some areas where originally showed promise. Most effective in cold and dry seasons. Populations frequently limited by predation, fungal attack, and heavy rainfall.
Limiting Factors	Climate; Disease; Predation
Research Organization	DAF
References	429, 605, 717, 1373, 1547, 1548, 1681, 1682, 1683

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	French Polynesia
Year	pre 1986
Source	Ex. Unknown
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	706, 1350

RELEASE	
Country	Ghana
Year	1971
Source	Ex. Mexico via Hawaii USA via Fiji via Australia via India
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established and very common. Though attack rates sometimes reach 50-80% of shoots, overall providing little control.
Research Organization	IIBC
References	312, 313, 429, 1618, 1940

RELEASE	
Country	Ghana
Year	1972
Source	Ex. Mexico via Hawaii USA via Kenya via Uganda; Ex. Trinidad via Uganda
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued at top of next page)

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

Country	Ghana (continued)
Notes	This release subsequently not differentiated in literature from release made year prior. Established and very common. Though attack rates sometimes reach 50-80% of shoots, overall providing little control.
Research Organization	IIBC
References	317, 429, 667, 668, 1618

RELEASE	
Country	Guam
Year	1969
Source	Ex. Mexico via Hawaii USA via Federated States of Micronesia (Pohnpei) via Palau via Northern Mariana Islands (Saipan)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Contributes to good control, especially in open sunny areas during the drier months. Population greatly reduced during the wet season.
Limiting Factors	Season
Research Organization	UOG
References	429, 481, 482, 1300, 1317

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Causes extensive defoliation during summer months and in drier areas. Summer defoliation by this insect complements winter defoliation by other introduced species.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	413, 507, 612, 635, 717, 1023, 1457, 1464, 1755, 1940

RELEASE	
Country	Hawaii USA
Year	1952
Source	Ex. Cuba
Established	No
Notes	Introduced for possible greater efficacy and in the belief it was a separate species, *Teleonemia vanduzeei* Drake.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	612, 717, 762, 1023, 1169, 1457, 1940, 1950

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Hawaii USA
Year	1954
Source	Ex. Belize (formerly British Honduras)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Introduced for possible greater efficacy or adaptability to varying climatic zones and subsequently not distinguished from other *Teleonemia scrupulosa* populations released since 1902. Causes extensive defoliation during summer months and in drier areas. Summer defoliation by this insect complements winter defoliation by other introduced species.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	413, 612, 635, 717, 762, 1023, 1169, 1457, 1940, 1950

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Hawaii USA
Year	1954
Source	Ex. Brazil
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Introduced for possible greater efficacy or adaptability to varying climatic zones and subsequently not distinguished from other *Teleonemia scrupulosa* populations released since 1902. Causes extensive defoliation during summer months and in drier areas. Summer defoliation by this insect complements winter defoliation by other introduced species.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	413, 612, 635, 717, 762, 1023, 1169, 1457, 1940, 1950

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Hawaii USA
Year	1954
Source	Ex. Trinidad
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Introduced for possible greater efficacy or adaptability to varying climatic zones and subsequently not distinguished from other *Teleonemia scrupulosa* populations released since 1902. Causes extensive defoliation during summer months and in drier areas. Summer defoliation by this insect complements winter defoliation by other introduced species.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	413, 612, 635, 717, 762, 1023, 1169, 1457, 1940, 1950

TABLE 1

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Hawaii USA
Year	1954
Source	Ex. USA (FL)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Introduced for possible greater efficacy and in the belief it was a separate species, *Teleonemia vanduzeei* Drake. Subsequently not distinguished from *T. scrupulosa* already established. Causes extensive defoliation during summer months and in drier areas. Summer defoliation by this insect complements winter defoliation by other introduced species.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	413, 612, 635, 717, 762, 1023, 1169, 1457, 1940, 1950

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Hawaii USA
Year	1963
Source	Ex. USA (FL)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Introduced for possible greater efficacy and in the belief it was a separate species, *Teleonemia vanduzeei* Drake. Subsequently not distinguished from *T. scrupulosa* already established. Causes extensive defoliation during summer months and in drier areas. Summer defoliation by this insect complements winter defoliation by other introduced species.
Other Species Attacked	Has been found feeding on a native Hawaiian tree, *Myoporum sandwicense* A. Gray, though not during more recent surveys. Also found attacking an exotic *Xanthium* sp.
Research Organization	HDOA
References	409, 413, 635, 762, 1169, 1457, 1940, 1950

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Kenya
Year	1953
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though established at all releases sites, causes no more than a temporary setback to lantana, and this only during the dry periods. Still present during recent surveys.
Research Organization	DAK
References	394, 418, 429, 667, 668

RELEASE	
Country	Madagascar
Year	1961
Source	Ex. Unknown via Mauritius
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established on plateau and east coast, wherever weed occurs. Damage only slight but causes tip dieback and may help keep weed in check, especially in plateau region.
References	160, 668, 1846

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	New Caledonia
Year	1936
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	In conjunction with *Ophiomyia lantanae* limits spread of the weed; however, more effective in dry zones than moist regions.
Research Organization	CSIRO, QLD State, FCN
References	429, 623, 698, 1093, 1548

RELEASE	
Country	Niue
Year	1994
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Research Organization	SPC
References	1403, 1868, 1940

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Northern Mariana Islands
Year	1963
Source	Ex. Mexico via Hawaii USA via Federated States of Micronesia (Pohnpei)
Established	Yes
Abundance	High
General Impact	Variable
Notes	Most effective of the lantana insects present, leading to severe defoliation in some stands, particularly in open sunny situations. At some locations, plants observed recovering completely following extensive defoliation.
Research Organization	HDOA
References	429, 481, 482, 1317

RELEASE	
Country	Palau
Year	1960
Source	Ex. Mexico via Hawaii USA via Federated States of Micronesia (Pohnpei)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Can cause extensive defoliation to some forms of lantana, while not surviving on others.
Limiting Factors	Host plant incompatibility
References	429, 481, 482, 1627

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Papua New Guinea
Year	1973
Source	Ex. Mexico via Hawaii USA via Fiji via Australia
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Common wherever lantana occurs. Severe damage in the dry season with complete defoliation, but this damage occurs only in ESP and MBP.
Research Organization	PNGDAL
References	429, 1400, 1427, 1428, 1940, 1982, 2050

VERBENACEAE
Lantana camara; Teleonemia scrupulosa (continued)

RELEASE	
Country	Republic of South Africa
Year	1961
Source	Ex. Mexico via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed, abundance varies. Populations low during winter, but increase rapidly in warmer months. Prefers drier areas/seasons. Can occasionally lead to complete defoliate of whole stands, dieback of branches, stunted growth and decreased reproduction. Along with *Octotoma scabripennis* and *Uroplata girardi* (which has since been largely replaced by *Ophiomyia camarae*) could reduce the rates of growth and reproduction of lantana. However attack is frequently temporary and plants can recover. Consequently, overall impact typically only moderate. Shows varietal preferences for the color form (pink) not the most abundant in South Africa.
Limiting Factors	Specificity; Climate
Other Species Attacked	Also attacks the native *Lantana rugosa* Thunb. and *Lippia* spp., especially when they are growing close to *Lantana camara* L. sens. lat.
Research Organization	ARC-PPRI
References	65, 66, 267, 269, 277, 280, 786, 992, 1342, 1399, 1849

VERBENACEAE
Lantana camara; Teleonemia scrupulosa (continued)

RELEASE	
Country	Republic of South Africa
Year	1971
Source	Ex. Brazil, Mexico, Paraguay, Trinidad, Venezuela via Australia
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed, abundance varies. Populations low during winter, but increase rapidly in warmer months. Prefers drier areas/seasons. Can occasionally lead to complete defoliate of whole stands, dieback of branches, stunted growth and decreased reproduction. Along with *Octotoma scabripennis* and *Uroplata girardi* (which has since been largely replaced by *Ophiomyia camarae*) could reduce the rates of growth and reproduction of lantana. However attack is frequently temporary and plants can recover. Consequently, overall impact typically only moderate. Shows varietal preferences for the color form (pink) not the most abundant in South Africa.
Limiting Factors	Specificity; Climate
Other Species Attacked	Also attacks the native *Lantana rugosa* Thunb. and *Lippia* spp., especially when they are growing close to *Lantana camara* L. sens. lat.
Research Organization	ARC-PPRI
References	65, 66, 277, 280, 717, 786, 992, 1849

TABLE 1

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Unknown via Mauritius
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed, abundance varies. Populations low during winter, but increase rapidly in warmer months. Prefers drier areas/seasons. Can occasionally lead to complete defoliate of whole stands, dieback of branches, stunted growth and decreased reproduction. Along with *Octotoma scabripennis* and *Uroplata girardi* (which has since been largely replaced by *Ophiomyia camarae*) could reduce the rates of growth and reproduction of lantana. However attack is frequently temporary and plants can recover. Consequently, overall impact typically only moderate. Shows varietal preferences for the color form (pink) not the most abundant in South Africa.
Limiting Factors	Specificity; Climate
Other Species Attacked	Also attacks the native *Lantana rugosa* Thunb. and *Lippia* spp., especially when they are growing close to *Lantana camara* L. sens. lat.
Research Organization	ARC-PPRI
References	65, 66, 277, 280, 668, 786, 992, 1849

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1989
Source	Ex. USA (FL, TX)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed, abundance varies. Populations low during winter, but increase rapidly in warmer months. Prefers drier areas/seasons. Can occasionally lead to complete defoliate of whole stands, dieback of branches, stunted growth and decreased reproduction. Along with *Octotoma scabripennis* and *Uroplata girardi* (which has since been largely replaced by *Ophiomyia camarae*) could reduce the rates of growth and reproduction of lantana. However attack is frequently temporary and plants can recover. Consequently, overall impact typically only moderate. Shows varietal preferences for the color form (pink) not the most abundant in South Africa.
Limiting Factors	Specificity; Climate
Other Species Attacked	Also attacks the native *Lantana rugosa* Thunb. and *Lippia* spp., especially when they are growing close to *Lantana camara* L. sens. lat.
Research Organization	ARC-PPRI
References	65, 66, 277, 280, 786, 992, 1849

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Samoa
Year	1936
Source	Ex. Mexico via Hawaii USA via Fiji
Established	No
References	431, 1548, 1940

RELEASE	
Country	Samoa
Year	1940
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Redistribution attempts to other districts on the main island of Upolu in 1978 failed. Where established, agent clearly affecting growth of lantana.
References	429, 431, 1548, 1940

RELEASE	
Country	Solomon Islands
Year	1993
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Provides excellent control on Russell Islands.
Research Organization	SPC
References	429, 431, 1868, 1940

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	St Helena
Year	1971
Source	Ex. Mexico via Hawaii USA via Fiji via Australia via India
Established	Yes
Abundance	High
General Impact	Variable
Notes	Exerts significant control in drier areas, but lantana remains problematic in more moist regions of island.
Research Organization	IIBC
References	312, 429, 582, 1940

RELEASE	
Country	Tanzania
Year	1958
Source	Ex. Mexico via Hawaii USA via Kenya
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Can cause heavy defoliation when populations high, though this is typically no more than a temporary setback to lantana, and usually only during the dry periods.
Limiting Factors	Climate
Research Organization	IIBC
References	394, 429, 667, 668

TABLE 1

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Tonga
Year	1937
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes only minor damage. Numbers remain low, possibly due to cultivation.
Limiting Factors	Land use
References	429, 962, 1093, 1548, 1940

RELEASE	
Country	Uganda
Year	1960
Source	Ex. Mexico via Hawaii USA via Kenya
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially believed to have failed so second release made subsequently. Has since been determined both releases were successful, and both are no longer differentiated. Can cause heavy defoliation when populations high, though this is typically no more than a temporary setback to lantana, and usually only during the dry periods.
Other Species Attacked	Found attacking the cultivated *Sesamum indicum* L. and *S. angustifolium* (Oliv.) Engl. when insect populations high.
Research Organization	IIBC
References	394, 429, 667, 668, 786

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Uganda
Year	1962
Source	Ex. Trinidad
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	This release made because was initially believed first release failed. Has since been determined both releases were successful, and both are no longer differentiated. Can cause heavy defoliation when populations high, though this is typically no more than a temporary setback to lantana, and usually only during the dry periods.
Limiting Factors	Climate
Other Species Attacked	Found attacking the cultivated *Sesamum indicum* L. and *S. angustifolium* (Oliv.) Engl. when insect populations high.
Research Organization	IIBC
References	394, 429, 667, 668, 786

RELEASE	
Country	Vanuatu
Year	1935
Source	Ex. Mexico via Hawaii USA via Fiji
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Well established, but not present on all islands. Where present, even high populations do not produce adequate level of control.
References	289, 418, 429, 698, 1093, 1548, 1940

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Zambia
Year	1962
Source	Ex. Mexico via Hawaii USA via Kenya via Zimbabwe
Established	No
Research Organization	MAZ
References	668, 1940

RELEASE	
Country	Zambia
Year	1969
Source	Ex. Trinidad via Uganda
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely established throughout country. Has massive impact on individual plants at very localized sites. Population densities vary by location and year, making overall impact far more limited. The cold season and heavy summer rains both limit populations.
Limiting Factors	Climate
Research Organization	IIBC
References	310, 311, 313, 429, 1117, 1940, 2005

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

RELEASE	
Country	Zimbabwe
Year	1961
Source	Ex. Mexico via Hawaii USA via Kenya
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Temporarily established then believed to have died out by 1965 without achieving control. Recent surveys indicated the agent is widespread and causing moderate damage.
Research Organization	MAR
References	418, 668, 1940

TABLE 1

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Tmolus echion* (L.)
Past Names/Synonyms	*Thecla* sp. (echion group), *Tmolus* sp. (echion group), *Strymon echion* (L.)
Classification	(Lepidoptera: Lycaenidae)

RELEASE	
Country	Fiji
Year	1922
Source	Ex. Mexico via Hawaii USA
Established	No
Research Organization	DAF
References	429, 431, 977, 1373, 1547, 1548, 1683, 1685

RELEASE	
Country	Hawaii USA
Year	1902
Source	Ex. Mexico
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Of only minor importance.
Limiting Factors	Parasitism
Other Species Attacked	Attacks numerous species besides *Lantana camara* agg. L.
Research Organization	HDOA
References	413, 612, 635, 1464, 1755, 1940, 2066

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Uroplata fulvopustulata* Baly
Past Names/Synonyms	*Uroplata* sp. nr *bilineata* Chapuis
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1976
Source	Ex. Costa Rica
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Restricted to north QLD. Causing only minimal damage.
Limiting Factors	Climate
Research Organization	QLD State
References	414, 418, 422, 429, 713, 1783

RELEASE	
Country	Fiji
Year	1976
Source	Ex. Costa Rica via Australia
Established	No
Research Organization	QLD State, FCN
References	429, 431, 1050

RELEASE	
Country	Republic of South Africa
Year	1978
Source	Ex. Costa Rica via Australia
Established	No
Research Organization	ARC-PPRI
References	268, 280, 992

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species *Uroplata girardi* Pic
Classification (Coleoptera: Chrysomelidae)

RELEASE

Country Ascension Island
Year 1973
Source Ex. Brazil via Hawaii USA via Australia via India via St Helena
Established Yes
Abundance Moderate
General Impact Medium
Geographical Scale of Impact Widespread throughout range
Notes Initially limited in distribution, but has since expanded and is contributing to significant control along with *Teleonemia scrupulosa* and *Orthezia insignis*.
References 429, 431, 582, 584

RELEASE

Country Australia
Year 1966
Source Ex. Brazil via Hawaii USA
Established Yes
Abundance High
General Impact Medium
Geographical Scale of Impact Widespread throughout range

(continued at top of next column)

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

Country Australia (continued)
Notes Present in large numbers throughout lantana range during favorable seasons, frequently alongside *Octotoma scabripennis*. Together cause severe defoliation and reduced flowering in late summer and autumn but do not permanently suppress the weed. Ineffective on Norfolk Island.
Other Species Attacked Documented attacking basil and other herbs (Lamiaceae).
Research Organization CSIRO, QLD State, NSW State
References 414, 422, 429, 713, 714, 715, 1212, 1783, 1940

RELEASE

Country Australia
Year 1974
Source Ex. Argentina
Established Yes
Abundance High
General Impact Medium
Geographical Scale of Impact Widespread throughout range
Notes
Limiting Factors
Other Species Attacked
Research Organization
References

Collected from cooler region in an attempt to increase the establishment and efficacy of the species in the southern portions of the weed's invaded range in Australia. No longer differentiated from earlier release. Present in large numbers throughout lantana range during favorable seasons, frequently alongside *Octotoma scabripennis*. Together cause severe defoliation and reduced flowering in late summer and autumn but do not permanently suppress the weed.

(continued on next page)

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

Country	Australia (continued)
Other Species Attacked	Documented attacking basil and other herbs (Lamiaceae).
Research Organization	CSIRO
References	414, 418, 422, 429, 715, 1212, 1783, 1940

RELEASE	
Country	Cook Islands
Year	1969
Source	Ex. Brazil via Hawaii USA via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Contributing to significant control.
References	429, 1548, 1940

RELEASE	
Country	Cook Islands
Year	1973
Source	Ex. Brazil via Hawaii USA via Australia via India
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Contributing to significant control. Remains uncertain if this release, the original, or both, was responsible for establishment.
References	429, 1940

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Federated States of Micronesia
Year	1963
Source	Ex. Brazil via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Among most effective biocontrol agents currently established in country. Most effective in shady areas with high humidity.
Limiting Factors	Habitat
Research Organization	UOG
References	429, 481, 482, 1302, 1627, 1940

RELEASE	
Country	Fiji
Year	1969
Source	Ex. Brazil via Hawaii USA
Established	Yes
Abundance	High
General Impact	Variable
Notes	Most prominent and effective of control agents released against *Lantana camara* to date in Fiji. Heavily damaging in shade, causing stunted growth and reduced seed production. Less effective in sunny conditions.
Limiting Factors	Habitat
Research Organization	DAF
References	418, 429, 960, 1050

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Ghana
Year	1971
Source	Ex. Brazil via Hawaii USA via Australia; Ex. Brazil via Hawaii USA via Trinidad via Uganda
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Caused spectacular damage at release sites, but overall providing only limited control. Though widely distributed, remains of minor importance with less than 50% of terminal shoots attacked. Generally more common at sites where *Teleonemia scrupulosa* rather scarce.
Limiting Factors	Interspecific competition
Research Organization	IIBC
References	308, 312, 314, 315, 316, 318, 429, 957, 1618, 1940

RELEASE	
Country	Guam
Year	1967
Source	Ex. Brazil via Hawaii USA via Northern Mariana Islands (Saipan)
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Contributes to good control, especially in shady areas.
Limiting Factors	Habitat
Research Organization	IIBC
References	429, 481, 482, 1300, 1317, 1940

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Hawaii USA
Year	1961
Source	Ex. Brazil
Established	Yes
Abundance	High
General Impact	Variable
Notes	Well adapted to Hawaiian conditions. Complements other foliage-feeding species. Can cause considerable foliar stress on small plants, but overall not effective on older plants.
Other Species Attacked	Documented attacking basil and other herbs (Lamiaceae).
Research Organization	HDOA
References	407, 409, 413, 431, 612, 635, 762, 1169, 1212, 1940

RELEASE	
Country	Hawaii USA
Year	1974
Source	Ex. Argentina via Australia
Established	Yes
Abundance	High
General Impact	Variable
Notes	Well adapted to Hawaiian conditions. Complements other foliage-feeding species. Can cause considerable foliar stress on small plants, but overall not effective on older plants.
Other Species Attacked	Documented attacking basil and other herbs (Lamiaceae).
Research Organization	HDOA
References	431, 612, 762, 1169, 1212, 1940

TABLE 1

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	India
Year	1972
Source	Ex. Brazil via Hawaii USA via Australia
Established	Yes
Abundance	Unknown
General Impact	None
Notes	Established in North India but not effective.
Research Organization	FRI
References	1312, 1542, 1940

RELEASE	
Country	Mauritius
Year	1967
Source	Ex. Brazil via Hawaii USA via Trinidad
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread and abundant on both the main island and Rodrigues Island, damage only minor on both.
Research Organization	IIBC
References	309, 429, 586, 668, 957

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	New Caledonia
Year	1977
Source	Ex. Brazil via Hawaii USA via Australia
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Causing significant defoliation to pink variety, particularly near Nouméa.
Research Organization	RSTO
References	286, 429, 698

RELEASE	
Country	Niue
Year	1993
Source	Ex. Brazil via Hawaii USA via Fiji
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Providing partial control. Most effective in open areas.
Research Organization	SPC
References	52, 429, 431, 1868, 1940

VERBENACEAE
Lantana camara; Uroplata girardi (continued)

RELEASE	
Country	Northern Mariana Islands
Year	1963
Source	Ex. Brazil via Hawaii USA
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Contributing to control; most effective in shady areas with high humidity.
Limiting Factors	Habitat
Research Organization	IIBC
References	429, 481, 482, 1317

RELEASE	
Country	Northern Mariana Islands
Year	1989
Source	Ex. Brazil via Hawaii USA via Northern Mariana Islands (Saipan) via Guam
Established	Yes
Abundance	Limited
General Impact	None
Notes	Surveys 10 months after release revealed although beetle had established, population was small and ineffective and had spread little from the release point.
Research Organization	UOG
References	481, 482, 1940

VERBENACEAE
Lantana camara; Uroplata girardi (continued)

RELEASE	
Country	Palau
Year	1974
Source	Ex. Brazil via Hawaii USA via Federated States of Micronesia (Pohnpei)
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Well established throughout country; exerting moderate damage on all varieties of lantana. Most effective in shady areas with high humidity.
Limiting Factors	Habitat
References	429, 481, 482, 1243, 1627, 1940

RELEASE	
Country	Papua New Guinea
Year	1972
Source	Ex. Brazil via Hawaii USA via Australia
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Though common wherever lantana occurs, causes only minor damage.
Research Organization	FRI
References	429, 1400, 1940

TABLE 1

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Philippines
Year	1985
Source	Ex. Brazil via Hawaii USA via Fiji
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	IIBC, PCA
References	291, 429, 1940

RELEASE	
Country	Republic of South Africa
Year	1974
Source	Ex. Brazil via Hawaii USA via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially moderately damaging where very abundant in coastal regions of KZN but sparse in LP and MP. Populations in KZN have since crashed, likely due to competition with *Ophiomyia camarae*; now distribution and abundance limited throughout South Africa. Exhibited strong lantana varietal preferences in the field, opposite to the preferences of *Octotoma scabripennis*.
Limiting Factors	Interspecific competition; Specificity
Research Organization	ARC-PPRI
References	65, 66, 268, 269, 280, 786, 993, 1849

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Republic of South Africa
Year	1983
Source	Ex. Argentina via Australia
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Originated from cooler region and released in attempt to increase establishment and efficacy under inland conditions of South Africa. Populations established in LP but scarce. Overall impact minimal. Exhibited strong lantana varietal preferences in the laboratory.
Limiting Factors	Specificity
Research Organization	ARC-PPRI
References	65, 66, 280, 786, 993

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Brazil via Hawaii USA via Trinidad via Mauritius
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Establishment from this introduction unlikely due to small release size and release occurring in climatically unsuitable area (too dry).
Limiting Factors	Small release size; Climate
Research Organization	ARC-PPRI
References	275, 993, 1940

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Samoa
Year	1975
Source	Ex. Brazil via Hawaii USA via Fiji
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	When occurs in high numbers has noticeable effect.
References	429, 431, 1940

RELEASE	
Country	Solomon Islands
Year	1992
Source	Ex. Brazil via Hawaii USA via Fiji
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	With *Teleonemia scrupulosa* provides excellent control on Russell Islands, especially in shady conditions
Research Organization	SPC
References	52, 429, 431, 1868, 1940

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	St Helena
Year	1970
Source	Ex. Brazil via Hawaii USA via Australia via India
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initial recoveries made some distance from release site, but does not appear to have established. Systematic searches not made.
Research Organization	IIBC
References	311, 312, 429, 582, 1940

RELEASE	
Country	Tanzania
Year	1967
Source	Ex. Brazil via Hawaii USA via Trinidad
Established	No
Research Organization	IIBC
References	308, 429, 667, 957, 1940

RELEASE	
Country	Tonga
Year	1969
Source	Ex. Brazil via Hawaii USA via Australia; Ex. Brazil via Hawaii USA via Fiji
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 1

TABLE 1

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

Country	Tonga (continued)
Notes	Though established, causes only partial or seasonal control. Numbers remain low, possibly due to cultivation.
Limiting Factors	Land use
Research Organization	IIBC
References	289, 429, 962, 1548, 1940

RELEASE

Country	Trinidad and Tobago
Year	pre 1969
Source	Ex. Brazil via Hawaii USA
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Released for a few (unspecified) years on Trinidad prior to the well documented 1969 release. Post-release recoveries made but heavy larval predation by wasps initially mitigated against effective establishment. Release sites subsequently destroyed; current status of this species unknown.
Research Organization	IIBC
References	288, 310, 429, 1940

RELEASE

Country	Uganda
Year	1966
Source	Ex. Brazil via Hawaii USA via Trinidad
Established	Yes
Abundance	Limited
General Impact	None
Notes	Though established, populations remain low and has provided no marked control.
Research Organization	IIBC
References	308, 310, 311, 429, 957

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE

Country	Vanuatu
Year	1983
Source	Ex. Brazil via Hawaii USA
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established rapidly and initially showed obvious damage to lantana. However, weed still very problematic so overall control now considered minimal.
Research Organization	ARC-PPRI
References	204, 289, 418, 429, 1940

RELEASE

Country	Zambia
Year	1969
Source	Ex. Brazil via Hawaii USA via Trinidad
Established	No
Notes	Numerous releases made as many populations failed to survive dry season. Despite temporary establishment of some populations, overall establishment considered failed.
Limiting Factors	Climate
Research Organization	IIBC
References	311, 313, 957, 1117

VERBENACEAE
Lantana camara; Uroplata girardi *(continued)*

RELEASE	
Country	Zambia
Year	2009
Source	Ex. South America via Republic of South Africa
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Initial introductions starting in 1969 failed to establish in dry conditions/sites. This second release made in 2009 from South African material. South Africa agents originated from two different sources; unclear which population or if a mixture of both was used for this release. Agents have thrived under rainforest conditions, though too early post release to determine overall abundance and impact.
Research Organization	ARC-PPRI, CABI-Africa
References	786, 1849, 2005

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Uroplata lantanae Buzzi* & Winder
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1977
Source	Ex. Brazil
Established	No
Notes	Establishment failure likely due to small release size, itself due to inability to maintain populations on lantana varieties naturalized in Australia.
Limiting Factors	Specificity; Small release size
Research Organization	CSIRO
References	414, 418, 429, 1783, 1993

RELEASE	
Country	Republic of South Africa
Year	1984
Source	Ex. Brazil via Australia
Established	No
Research Organization	ARC-PPRI
References	280, 992

TABLE 1

VERBENACEAE *(continued)*

WEED	
Family	Verbenaceae
Species	*Lantana montevidensis* (Spreng.) Briq.
Origin	South America
Common Name	creeping lantana

AGENT	
Species	*Calycomyza lantanae* (Frick)
Past Names/Synonyms	*Phytobia lantanae* Frick
Classification	(Diptera: Agromyzidae)

RELEASE	
Country	Australia
Year	1974
Source	Ex. Trinidad
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Released on *Lantana camara* agg. but established *L. montevidensis* as well. Widely distributed throughout range of weed. Populations fluctuate seasonally, peaking in summer and autumn in warm, moist areas but waning over winter and in temperate areas. Even at high densities causes only minor damage.
Limiting Factors	Climate
Research Organization	CSIRO
References	314, 414, 415, 422

VERBENACEAE
Lantana montevidensis *(continued)*

AGENT	
Species	*Charidotis pygmaea* Klug
Classification	(Coleoptera: Chrysomelidae)

RELEASE	
Country	Australia
Year	1994
Source	Ex. Brazil
Established	No
Notes	Adults persisted for several months following release but failed to lay many eggs and disappeared completely within 24 months. Failure attributed to heat stress and dry conditions.
Limiting Factors	Climate
Research Organization	QLD State
References	415, 418, 425, 429

AGENT	
Species	*Ectaga garcia* Becker
Classification	(Lepidoptera: Oecophoridae)

RELEASE	
Country	Australia
Year	1993
Source	Ex. Brazil
Established	No
Research Organization	QLD State
References	415, 429, 430

VERBENACEAE
Lantana montevidensis *(continued)*

AGENT

Species	*Hypena laceratalis* Walker
Incorrect Past Names/Synonyms	*Hypena strigata* (Fabricius), *Hypena jussalis* Walker, *Hypena strigalis*
Classification	(Lepidoptera: Erebidae)

RELEASE

Country	Australia
Year	1965
Source	Ex. Kenya, Zimbabwe via Hawaii USA
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Released on *Lantana camara* agg. but established on *L. montevidensis* as well. Prior to release of this African population, the species was found to be present in Australia, and assumed to be native. Both populations no longer differentiated in the literature. Frequently found in warm moist areas where plant growth is lush but absent from dry slopes. Populations fluctuate seasonally, peaking in summer and autumn but waning over winter. Even at high densities causes only minor damage.
Limiting Factors	Climate
Research Organization	QLD State
References	414, 415, 422, 429, 714

ZYGOPHYLLACEAE

TABLE 1

WEED

Family	Zygophyllaceae
Species	*Tribulus cistoides* L.
Origin	tropical and sub-tropical Africa, Indo-Australia
Common Name	false puncturevine, nohu, Jamaican feverplant, Jamaican fever vine, puncturevine, bur-not

AGENT

Species	*Microlarinus lareynii* (Jacquelin du Val)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Federation of St Kitts and Nevis
Year	1968
Source	Ex. Italy via USA (CA)
Established	No
Notes	Initially recovered one year following release, but not subsequently.
Research Organization	IIBC
References	98, 99, 288, 1128

RELEASE

Country	Hawaii USA
Year	1962
Source	Ex. Italy via USA (CA)
Established	No

(continued on next page)

TABLE 1

ZYGOPHYLLACEAE
Tribulus cistoides; Microlarinus lareynii *(continued)*

Country	Hawaii USA (continued)
Notes	Initially very damaging on KA and OA in conjunction with *Microlarinus lypriformis* (the most important agent), but populations disappeared as weed populations destroyed by feeding. The target weed is considered native to Hawaii.
Research Organization	HDOA
References	405, 408, 409, 410, 635, 762, 1128

RELEASE

Country	Hawaii USA
Year	1963
Source	Ex. Italy via USA (AZ)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Reportedly in bad condition by the time it reached MA where only gives partial control. Populations from other releases more effective on other islands. The target weed is considered native to Hawaii.
Limiting Factors	Unhealthy release material
Research Organization	HDOA
References	405, 409, 635, 762, 1128

ZYGOPHYLLACEAE
Tribulus cistoides; Microlarinus lareynii *(continued)*

RELEASE

Country	Hawaii USA
Year	1967
Source	Ex. Italy via USA (CA)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initial releases very damaging on KA and OA in conjunction with *Microlarinus lypriformis* (the most important agent), but populations disappeared as weed populations destroyed by feeding. This 1967 reintroduction successful and helps keep *Tribulus* spp. low. The target weed is considered native to Hawaii.
Research Organization	HDOA
References	405, 409, 410, 635, 762, 1128, 1894

RELEASE

Country	Papua New Guinea
Year	1966
Source	Ex. Italy via continental USA via Hawaii USA
Established	No
Research Organization	PNGDAL
References	1128, 2050

ZYGOPHYLLACEAE
Tribulus cistoides *(continued)*

AGENT	
Species	*Microlarinus lypriformis* (Wollaston)
Classification	(Coleoptera: Curculionidae)

RELEASE	
Country	Federation of St Kitts and Nevis
Year	1966
Source	Ex. Italy via continental USA via Hawaii USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Well established and providing excellent control on St Kitts. Initially successful control on Nevis, but subsequent enlargement of airport destroyed the weed and probably also the weevil population. Current status of weed and weevil unknown on Nevis.
Limiting Factors	Land use
Research Organization	IIBC
References	98, 99, 104, 288, 1128

ZYGOPHYLLACEAE
Tribulus cistoides; Microlarinus lypriformis *(continued)*

RELEASE	
Country	Hawaii USA
Year	1963
Source	Ex. Italy via USA (AZ, CA)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Substantial to complete control on KA and OA, but only partial control on MA and HA. The target weed is considered native to Hawaii.
Research Organization	HDOA
References	44, 405, 409, 410, 411, 635, 762, 1128

RELEASE	
Country	Papua New Guinea
Year	1967
Source	Ex. Italy via continental USA via Hawaii USA
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Controlling plant at release points and spreading.
Research Organization	PNGDAL
References	155, 1128, 1427, 1428, 2050

TABLE 1

ZYGOPHYLLACEAE *(continued)*

WEED

Family	Zygophyllaceae
Species	*Tribulus terrestris* L.
Origin	Mediterranean, western Asia, Africa
Common Name	puncturevine, ground bur nut, bull's head, goat head, caltrop

AGENT

Species	*Microlarinus lareynii* (Jacquelin du Val)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Canada
Year	1986
Source	Ex. Italy via USA (CO)
Established	No
Research Organization	AAFC
References	101

RELEASE

Country	Hawaii USA
Year	1962
Source	Ex. Italy via USA (CA)
Established	No
Notes	Initially very damaging on KA and OA in conjunction with *Microlarinus lypriformis* (the most important agent), but populations disappeared as weed populations destroyed by feeding.
Research Organization	HDOA
References	405, 408, 409, 410, 635, 762, 1128

ZYGOPHYLLACEAE
Tribulus terrestris; Microlarinus lareynii (continued)

RELEASE

Country	Hawaii USA
Year	1963
Source	Ex. Italy via USA (AZ)
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Reportedly in bad condition by the time it reached MA where only gives partial control. Populations from other releases more effective on other islands.
Limiting Factors	Unhealthy release material
Research Organization	HDOA
References	405, 409, 635, 762

RELEASE

Country	Hawaii USA
Year	1967
Source	Ex. Italy via USA (CA)
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initial releases very damaging on KA and OA in conjunction with *Microlarinus lypriformis* (the most important agent), but populations disappeared as weed populations destroyed by feeding. This 1967 reintroduction successful and helps keep *Tribulus* spp. low.
Research Organization	HDOA
References	405, 409, 410, 635, 762, 1128, 1894

ZYGOPHYLLACEAE
Tribulus terrestris; Microlarinus lareynii *(continued)*

RELEASE	
Country	United States of America
Year	1961
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	In combination with *Microlarinus lypriformis* successfully reduced weed cover and seed production up to 80% in warmer areas of southwest USA, especially CA. Contributed to successful control in AL such that current establishment there unknown. Generally ineffective at higher elevations where cold winter temperatures reduce weevil populations. Recent redistribution within CA successfully established a population at one high elevation site, indicating establishment possible when sites have overwintering shelter and limited disturbance. This species much more successful at high elevation site compared to *M. lypriformis*, and is established in limited amounts in WA and OR whereas *M. lypriformis* is not, indicating higher cold tolerance. Populations limited by parasites and predators at some sites.
Limiting Factors	Climate; Parasitism; Predation

(continued at top of next column)

ZYGOPHYLLACEAE
Tribulus terrestris; Microlarinus lareynii *(continued)*

Country	United States of America (continued)
Other Species Attacked	Also attacks the native *Kallstroemia californica* (S. Watson) Vail, *K. grandiflora* Torr. ex A. Gray, and one additional native *Kallstroemia* sp. Adults found on numerous exotic species (some of economic importance), though impact is typically negligible.
Research Organization	USDA (7,12), State (4,5,6,9,13,14,15,21)
References	39, 45, 332, 334, 335, 862, 1114, 1128, 1457, 1501, 1578, 1731, 1840, 1894, 1906

RELEASE	
Country	United States of America
Year	1994
Source	Ex. Italy
Established	No
Notes	Cold adapted strains from the Abruzzi Mountains, Italy, were distributed to more northern areas but failed to establish in CA.
Research Organization	State (14)
References	335, 1840, 1906

TABLE 1

TABLE 1

ZYGOPHYLLACEAE
Tribulus terrestris *(continued)*

AGENT

Species	*Microlarinus lypriformis* (Wollaston)
Classification	(Coleoptera: Curculionidae)

RELEASE

Country	Canada
Year	1986
Source	Ex. Italy via USA (CO)
Established	No
Research Organization	AAFC
References	659

RELEASE

Country	Hawaii USA
Year	1963
Source	Ex. Italy via USA (AZ, CA)
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Substantial to complete control on KA and OA, but only partial control on MA and HA.
Research Organization	HDOA
References	44, 405, 409, 410, 411, 635, 762, 1128

ZYGOPHYLLACEAE
Tribulus terrestris; Microlarinus lypriformis *(continued)*

RELEASE

Country	United States of America
Year	1961
Source	Ex. Italy
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	In combination with *Microlarinus lareynii* successfully reduced weed cover and seed production up to 80% in warmer areas of southwest USA, especially CA. Contributed to successful control in AL such that current establishment there unknown. Generally ineffective at higher elevations where cold winter temperatures reduce weevil populations. Recent redistribution within CA successfully established a population at one high elevation site, indicating establishment possible when sites have overwintering shelter and limited disturbance. However, this species much less abundant at high elevation site compared to *M. lareynii*, and is not established in WA and OR whereas *M. lareynii* is, indicating lower cold tolerance. Populations limited by parasites and predators at some sites.
Limiting Factors	Climate; Parasitism; Predation

(continued on next page)

ZYGOPHYLLACEAE
Tribulus terrestris; Microlarinus lypriformis *(continued)*

Country	United States of America (continued)
Other Species Attacked	Also attacks the native *Kallstroemia californica* (S. Watson) Vail, *K. grandiflora* Torr. ex A. Gray, and one additional native *Kallstroemia* sp. Adults found on numerous exotic species (some of economic importance), though impact is typically negligible.
Research Organization	USDA (7,12), State (4,5,6,9,13,14,15,21)
References	39, 45, 332, 335, 862, 1128, 1129, 1457, 1501, 1578, 1731, 1840, 1894, 1906

RELEASE

Country	United States of America
Year	1993
Source	Ex. Italy
Established	No
Notes	Cold adapted populations from the Abruzzi Mountains, Italy, were distributed to more northern areas but failed to establish in CA.
Research Organization	State (14)
References	1840, 1906

TABLE 2. NATIVE ORGANISMS INTENTIONALLY REDISTRIBUTED

Redistribution Information

Releases in this table are typically redistributions because the agents in question already occur naturally within the country of discussion and are simply redistributed to select locations within the country. These entries are listed alphabetically according to the country of redistribution and are accompanied by the year the first field release/redistribution was made. Some species have been redistributed in the same country multiple times. When subsequent redistributions were separated by five years or more, or were successfully established following the failure of the original redistribution(s), then these subsequent redistributions are given their own entries and are listed numerically by the redistribution year.

Current Status

Please note that all information included in this section pertains only to the intentionally redistributed populations, and not to naturally occurring populations established elsewhere within the country.

The establishment status of each intentional redistribution is given when known. The impact of established agents is then stated using eight categories pre-determined for the ease of quick data summary, including: None, Slight, Medium, Heavy, Variable, Too early post release, Unknown, and Compromised (the latter for sites destroyed post release). Because the choices selected for impact are subjective estimates by the editors, an additional notes section is provided which includes a brief summary of the status for each redistribution system. All impact is assumed to occur only on a localized scale following the redistribution, unless stated otherwise in the notes. Abbreviations used in the notes section to denote sub-regions of a country are provided along with their corresponding regions at the front of this catalogue immediately following the Table of Contents. If the biocontrol agent has been observed in the field attacking plant species other than those targeted for control, this information is included. Likewise, factors believed to limit the efficacy of any particular release are listed when known.

TABLE 2

AMARANTHACEAE

WEED	
Family	Amaranthaceae
Species	*Amaranthus retroflexus* L.
Origin	North America
Common Name	rough pigweed, redroot
AGENT	
Species	*Disonycha glabrata* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

REDISTRIBUTION	
Country	United States of America
Year	1979
Established	No
General Impact	Not established
Notes	Beetles subjected to predation and failed to overwinter.
Limiting Factors	Predation; Climate
Research Organization	State (27)
References	81

AMARANTHACEAE *(continued)*

WEED	
Family	Amaranthaceae
Species	*Amaranthus spinosus* L.
Origin	tropical Americas
Common Name	spiny amaranth, phak khom nam
AGENT	
Species	*Hypolixus truncatulus* (Fabricius)
Classification	(Coleoptera: Curculionidae)

REDISTRIBUTION	
Country	Thailand
Year	pre 1982
Established	Yes
General Impact	Heavy
Notes	Augmentative releases have resulted in a country-wide distribution, giving satisfactory control and replacing use of herbicides.
Other Species Attacked	Also attacks *Chromolaena odorata* L., *Amaranthus viridis* L., and *Digera arvensis* (whose name has since been changed to *Digera muricata* (L.) Mart.).
Research Organization	NBCRC
References	1326, 1329, 1939

ARACEAE

WEED	
Family	Araceae
Species	*Pistia stratiotes* L.
Origin	tropical Americas, Asia, Malesia, Australia (NT)
Common Name	water lettuce, Nile cabbage, chok, jawg

AGENT	
Species	*Spodoptera pectinicornis* (Hampson)
Past Names/Synonyms	*Namangana pectinicornis* (Hampson), *Epipsammea pectinicornis* (Hampson)
Incorrect Past Names/Synonyms	*Epipsammia pectinicornis*, *Episammia pectinicornis* (Hampson)
Classification	(Lepidoptera: Noctuidae)

REDISTRIBUTION	
Country	Thailand
Year	1982
Established	Yes
General Impact	Heavy
Notes	Augmentative releases have resulted in widespread distribution, giving excellent control and replacing use of herbicides. Releases still ongoing.
Research Organization	NBCRC
References	1326, 1327, 1329, 1347, 1745, 1939

ASTERACEAE

WEED	
Family	Asteraceae
Species	*Baccharis halimifolia* L.
Origin	North America
Common Name	groundsel bush, sea myrtle, consumption-weed

AGENT	
Species	*Rhopalomyia californica* Felt
Classification	(Diptera: Cecidomyiidae)

REDISTRIBUTION	
Country	United States of America
Year	1985
Established	No
General Impact	Not established
Research Organization	USDA (9), State (22)
References	136, 533

TABLE 2

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Baccharis neglecta* Britton
Origin	Texas USA, Mexico
Common Name	Roosevelt weed, linear-leaf false willow

AGENT	
Species	*Rhopalomyia californica* Felt
Classification	(Diptera: Cecidomyiidae)

REDISTRIBUTION	
Country	United States of America
Year	1985
Established	No
General Impact	Not established
Research Organization	USDA (9), State (22)
References	136, 533

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Cassinia arcuata* R. Br.
Origin	Australia
Common Name	sifton bush

AGENT	
Species	*Austrotachardia* sp.
Classification	(Hemiptera: Kerridae)

REDISTRIBUTION	
Country	Australia
Year	1985
Established	Yes
General Impact	Heavy
Notes	250 ha of *Cassinia arculata* were killed within 4 years and pastures regenerated. Redistribution and control success have continued in some locations. Current distribution and population levels unknown.
Limiting Factors	Parasitism
Research Organization	NSW State
References	224, 839, 842

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Cassinia* spp.
Notes	Includes *Cassinia laevis* R. Br. and *Cassinia quinquefaria* R. Br.
Origin	Australia
Common Name	coughbush
AGENT	
Species	*Paratachardina* sp.
Classification	(Hemiptera: Kerridae)
REDISTRIBUTION	
Country	Australia
Year	1991
Established	Yes
General Impact	Heavy
Notes	Substantial but unquantified areas of *Cassinia laevis* and *C. quinquefaria* have been killed. Redistribution and control success have continued in some locations. Current distribution and population levels unknown.
Limiting Factors	Parasitism
Research Organization	NSW State
References	224, 839

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Cirsium arvense* (L.) Scop.
Origin	Eurasia
Common Name	Canada thistle, creeping thistle, Californian thistle, field thistle
AGENT	
Species	*Corythucha distincta* Osborn & Drake
Incorrect Past Names/Synonyms	*Corythuca disticta* Osborn & Drake
Classification	(Hemiptera: Tingidae)
REDISTRIBUTION	
Country	United States of America
Year	1984
Established	Yes
General Impact	Heavy
Notes	Feeding observed to stunt or kill *Cirsium arvense* shoots when populations high. Attack on native *Cirsium* spp. precludes applied utilization of *Corythucha distincta* as biocontrol agent.
Other Species Attacked	Regularly attacks numerous native *Cirsium* spp. Causes lesser damage to other exotic thistle species.
Research Organization	State (13)
References	74, 709

TABLE 2

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Rhaponticum repens* (L.) Hidalgo
Past Names/Synonyms	*Centaurea repens* L., *Acroptilon repens* (L.) DC.
Origin	Central Asia
Common Name	Russian knapweed
References	792

AGENT	
Species	*Aceria acroptiloni* Shevchenko & Kovalev
Past Names/Synonyms	*Aceria* sp. n.
Classification	(Acari: Eriophyidae)

REDISTRIBUTION	
Country	Ukraine
Year	pre 1973
Established	Yes
General Impact	Heavy
Notes	Efficiently suppressed reproduction of the weed.
References	1015, 1021

REDISTRIBUTION	
Country	Uzbekistan
Year	pre 1997
Established	Yes
General Impact	Heavy
Notes	Abundance of the mite in cultivation is maintained by preservation on 2 ha plots among crops. Successful control of seed production observed in different crops.
Research Organization	ZIAS
References	1017

ASTERACEAE
Rhaponticum repens (continued)

AGENT	
Species	*Subanguina picridis* (Kirjanova) Brzeski
Past Names/Synonyms	*Paranguina picridis* (Kirjanova) Kirjanova & Ivanova, *Mesoanguina picridis* (Kirjanova) Chizhov & Subbotin
Classification	(Tylenchida: Anguinidae)

REDISTRIBUTION	
Country	Tajikistan
Year	1962
Established	Yes
General Impact	Heavy
Notes	Incorporation of chopped galls into soils in December/January led to up to 100% infection, including 30% severely infected and 20% killed.
References	895, 1613

REDISTRIBUTION	
Country	Ukraine
Year	pre 1973
Established	Yes
General Impact	Heavy
Notes	Spray application resulted in up to 60% infestation and 30% mortality in some field trials. Reduced number of plants to 27% in others. Efficiently suppressed reproduction of the weed.
References	1015, 1018

ASTERACEAE
Rhaponticum repens; Subanguina picridis *(continued)*

REDISTRIBUTION	
Country	Uzbekistan
Year	pre 1993
Established	Yes
General Impact	Heavy
Notes	Application of a suspension of nematode larvae and water in autumn and spring proved to be particularly successful in perennial grass crops, e.g. alfalfa. Mass rearing of nematodes and gall collections performed on special plots (2 ha) among crops.
Research Organization	ZIAS
References	1017, 1596

CACTACEAE

WEED	
Family	Cactaceae
Species	*Opuntia ficus-indica* (L.) Mill.
Past Names/Synonyms	*Opuntia cordobensis* Spegazzini, *Opuntia megacantha* Salm-Dyck
Notes	Previous literature referred to this release as occurring on *Opuntia cordobensis* Spegazzini which has since been synonymized with *O. ficus-indica* (L.) Mill. While some authors consider *O. ficus-indica* to be a spineless cultivar derived from *O. megacantha*, many other authors consider *O. megacantha* to also be a cultivated taxon or a name applied to multiple ruderal reversions to spininess from the escaped, cultivated *O. ficus-indica* and they treat *O. megacantha* as a later synonym. The editors of this catalogue are in the latter group.
Origin	Mexico
Common Name	Indian fig, mission prickly pear, grootdoringturksvy

AGENT	
Species	*Fusarium oxysporum* Schlecktendahl
Classification	(Sordariomycetes: Hypocreales)

TABLE 2

CACTACEAE
Opuntia ficus-indica; Fusarium oxysporum *(continued)*

REDISTRIBUTION	
Country	Hawaii USA
Year	1943
Established	Yes
General Impact	Variable
Notes	Fungus first documented on KA and later was successful against red-fruited variety of *Opuntia* on NI, OA, MO, and MA. Deliberately released on *Opuntia* on HA. Largely ineffective on the less desirable white form. Field inoculations discontinued in 1949 when introduction of insect agents began.
Research Organization	BAF
References	413, 601, 611, 612, 1986

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia littoralis* (Engelm.) Cockerell
Origin	southwestern coastal USA including Santa Cruz Island and Baja California, Mexico
Common Name	prickly pear, coastal prickly pear

AGENT	
Species	*Chelinidea tabulata* (Burmeister)
Classification	(Hemiptera: Coreidae)

REDISTRIBUTION	
Country	United States of America
Year	1945
Established	Yes
General Impact	None
Notes	Initially thought to have not established but recovered in 1961 immediately prior to second release. Currently has very limited distribution and having no impact. Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

REDISTRIBUTION	
Country	United States of America
Year	1961
Established	Yes
General Impact	None
Notes	Not differentiated from earlier release. Established but with very limited distribution and having no impact. Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

CACTACEAE
Opuntia littoralis *(continued)*

AGENT	
Species	*Chelinidea vittiger* Uhler
Classification	(Hemiptera: Coreidae)

REDISTRIBUTION	
Country	United States of America
Year	1945
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	447, 635, 638, 639

REDISTRIBUTION	
Country	United States of America
Year	1961
Established	Yes
General Impact	None
Notes	Establishment tenuous due to competition by *Dactylopius opuntiae* and predation. Target weed considered native.
Limiting Factors	Interspecific competition; Predation
Research Organization	State (5)
References	447, 635, 638, 639

CACTACEAE
Opuntia littoralis *(continued)*

AGENT	
Species	*Dactylopius confusus* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)

REDISTRIBUTION	
Country	United States of America
Year	1942
Established	No
General Impact	Not established
Notes	Establishment failed because colonies washed into ocean during winter following extremely heavy rainfall. Target weed considered native.
Limiting Factors	Flooding
Research Organization	State (5)
References	635, 638, 639

AGENT	
Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

REDISTRIBUTION	
Country	United States of America
Year	1940
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	638, 639

TABLE 2

CACTACEAE
Opuntia littoralis *(continued)*

AGENT

Species	*Melitara prodenialis* Walker
Classification	(Lepidoptera: Pyralidae)

REDISTRIBUTION

Country	United States of America
Year	1945
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

REDISTRIBUTION

Country	United States of America
Year	1962
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

CACTACEAE
Opuntia littoralis *(continued)*

AGENT

Species	*Olycella junctolineella* (Hulst)
Classification	(Lepidoptera: Pyralidae)

REDISTRIBUTION

Country	United States of America
Year	1961
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Opuntia oricola* Philbrick
Origin	southwestern coastal USA including Santa Cruz Island and Baja California, Mexico
Common Name	prickly pear, chaparral prickly pear

AGENT

Species	*Chelinidea tabulata* (Burmeister)
Classification	(Hemiptera: Coreidae)

REDISTRIBUTION

Country	United States of America
Year	1945
Established	Yes
General Impact	None
Notes	Initially thought to have not established but recovered in 1961 immediately prior to second release. Currently has very limited distribution and having no impact. Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

REDISTRIBUTION

Country	United States of America
Year	1961
Established	Yes
General Impact	None
Notes	Not differentiated from earlier release. Established but with very limited distribution and having no impact. Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

CACTACEAE
Opuntia oricola *(continued)*

AGENT

Species	*Chelinidea vittiger* Uhler
Classification	(Hemiptera: Coreidae)

REDISTRIBUTION

Country	United States of America
Year	1945
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	447, 635, 638, 639

REDISTRIBUTION

Country	United States of America
Year	1961
Established	Yes
General Impact	None
Notes	Establishment tenuous due to competition by *Dactylopius opuntiae* and predation. Target weed considered native.
Limiting Factors	Interspecific competition; Predation
Research Organization	State (5)
References	447, 635, 638, 639

TABLE 2

CACTACEAE
Opuntia oricola *(continued)*

AGENT

Species	*Dactylopius confusus* (Cockerell)
Past Names/Synonyms	*Dactylopius greenii* Cockerell
Classification	(Hemiptera: Dactylopiidae)

REDISTRIBUTION

Country	United States of America
Year	1942
Established	No
General Impact	Not established
Notes	Establishment failed because colonies washed into ocean during winter following extremely heavy rainfall. Target weed considered native.
Limiting Factors	Flooding
Research Organization	State (5)
References	635, 638, 639

AGENT

Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

REDISTRIBUTION

Country	United States of America
Year	1940
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	638, 639

CACTACEAE
Opuntia oricola *(continued)*

AGENT

Species	*Melitara prodenialis* Walker
Classification	(Lepidoptera: Pyralidae)

REDISTRIBUTION

Country	United States of America
Year	1945
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

REDISTRIBUTION

Country	United States of America
Year	1962
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

CACTACEAE
Opuntia oricola *(continued)*

AGENT

Species	*Olycella junctolineella* (Hulst)
Classification	(Lepidoptera: Pyralidae)

REDISTRIBUTION

Country	United States of America
Year	1961
Established	No
General Impact	Not established
Notes	Target weed considered native.
Research Organization	State (5)
References	635, 638, 639

CONVOLVULACEAE

WEED

Family	Convolvulaceae
Species	*Calystegia sepium* (L.) R. Br.
Past Names/Synonyms	*Convolvulus sepium* L.
Origin	North America
Common Name	hedge bindweed, hedge false bindweed

AGENT

Species	*Charidotella sexpunctata bicolor* (Fabricius)
Past Names/Synonyms	*Metriona bicolor* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

REDISTRIBUTION

Country	Canada
Year	1969
Established	Yes
General Impact	Slight
Notes	Confirmed established at original 1969 release in BC as of 2001; found spreading to new hedge bindweed patches during 2007-2012 monitoring. Considered a pest of morning glory and sweet potato in ON so further redistribution being reconsidered.
Other Species Attacked	Also feeds on numerous desirable and weedy plant species.
Research Organization	AAFC
References	117, 437, 1173, 1841

TABLE 2

TABLE 2

CONVOLVULACEAE
Calystegia sepium *(continued)*

AGENT	
Species	*Deloyala guttata* (Olivier)
Past Names/Synonyms	*Chirida guttata* (Olivier)
Classification	(Coleoptera: Chrysomelidae)
References	117, 1089

REDISTRIBUTION	
Country	Canada
Year	1971
Established	No
General Impact	Not established
Notes	Though common in its original range in Canada, transfer to BC failed to establish.
Research Organization	UBC
References	1173

CONVOLVULACEAE *(continued)*

WEED	
Family	Convolvulaceae
Species	*Convolvulus arvensis* L.
Origin	Eurasia
Common Name	field bindweed

AGENT	
Species	*Charidotella purpurata* (Boheman)
Past Names/Synonyms	*Metriona purpurata* (Boheman)
Classification	(Coleoptera: Chrysomelidae)

REDISTRIBUTION	
Country	Canada
Year	1979
Established	Yes
General Impact	Unknown
Research Organization	AAFC
References	735, 1173, 1185

CONVOLVULACEAE
Convolvulus arvensis (continued)

AGENT

Species	*Charidotella sexpunctata bicolor* (Fabricius)
Past Names/Synonyms	*Metriona bicolor* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

REDISTRIBUTION

Country	Canada
Year	1969
Established	No
General Impact	Not established
Notes	Though common in its original range in Canada, transfer to BC failed to establish.
Other Species Attacked	Also feeds on numerous desirable and weedy plant species.
Research Organization	AAFC
References	117, 1173

AGENT

Species	*Chelymorpha cassidea* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

REDISTRIBUTION

Country	Canada
Year	1979
Established	No
General Impact	Not established
Notes	Though common in its original range in Canada, transfer to SK failed to establish.
Research Organization	AAFC
References	735, 1173

CONVOLVULACEAE
Convolvulus arvensis (continued)

AGENT

Species	*Deloyala guttata* (Olivier)
Past Names/Synonyms	*Chirida guttata* (Olivier)
Classification	(Coleoptera: Chrysomelidae)
References	117, 1089

REDISTRIBUTION

Country	Canada
Year	1969
Established	No
General Impact	Not established
Notes	Though common in its original range in Canada, transfers to AB and BC failed to establish.
Research Organization	AAFC
References	1173

TABLE 2

CONVOLVULACEAE *(continued)*

WEED

Family	Convolvulaceae
Species	*Cuscuta campestris* Yunck.
Origin	Americas
Common Name	dodder

AGENT

Species	*Alternaria cuscutacidae* Rudakov
Classification	(Dothideomycetes: Pleosporales)

REDISTRIBUTION

Country	Russia
Year	1950s
Established	Yes
General Impact	Variable
Notes	Mass production and inoculation of the fungus has resulted in control in some crops, but less effective control in others.
References	629, 944, 1015, 1986

CONVOLVULACEAE *(continued)*

WEED

Family	Convolvulaceae
Species	*Cuscuta capulata* Engelm.
Notes	This species is largely missing from the literature and current taxonomic databases.
Origin	Americas
Common Name	dodder

AGENT

Species	*Alternaria cuscutacidae* Rudakov
Classification	(Dothideomycetes: Pleosporales)

REDISTRIBUTION

Country	Russia
Year	1950s
Established	Yes
General Impact	Variable
Notes	Mass production and inoculation of the fungus has resulted in control in some crops, but less effective control in others.
References	629, 944, 1015, 1986

CONVOLVULACEAE *(continued)*

WEED	
Family	Convolvulaceae
Species	*Cuscuta europaea* L.
Origin	Europe
Common Name	dodder

AGENT	
Species	*Melanagromyza cuscutae* Héring
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION	
Country	Kazakhstan
Year	pre 1979
Established	Yes
General Impact	Unknown
Notes	Natural populations augmented by spring releases of adults emerging from plant material kept indoors during winter. Overall impact unknown.
References	629, 1716

CONVOLVULACEAE *(continued)*

WEED	
Family	Convolvulaceae
Species	*Cuscuta lehmanniana* Bunge
Origin	Eurasia
Common Name	dodder

AGENT	
Species	*Melanagromyza cuscutae* Héring
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION	
Country	Kazakhstan
Year	pre 1979
Established	Yes
General Impact	Unknown
Notes	Natural populations augmented by spring releases of adults emerging from plant material kept indoors during winter. Overall impact unknown.
References	629, 1716

TABLE 2

CONVOLVULACEAE *(continued)*

WEED	
Family	Convolvulaceae
Species	*Cuscuta lupuliformis* Krock.
Origin	Eurasia
Common Name	dodder

AGENT	
Species	*Melanagromyza cuscutae* Héring
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION	
Country	Kazakhstan
Year	pre 1979
Established	Yes
General Impact	Unknown
Notes	Natural populations augmented by spring releases of adults emerging from plant material kept indoors during winter. Overall impact unknown.
References	629, 1716

CYPERACEAE

WEED	
Family	Cyperaceae
Species	*Cyperus esculentus* L.
Origin	cosmopolitan
Common Name	yellow nutsedge

AGENT	
Species	*Bactra verutana* Zeller
Classification	(Lepidoptera: Tortricidae)

REDISTRIBUTION	
Country	United States of America
Year	1967
Established	Yes
General Impact	Slight
Notes	Although severe insect infestations markedly reduced plant growth, majority of plants survived to produce numerous tubers. Natural populations limited by parasitism.
Limiting Factors	Parasitism
Research Organization	State (9)
References	595, 972

CYPERACEAE *(continued)*

WEED

Family	Cyperaceae
Species	*Cyperus rotundus* L.
Origin	cosmopolitan
Common Name	nut grass, purple nutsedge, vucesa, soronakabani, oni ani, pakopako

AGENT

Species	*Antonina australis* Froggatt
Past Names/Synonyms	*Chaetococcus australis* (Froggatt), *Kuwanina hilli* Laing, *Kuwanina australis* (Green) Brimblecombe
Classification	(Hemiptera: Pseudococcidae)
References	597, 779

REDISTRIBUTION

Country	Australia
Year	1901
Established	Yes
General Impact	Slight
Notes	May cause severe damage locally under dry conditions but overall impact is minimal.
References	597, 779, 902, 1748, 1989

CYPERACEAE
Cyperus rotundus *(continued)*

AGENT

Species	*Bactra venosana* (Zeller)
Past Names/Synonyms	*Bactra truculenta* Meyrick
Classification	(Lepidoptera: Tortricidae)

REDISTRIBUTION

Country	Thailand
Year	pre 1997
Established	Yes
General Impact	Unknown
Notes	Augmentative releases hampered by attack of egg parasite, *Trichogrammatoidea bactrae fumata* Nagaraja.
Limiting Factors	Parasitism
Research Organization	NBCRC
References	1329

AGENT

Species	*Bactra verutana* Zeller
Classification	(Lepidoptera: Tortricidae)

REDISTRIBUTION

Country	United States of America
Year	1972
Established	Yes
General Impact	Heavy
Notes	Augmentative releases in early season reduced above-ground growth of weed by up to 68% and resulted in seed cotton yields similar to those of uninfested plots. In their natural cycle, these insects do not cause appreciable damage to their host plants.
Research Organization	USDA (5)
References	595

TABLE 2

TABLE 2

EBENACEAE

WEED	
Family	Ebenaceae
Species	*Diospyros virginiana* L.
Origin	North America
Common Name	persimmon, eastern persimmon
AGENT	
Species	*Nalanthamala diospyri* (Crand.) Schroers & M.J. Wingf.
Past Names/Synonyms	*Acremonium diospyri* (Crand.) W. Gams, *Cephalosporium diospyri* Crandall
Classification	(Sordariomycetes: Hypocreales)
REDISTRIBUTION	
Country	United States of America
Year	1949
Established	Yes
General Impact	Heavy
Notes	Oklahoma State Legislature approved spread of this agent for control of persimmon in 1965. Very effective when cut stumps are inoculated with a spore suspension of this pathogen. Using this method, only unwanted trees are killed. In practical use throughout eighties but other forms of control now recommended for this weed.
Research Organization	State (2), SRNF
References	251, 1109, 1786, 1986

FABACEAE

WEED	
Family	Fabaceae
Species	*Mimosa pigra* L.
Past Names/Synonyms	*Mimosa pigra* L. var. *pigra*
Origin	tropical Americas
Common Name	giant sensitive plant, mimosa, giant mimosa
AGENT	
Species	*Rhytiphora piperitia* Hope
Incorrect Past Names/Synonyms	*Sympheletes humeralis* White, *Platyomopsis humeralis* White
Classification	(Coleoptera: Cerambycidae)
Notes	Identified and pusblished as *Sympheletes humeralis* White (whose name was later changed to *Platyomopsis humeralis* White) though it had already been described under the name *Rhytiphora piperitia* Hope.
References	293

FABACEAE
Mimosa pigra; Rhytiphora piperitia *(continued)*

REDISTRIBUTION

Country	Australia
Year	1997
Established	Yes
General Impact	Variable
Notes	Stem girdling reduces growth and seed production but does not kill mature plants. High populations cause conspicuous damage, though populations typically fluctuate and redistributions often necessary. Parasitism limits efficacy.
Other Species Attacked	Also feeds on *Acacia* spp., *Cassia* spp., the native *Peltophorum pterocarpum* (DC.) Backer ex K. Heyne, and *Samanea saman* (Jacq.) Merr. (an exotic species useful in grazing systems).
Research Organization	CSIRO, NT
References	531, 571, 765, 776

HALORAGACEAE

WEED

Family	Haloragaceae
Species	*Myriophyllum spicatum* L.
Origin	Europe, northern Africa, Asia
Common Name	Eurasian watermilfoil

AGENT

Species	*Euhrychiopsis lecontei* (Dietz)
Classification	(Coleoptera: Curculionidae)

REDISTRIBUTION

Country	United States of America
Year	pre 1994
Established	Yes
General Impact	Variable
Notes	Now commercially available as Milfoil Solution®, formerly known as The Middfoil® process, which entails placing egg- and larvae-infested plant material into new locations. Releases into lakes and ponds often intended to only supplement existing populations as this species is naturally already widespread in North America. Associated with weed declines in some lakes in CT, MA, MI, MN, NY, OH, VT and WI, but not in others. High weevil densities can suppress weed populations, however most infestations can potentially recover when weevils move to shorelines for overwintering. Impact could be due to combination of this species and *Acentria ephemerella*, as damage caused by the two often difficult to differentiate.

(continued on next page)

TABLE 2

TABLE 2

HALORAGACEAE
Myriophyllum spicatum; Euhrychiopsis lecontei *(continued)*

Country	United States of America (continued)
Notes (continued)	Fish predation and lack of suitable over-wintering habitat likely factors limiting weevil populations. Augmentation with larvae and/or eggs ineffective for increasing adult weevil counts or decreasing weed density. Augmentation with adults increases weevil densities the year following release. Establishment in OR suspected but not confirmed.
Limiting Factors	Predation; Habitat
Other Species Attacked	Native host is *Myriophyllum sibiricum* Kom. Feeds on other native *Myriophyllum* spp. when densities are high, but due to lowered fecundity, weevil impact is considered to be significantly less on all native *Myriophyllum* spp. than on Eurasian watermilfoil.
Research Organization	State (29,30,31,32,33)
References	198, 334, 335, 356, 357, 358, 359, 923, 1233, 1653, 1654

HALORAGACEAE
Myriophyllum spicatum *(continued)*

AGENT	
Species	*Phytobius leucogaster* (Marsham)
Past Names/Synonyms	*Litodactylus leucogaster* (Marsham)
Classification	(Coleoptera: Curculionidae)

REDISTRIBUTION	
Country	United States of America
Year	1979
Established	No
General Impact	Not established
Notes	Recovered 1.5km away after three months but not recovered since 1979.
Research Organization	USDA (3)
References	194, 923

HALORAGACEAE
Myriophyllum spicatum *(continued)*

AGENT

Species	*Triaenodes tarda* Milne
Classification	(Trichoptera: Leptoceridae)

REDISTRIBUTION

Country	Canada
Year	1980
Established	Yes
General Impact	Variable
Notes	Extremely abundant population virtually eliminated weed from one lake in 1979 where fish apparently not present. In other locations impact from larval herbivory minimal. Intentional transfer of approximately 3,500 larvae to new lake unsuccessful, possibly due to cold weather and fish predation.
Limiting Factors	Predation; Climate
Other Species Attacked	Also feeds on native plant species but preferred *Myriophyllum* spp. in laboratory tests.
Research Organization	BCME
References	964, 1573

MALVACEAE

WEED

Family	Malvaceae
Species	*Abutilon theophrasti* Medik.
Origin	Asia
Common Name	velvetleaf

AGENT

Species	*Niesthrea louisianica* Sailer
Classification	(Heteroptera: Rhopalidae)

REDISTRIBUTION

Country	United States of America
Year	1985
Established	Yes
General Impact	Variable
Notes	At some locations, in combination with pathogenic fungi significantly decreased seed viability and seedling emergence compared to either the insect or fungi alone. At other sites where large augmentative releases of insects made, seed viability significantly reduced in area of establishment. As cold weather slows insect population growth, re-introductions most practical.
Limiting Factors	Climate
Research Organization	USDA (11)
References	1027, 1028, 1718

TABLE 2

ONAGRACEAE

WEED	
Family	Onagraceae
Species	*Ludwigia adscendens* (L.) H. Hara
Past Names/Synonyms	*Jussiaea repens* L.
Origin	Indo-Australia
Common Name	water primrose
AGENT	
Species	*Altica foveicollis* (Jacoby)
Incorrect Past Names/Synonyms	*Altica foeveicollis* Jacoby
Classification	(Coleoptera: Chrysomelidae)
REDISTRIBUTION	
Country	Thailand
Year	pre 1989
Established	Yes
General Impact	Heavy
Notes	Augmentative releases resulted in seasonal but satisfactory control.
Research Organization	NBCRC
References	1326, 1328, 1329

OROBANCHACEAE

WEED	
Family	Orobanchaceae
Species	*Orobanche cernua* Loefl. var. *cumana* (Wallr.) Beck
Past Names/Synonyms	*Orobanche cumana* Wallr.
Notes	In Russia and the Ukraine, the literature reports of releases made on both *Orobanche cernua* Loefl. and *O. cumana* Wallr. *Orobanche cumana* has since been synonomized with *O. cernua* Loefl. var. *cumana* (Wallr.) Beck. Consequently, releases in both Russia and the Ukraine are reported for *C. cernua* Loefl. var. *cumana* only.
Origin	Eurasia
Common Name	broomrape, sunflower broomrape
References	2041
AGENT	
Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)
REDISTRIBUTION	
Country	Former Yugoslavia
Year	1960s
Established	Yes
General Impact	Medium
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Can achieve considerable control by destroying up to 96% of seeds. Populations limited by parasitism and low temperatures.
Limiting Factors	Parasitism; Climate
Research Organization	PPIB
References	1085, 1098, 1716

OROBANCHACEAE
Orobanche cernua; Phytomyza orobanchia (continued)

REDISTRIBUTION	
Country	Romania
Year	1970s
Established	Yes
General Impact	Medium
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Larvae can destroy up to 65% of seeds in some years. Mechanical separation of larvae from their parasites increased effectiveness.
Limiting Factors	Parasitism
References	1003

REDISTRIBUTION	
Country	Russia
Year	1960s
Established	Yes
General Impact	Heavy
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Pupae collected and stored during winter and released before the emergence of new shoots in spring. Efforts made to exclude parasites. Provides substantial control of infestations over a large area.
Limiting Factors	Parasitism
References	994, 1015, 1098

OROBANCHACEAE
Orobanche cernua; Phytomyza orobanchia (continued)

REDISTRIBUTION	
Country	Ukraine
Year	1960s
Established	Yes
General Impact	Heavy
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Destroying up to 94% of peduncles, allowing significant yield increases for many crop species.
Limiting Factors	Parasitism
References	629, 994, 1716

TABLE 2

OROBANCHACEAE *(continued)*

WEED

Family	Orobanchaceae
Species	*Orobanche crenata* Forsk.
Origin	Eurasia
Common Name	broomrape, bean broomrape

AGENT

Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION

Country	Egypt
Year	1999
Established	Yes
General Impact	Medium
Notes	Led to capsule infestation rate of 70% by *Phytomyza* compared to 27% natural infestation rate in fields without releases. Larvae consumed all seeds within infested capsules. Though this led to decreased input into soil seed bank, insufficient to control weed population completely.
Research Organization	WRCL
References	24, 754, 1941

OROBANCHACEAE
Orobanche crenata; Phytomyza orobanchia (continued)

REDISTRIBUTION

Country	Morocco
Year	1996
Established	Yes
General Impact	Variable
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Infested stems collected and stored during winter and released before the emergence of new shoots in spring. Can reduce viable seed production by 95% which controls the weed in low to moderate infested fields, but is still sufficient to contribute to seed bank (and is thus ineffective) in highly infested fields.
Research Organization	UHG
References	33, 994, 1941

OROBANCHACEAE *(continued)*

WEED	
Family	Orobanchaceae
Species	*Orobanche* spp.
Origin	Eurasia
Common Name	broomrape

AGENT	
Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION	
Country	Turkmenistan
Year	1960s
Established	Yes
General Impact	Heavy
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche* spp.; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Can achieve considerable control by destroying up to 100% of seeds.
References	994

OROBANCHACEAE *(continued)*

WEED	
Family	Orobanchaceae
Species	*Phelipanche aegyptiaca* (Pers.) Pomel
Past Names/Synonyms	*Orobanche aegyptiaca* Pers.
Origin	Eurasia
Common Name	broomrape

AGENT	
Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION	
Country	Uzbekistan
Year	1970s
Established	Yes
General Impact	Heavy
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Can achieve considerable control by destroying up to 89% of seeds.
References	994

TABLE 2

OROBANCHACEAE *(continued)*

WEED	
Family	Orobanchaceae
Species	*Phelipanche ramosa* (L.) Pomel
Past Names/Synonyms	*Orobanche ramosa* L.
Origin	Eurasia
Common Name	broomrape, branched broomrape
References	922, 1463
AGENT	
Species	*Phytomyza orobanchia* Kaltenbach
Classification	(Diptera: Agromyzidae)

REDISTRIBUTION	
Country	Egypt
Year	2001
Established	Yes
General Impact	Medium
Notes	Led to capsule infestation rate of 61% by *Phytomyza* compared to 33% natural infestation rate in fields without releases. Larvae consumed all seeds within infested capsules. Though this led to decreased input into soil seed bank, insufficient to control weed population completely.
Research Organization	WRCL
References	24, 754, 1941

OROBANCHACEAE
Phelipanche ramosa; Phytomyza orobanchia (continued)

REDISTRIBUTION	
Country	Former Yugoslavia
Year	1960s
Established	Yes
General Impact	Heavy
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Can achieve considerable control by destroying up to 96% of seeds. Populations limited by parasitism and low temperatures.
Limiting Factors	Parasitism; Climate
Research Organization	PPIB
References	994, 1085, 1716

REDISTRIBUTION	
Country	Romania
Year	1970s
Established	Yes
General Impact	Slight
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Larvae can destroy up to 20% of seeds in some years. Mechanical separation of larvae from their parasites increased effectiveness.
Limiting Factors	Parasitism
References	1003

OROBANCHACEAE
Phelipanche ramosa; Phytomyza orobanchia *(continued)*

REDISTRIBUTION

Country	Russia
Year	1960s
Established	Yes
General Impact	Medium
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Achieving up to 80% control, allowing a significant increase in crop production. Widely applied.
Limiting Factors	Parasitism
Research Organization	AUPPI
References	629, 994, 1015, 1098

REDISTRIBUTION

Country	Ukraine
Year	1950s
Established	Yes
General Impact	Heavy
Notes	Natural populations typically insufficient to avoid economic damage by *Orobanche*; consequently, inundative releases made to temporarily increase *Phytomyza* populations. Destroying up to 94% of peduncles, allowing significant yield increases for many crop species.
Limiting Factors	Parasitism
References	629, 994, 1716

POACEAE

WEED

Family	Poaceae
Species	*Spartina alterniflora* Loisel.
Origin	Atlantic and Gulf Coasts of North America, Caribbean, South America
Common Name	spartina, smooth cordgrass

AGENT

Species	*Prokelisia marginata* (Van Duzee)
Classification	(Hemiptera: Delphacidae)

REDISTRIBUTION

Country	United States of America
Year	2000
Established	Yes
General Impact	Variable
Notes	Redistributed from *Spartina alterniflora* in CA to WA. Additional populations from GA, RI, and VA USA released along with the CA population in order to ascertain best climatic fit for WA. Following release in WA, populations grew explosively during first summer and caused visible damage to plants by fall, including up to 50% reduced biomass and up to 90% reduction in seed viability. High overwintering mortality led to annual reductions of populations followed by steady annual increases at some populations, but extinctions at others. By 2007, aggressive treatment program resulted in herbicide application at all spartina-infested regions of WA.

(continued on next page)

TABLE 2

TABLE 2

POACEAE
Spartina alterniflora; Prokelisia marginata *(continued)*

Country	United States of America (continued)
Notes (continued)	Whether *Prokelisia marginata* is capable of persisting and suppressing sparse surviving shoots is unknown. Of the four populations experimentally released in 2004, RI and CA populations appeared most effective under WA conditions.
Limiting Factors	Other control methods; Climate
Research Organization	State (22,48)
References	609, 672, 674, 675, 676, 677, 1953

WEED

Family	Poaceae
Species	*Spartina anglica* C. E. Hubb.
Notes	*Spartina anglica* arose in England as a result of chromosome doubling by *Spartina ×townsendii* H. & J. Groves, the sterile hybrid between the native European *Spartina maritima* (Curtis) Fernald and the introduced North American *Spartina alterniflora* Loisel.
Origin	England
Common Name	spartina, English cordgrass

AGENT

Species	*Prokelisia marginata* (Van Duzee)
Classification	(Hemiptera: Delphacidae)

REDISTRIBUTION

Country	United States of America
Year	2003
Established	Yes
General Impact	Variable

(continued at top of next column)

POACEAE
Spartina anglica; Prokelisia marginata *(continued)*

Country	United States of America (continued)
Notes	Redistributed from *Spartina alterniflora* to *S. anglica*. Following release, populations typically grew explosively during their first summer and caused visible damage to the plants by fall, including up to 50% reduced biomass and up to 90% reduction in seed viability. High overwintering mortality led to annual reductions of populations followed by steady annual increases at some populations, but extinctions at others. By 2007, aggressive treatment program resulted in herbicide application at all spartina-infested regions of WA. Whether *Prokelisia marginata* is capable of persisting and suppressing sparse surviving shoots is unknown.
Limiting Factors	Other control methods; Climate
Research Organization	State (22,48)
References	672, 677

POLYGONACEAE

WEED

Family	Polygonaceae
Species	*Rumex obtusifolius* L.
Origin	Eurasia
Common Name	broadleaf dock

AGENT

Species	*Gastrophysa atrocyanea* Motschulsky
Classification	(Coleoptera: Chrysomelidae)

REDISTRIBUTION

Country	Japan
Year	1976
Established	Yes
General Impact	Heavy
Notes	Quickly established, multiplied and spread. Populations of the beetle reached satisfactory levels within 4 years of release.
Research Organization	MAF, PIJ
References	691, 1250, 1319, 1320

REDISTRIBUTION

Country	South Korea
Year	2007
Established	Yes
General Impact	Heavy
Notes	Established rapidly in field of release. Reduced final fresh weight and flower stalk formation by 80%; significantly decreased seed production.
References	1429, 1430

POLYGONACEAE
Rumex obtusifolius *(continued)*

AGENT

Species	*Ostrinia palustralis memnialis* (Walker)
Classification	(Lepidoptera: Crambidae)

REDISTRIBUTION

Country	South Korea
Year	2007
Established	Yes
General Impact	Heavy
Notes	Stem and root damage by larvae resulted in death of over 98% of stems at release location within 30 days of release.
References	1429, 1430

TABLE 2

TABLE 2

PONTEDERIACEAE

WEED

Family	Pontederiaceae
Species	*Eichhornia crassipes* (Mart.) Solms
Origin	South America
Common Name	water hyacinth, waterhyacinth, Majavani, keladi bunting, phak top chawaa, sawah, ècèng, etjeng padi, luc bình, beda bin, ye padauk

AGENT

Species	*Acremonium zonatum* (Sawada) W. Gams
Classification	(Sordariomycetes: Hypocreales)

REDISTRIBUTION

Country	Mexico
Year	pre 2006
Established	Yes
General Impact	Heavy
Notes	Strain Mx-WH-26. In combination with *Cercospora piaropi* and *Neochetina* spp. provided excellent control in a reservoir.
Research Organization	IMTA
References	1163

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Bellura densa* (Walker)
Past Names/Synonyms	*Arzama densa* Walker
Classification	(Lepidoptera: Noctuidae)

REDISTRIBUTION

Country	United States of America
Year	1974
Established	Yes
General Impact	Variable
Notes	High populations, such as following augmentative releases, significantly reduced weed cover and biomass in some ponds, but had little impact on density or cover in others. Natural populations greatly hindered by parasitism, predation and disease. Agent feeds on native and economically important species, precluding its use elsewhere as biocontrol agent.
Limiting Factors	Parasitism; Predation; Disease
Other Species Attacked	Feeds on taro (*Colocasia esculenta* (L.) Schott), the native *Pontederia cordata* L., and other species in the Araceae and Pontederiaceae.
Research Organization	USAE, USDA (5), State (23)
References	241, 242, 304, 701, 1919, 1920

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Cercospora piaropi* Tharp
Past Names/Synonyms	*Cercospora rodmanii* Conway
Classification	(Dothideomycetes: Capnodiales)
Notes	Historically two species of *Cercospora* were recognized in discussions regarding fungal biological control of *Eichhornia crassipes* (Mart.) Solms: *C. piaropi* Tharp and *C. rodmanii* Conway. Recent studies suggest the pathogens may be the same, and *C. rodmanii* should be recognized as a later synonym for the currently accepted *C. piaropi*. Though disagreements and difficulties remain in this taxonomic group, the editors of this catalogue support the idea that the *Cercospora* pathogens utilized for biological control of *E. crassipes* are the same. *Cercospora piaropi* is among the most widespread and commonly found pathogens of *E. crassipes* worldwide. Consequently, only those countries where this species has been utilized/distributed intentionally are listed in this catalogue.
References	987, 1284, 1789

PONTEDERIACEAE
Eichhornia crassipes; Cercospora piaropi *(continued)*

REDISTRIBUTION

Country	Mexico
Year	pre 2006
Established	Yes
General Impact	Heavy
Notes	Strain Mx-WH-15.1. In combination with *Acremonium zonatum* and *Neochetina* spp. provided excellent control in a reservoir.
Research Organization	IMTA
References	1163

REDISTRIBUTION

Country	United States of America
Year	1973
Established	Yes
General Impact	Variable
Notes	Capable of decreasing waterhyacinth biomass, and in some instances under right conditions has caused substantial decline of weed populations. Long-term success of this species with only a single application unlikely when the host growth is rapid. Combined feeding by the *Neochetina* weevils and infection with this fungus has additive effects. Patent obtained 1978, EPA Experimental Use Permit obtained 1979. Successful large-scale aerial application of Abbott formulation 1980. Not formally registered as a bioherbicide.
Research Organization	State (35)
References	242, 298, 329, 591, 1789

TABLE 2

TABLE 2

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Neochetina bruchi* Hustache
Classification	(Coleoptera: Erirhinidae)

REDISTRIBUTION

Country	Argentina
Year	1974
Established	Yes
General Impact	Heavy
Notes	After six years water surface cover of weed reduced from 50% to at most 8%.
Research Organization	USDA (13)
References	463

REDISTRIBUTION

Country	Bolivia
Year	pre 1995
Established	Yes
General Impact	Unknown
Notes	Weevils introduced from warmer regions (Santa Cruz de la Sierra) where weed not problematic, to temperate regions (Tarija) where weed is serious problem in summer. Impact unknown.
Research Organization	FAO
References	1044

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Neochetina eichhorniae* Warner
Classification	(Coleoptera: Erirhinidae)

REDISTRIBUTION

Country	Bolivia
Year	pre 1995
Established	Yes
General Impact	Unknown
Notes	Weevils introduced from warmer regions (Santa Cruz de la Sierra) where weed not problematic, to temperate regions (Tarija) where weed is serious problem in summer. Impact unknown.
Research Organization	FAO
References	1044

ROSACEAE

WEED

Family	Rosaceae
Species	*Rosa multiflora* Thunb.
Origin	Asia
Common Name	multiflora rose

AGENT

Species	*Phyllocoptes fructiphilus* Keifer
Classification	(Acari: Eriophyidae)

REDISTRIBUTION

Country	United States of America
Year	post 1968
Established	Yes
General Impact	Variable
Notes	The mite transmits a virus that causes rose rosette disease (RRD), though the disease is spread by grafting as well. Both the mite and disease have spread widely on their own and by artificial means. The disease takes ~ 2-6 years to kill *Rosa multiflora*. Large infected plants can still successfully produce seed, perpetuating the weed population. Mites can only effectively transmit the disease when feeding on rapidly growing plants, which only occurs in the spring or after abundant rainfall. Dispersing mites do not infect many plants that are greater than ~100 m from heavily infested plants, so geographic spread of RRD is relatively slow except within densely populated patches.

(continued at top of next column)

ROSACEAE
Rosa multiflora; Phyllocoptes fructiphilus *(continued)*

Country	United States of America (continued)
Notes (continued)	Public concern over risk of damage to commercial, ornamental, and native roses has prevented efforts to further distribute the disease or mite, though both are continuing to spread on their own.
Limiting Factors	Plant stage
Other Species Attacked	Also infects native, ornamental, and commercial roses.
Research Organization	State (47,44,46,41)
References	31, 518, 547, 1448, 1698, 1806, 1897, 1995

TABLE 2

SOLANACEAE

WEED	
Family	Solanaceae
Species	*Solanum elaeagnifolium* Cav.
Origin	North America, South America
Common Name	silverleaf nightshade, satansbos

AGENT	
Species	*Ditylenchus phyllobius* (Thorne)
Past Names/Synonyms	*Nothanguina phyllobia* Thorne, *Orrina phyllobia* (Thorne)
Classification	(Tylenchida: Anguinidae)
References	544, 581

REDISTRIBUTION	
Country	United States of America
Year	1974
Established	Yes
General Impact	Heavy
Notes	Inoculation led to rapid spread of nematodes which resulted in reduced plant biomass and density. Nematode activity depends on moist conditions. This weed species and its agent are native to the USA.
Limiting Factors	Habitat; Land use (moist conditions needed)
Research Organization	USDA (6)
References	544, 1363, 1405, 1577

VERBENACEAE

WEED	
Family	Verbenaceae
Species	*Lantana camara* L. sens. lat.
Past Names/Synonyms	*Lantana camara* subsp. *aculeata* Moldenke, *Lantana camara* var. *aculeata* (L.) Moldenke, *Lantana aculeata* L., *Lantana camara aculeata*
Notes	Comprises a complex of horticultural/weedy hybrids and closely related species within the section Camara.
Origin	Original parent species likely native to tropical Americas
Common Name	lantana, kauboica, tataramoa, bands, guphul, nagaairi, phullaki, putus, tantbi, vieille fille, chiponiwe (Shona), tick berry, bahug-bahug, sapinit, pha-ka-krong, talamoa, prickly lantana

AGENT	
Species	*Aceria lantanae* (Cook)
Past Names/Synonyms	*Eriophyes lantanae* Cook
Classification	(Acari: Eriophyidae)

VERBENACEAE
Lantana camara; Aceria lantanae *(continued)*

REDISTRIBUTION	
Country	United States of America
Year	pre 1976
Established	Yes
General Impact	Unknown
Notes	Intentionally utilized in the 1970s, though native to FL so populations already widespread in south. Heavy infestations observed after an exceptionally wet season in 1998, resulted in large stands of lantana being devoid of mature flowers. Results of intentional redistributions in 1970s unknown.
Research Organization	FDA
References	66, 474, 973, 1698

TABLE 3. PREVIOUSLY USED OR POTENTIAL AGENTS FOUND IN EXOTIC RANGES WHERE THEIR DELIBERATE RELEASE IS NOT RECORDED

Identification/Release Information

Entries are listed alphabetically according to the country where the agent was recorded as established, accompanied by the year the agent was first recorded, when known. In some instances, organisms initially introduced accidentally or illegally into a country were subsequently approved for redistribution within that country by the appropriate authorities. In these instances, the first year of intentional redistribution is also given. The original source of each species is typically not known and is listed as such. However, in some cases, the pathway of accidental introduction is known for certain. For these cases, the source of the accidental/adventive population is given, preceded by "Ex." When the population did not originate directly from the agent's native range, the countries or regions from where it originated are given, preceded by "via". For example, a species that originated in Argentina and was intentionally introduced into India prior to the agent naturally crossing the border from India into Nepal would be stated as: Nepal Ex. Argentina via India.

Current Status

Establishment of each species is given when known, but is typically "Yes" for all entries on this list. The current abundance and impact of established agents are then stated using key choices pre-determined for the ease of quick data summary. Agent abundance is represented by seven categories: Rare, Limited, Moderate, High, Variable, Too early post release, and Unknown. Agent impact is represented by eight categories: None, Slight, Medium, Heavy, Variable, Too early post release, and Unknown. In order to place the agent impact into a geographical context, the scale of impact is also provided. The four categories for scale of impact include: Localized, Regional, Widespread throughout range, and Unknown. Because the choices selected for abundance, impact, and scale of impact are subjective estimates by the editors, an additional notes section is provided which includes a brief summary of the status for each release system. Abbreviations used in the notes section to denote sub-regions of a country are provided along with their corresponding regions at the front of this catalogue immediately following the Table of Contents. If the biocontrol agent has been observed in the field attacking plant species other than those targeted for control, this information is included. Likewise, factors believed to limit the efficacy of any particular release are listed when known.

ANACARDIACEAE

WEED

Family	Anacardiaceae
Species	*Schinus terebinthifolius* Raddi
Origin	South America
Common Name	christmas berry, Brazilian pepper tree, Brazilian holly, wilelaiki, Florida holly

AGENT

Species	*Megastigmus transvaalensis* (Hussey)
Classification	(Hymenoptera: Torymidae)

INTRODUCTION

Country Found	Hawaii USA
Year First Recorded	1971
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Overall damage to seeds moderate; fluctuates between 10% and 80%, depending on time of year.
References	93, 793, 796, 1617, 1964

INTRODUCTION

Country Found	United States of America
Year First Recorded	1961
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	pre 2011
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Redistributed within FL. Wasp damage prevents seed germination. In FL, damage to drupes ranges from 22-76%; attack varies by season and location.
Other Species Attacked	Also found attacking the exotic *Schinus molle* L. in CA.
Research Organization	State (3), USDA (4)
References	372, 374, 702, 1617, 1964

APIACEAE

WEED	
Family	Apiaceae
Species	*Conium maculatum* L.
Origin	Eurasia
Common Name	poison hemlock, hemlock

AGENT	
Species	*Agonopterix alstroemeriana* (Clerck)
Classification	(Lepidoptera: Oecophoridae)

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	1986
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1993
Established	Yes
Abundance	High
General Impact	Variable
Notes	Redistributed throughout both North and South Islands. Feeding on flowers reduces seed production. Widespread and commonly causing complete defoliation in some areas, though impact only limited at other sites.
Research Organization	MWLR
References	720, 761, 818, 1064

APIACEAE
Conium maculatum; Agonopterix alstroemeriana (continued)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1973
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	post 1984
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Commercially available for purchase so redistributions have occurred in numerous states in numerous years. In Pacific Northwest can reduce seed production and cause severe defoliation. Changes in stand density not documented.
Research Organization	State (4,9,14,15)
References	107, 229, 332, 334, 896, 1105, 1502, 1524

TABLE 3

APOCYNACEAE

WEED	
Family	Apocynaceae
Species	*Cryptostegia grandiflora* R. Br.
Origin	Madagascar
Common Name	rubber vine
AGENT	
Species	*Maravalia cryptostegiae* (Cummins) Ono
Classification	(Pucciniomycetes: Pucciniales)
INTRODUCTION	
Country Found	Papua New Guinea
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Found infecting ornamental *Cryptostegia grandiflora* growing in Port Moresby.
References	1403

ARACEAE

WEED	
Family	Araceae
Species	*Pistia stratiotes* L.
Origin	tropical Americas, Asia, Malesia, Australia (NT)
Common Name	water lettuce, Nile cabbage, chok, jawg
AGENT	
Species	*Neohydronomus affinis* Hustache
Classification	(Coleoptera: Curculionidae)
INTRODUCTION	
Country Found	Cote d'Ivoire
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Deliberately released in 1998, though found to already be present in some regions likely as a result of natural spread from Ghana. Populations subsequently not differentiated. Less than two years post release, *Neohydronomus affinis* had controlled the weed at the six major infestations that were inspected.
Research Organization	IITA
References	939, 1347

ARACEAE
Pistia stratiotes; Neohydronomus affinis *(continued)*

INTRODUCTION	
Country Found	Zambia
Year First Recorded	1991
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Intentionally released in 1991, at which time weevil found to be already present. Both populations subsequently not differentiated in the literature. Providing excellent control in the region of release.
References	1314, 1587

ASPARAGACEAE

WEED	
Family	Asparagaceae
Species	*Asparagus asparagoides* (L.) Druce
Origin	southern Africa
Common Name	bridal creeper, smilax

AGENT	
Species	*Puccinia myrsiphylli* (Thüm.) Wint.
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	After accidental introduction, spread naturally throughout majority of weed's range. Damage typically severe, causing up to 100% premature defoliation.
Research Organization	MWLR
References	721, 722, 761, 1927

TABLE 3

TABLE 3

ASTERACEAE

WEED	
Family	Asteraceae
Species	*Ageratina adenophora* (Spreng.) R. M. King & H. Rob.
Past Names/Synonyms	*Eupatorium adenophorum* Spreng., *Eupatorium glandulosum* Michx.
Origin	Mexico
Common Name	crofton weed, Mexican devil weed, Maui pamakani, pamakani, banmara

AGENT	
Species	*Passalora ageratinae* Crous & A.R. Wood
Past Names/Synonyms	*Phaeoramularia* sp.
Incorrect Past Names/Synonyms	*Cercospora eupatorii* Peck, *Phaeoramularia eupatorii-odorati* (Yen) Liu & Guo
Classification	(Dothideomycetes: Capnodiales)
References	362, 987

INTRODUCTION	
Country Found	Australia
Year First Recorded	1954
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Ageratina adenophora; Passalora ageratinae *(continued)*

Country Found	Australia (continued)
Notes	First detected in 1954, though probably carried by *Procecidochares utilis* adult flies when they were introduced in 1952 from Mexico via Hawaii. Likely to have spread beyond NSW, though no specimens have officially been collected. Has led to successful control of *Ageratina adenophora*, which is now far less invasive and regarded as only a minor weed.
References	513, 1216, 1223, 1307, 1989

INTRODUCTION	
Country Found	Hawaii USA
Year First Recorded	1945
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Undocumented in Hawaii until 1956 on MA when Australians traced the origin of their fungus as likely arriving via Hawaiian collections of *Procecidochares utilis*. Abundance and impact on MA unknown.
References	325, 362, 513, 1307

ASTERACEAE
Ageratina adenophora; Passalora ageratinae *(continued)*

INTRODUCTION	
Country Found	India
Year First Recorded	1963
Source	Ex. Unknown via Hawaii USA via Australia via New Zealand
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1307

INTRODUCTION	
Country Found	Nepal
Year First Recorded	1984
Source	Ex. Unknown via Hawaii USA via Australia via New Zealand via India
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1307

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	1958
Source	Ex. Unknown via Hawaii USA via Australia
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued at top of next column)

ASTERACEAE
Ageratina adenophora; Passalora ageratinae *(continued)*

Country Found	New Zealand (continued)
Notes	Probably carried by *Procecidochares utilis* adult flies when they were introduced from Mexico via Hawaii via Australia in 1958, though not officially recorded as present until 1962. Established throughout range of weed. No formal impact evaluation occurred so unknown if subsequent decrease in weed due entirely to impact from fungus and fly, or changes in land management.
Research Organization	DSIR
References	761, 807, 1307

INTRODUCTION	
Country Found	People's Republic of China
Year First Recorded	1984
Source	Ex. Unknown via Hawaii USA via Australia via New Zealand via India via Nepal
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Causes reductions in the photosynthetic rate, transpiration rate and chlorophyll content, thus reducing plant height and number of leaves and flowers. However, overall impact to weed populations unknown.
References	1307, 2062

ASTERACEAE
Ageratina adenophora *(continued)*

AGENT	
Species	*Procecidochares utilis* Stone
Classification	(Diptera: Tephritidae)

INTRODUCTION	
Country Found	Nepal
Year First Recorded	1973
Source	Ex. Mexico via Hawaii USA via Australia via New Zealand via India
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Causes some reduction in vigor, growth, and density of the plant; however, heavy parasitism has reduced agent efficacy.
References	763, 965, 1307, 1935

ASTERACEAE
Ageratina adenophora; Procecidochares utilis *(continued)*

INTRODUCTION	
Country Found	People's Republic of China
Year First Recorded	1984
Source	Ex. Mexico via Hawaii USA via Australia via New Zealand via India via Nepal
Deliberately Redistributed	Y
Year Redistributed	1985
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Spread naturally via Nepal, but subsequently tested for host specificity, mass produced, and redistributed intentionally. Established readily and spread rapidly. Despite infestation rates up to 75%, overall impact minimal. Populations have since decreased due to native parasitoids.
Limiting Factors	Parasitism
Research Organization	KIEC
References	763, 920, 1307, 1935, 2062, 2063

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Ageratina riparia* (Regel) R. M. King & H. Rob.
Past Names/Synonyms	*Eupatorium riparium* Regel
Origin	Mexico
Common Name	mistflower, Hamakua pamakani, creeping crofton weed

AGENT

Species	*Entyloma ageratinae* Barreto & Evans
Incorrect Past Names/Synonyms	*Cercosporella ageratina*, *Cercosporella* sp.
Classification	(Exobasidiomycetes: Entylomatales)

INTRODUCTION

Country Found	Australia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	2011
Established	Yes
Abundance	High
General Impact	Variable
Notes	Prior to accidental introduction, had been candidate for introduction and study. Under optimal weather conditions conducive for epidemic development has been recorded to reduce mistflower density to less than 5% of former abundance, seeing a return of other plant species. Not as effective in pastures with high light availability.
Limiting Factors	Habitat; Climate
Research Organization	CSIRO
References	413, 1261, 1268, 1623, 1625

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Ambrosia artemisiifolia* L.
Origin	North America
Common Name	common ragweed, ragweed, annual ragweed

AGENT

Species	*Ophraella communa* LeSage
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION

Country Found	Japan
Year First Recorded	1996
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Prefers *Ambrosia artemisiifolia* which it can completely defoliate. Will attack/reproduce on *A. trifida* when *A. artemisiifolia* defoliated, and adults will feed slightly on *Xanthium strumarium* for survival in absence of preferred *Ambrosia* spp. Effects of complete defoliation to *A. artemisiifolia* populations unknown.
Other Species Attacked	Prefers *Ambrosia artemisiifolia* L. but will attack/reproduce on the exotic *A. trifida* L. and adults will feed slightly on the exotic *Xanthium strumarium* L. Introduced *Helianthus* spp. attacked rarely.
References	483, 1271, 1938, 2042, 2043

TABLE 3

TABLE 3

ASTERACEAE
Ambrosia artemisiifolia; Ophraella communa *(continued)*

INTRODUCTION	
Country Found	People’s Republic of China
Year First Recorded	2001
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	2007
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Significantly damages weed throughout agent’s range, especially moist/humid regions. In combination with *Epiblema strenuana*, control of weed population often complete.
Limiting Factors	Climate
Research Organization	CAAS-BCI
References	624, 696, 697, 2063, 2064, 2065

INTRODUCTION	
Country Found	South Korea
Year First Recorded	2000
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Currently everywhere in Korea; not intentionally redistributed as doing very well without human intervention.
References	697, 1316, 1708, 1709, 2043

ASTERACEAE
Ambrosia artemisiifolia *(continued)*

AGENT	
Species	*Ponometia candefacta* (Hübner)
Past Names/Synonyms	*Tarachidia candefacta* (Hübner)
Classification	(Lepidoptera: Noctuidae)

INTRODUCTION	
Country Found	Bulgaria
Year First Recorded	2011
Source	Ex. Canada, USA (CA) via Russia via Ukraine
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	AUPPI, AAFC, ZIAS, State (5)
References	628, 640, 1014, 1015, 1020, 1168, 1568, 1774

INTRODUCTION	
Country Found	Romania
Year First Recorded	2011
Source	Ex. Canada, USA (CA) via Russia via Ukraine
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	AUPPI, AAFC, ZIAS, State (5)
References	628, 640, 1014, 1015, 1020, 1168, 1568, 1774

ASTERACEAE
Ambrosia artemisiifolia; Ponometia candefacta (continued)

INTRODUCTION	
Country Found	Ukraine
Year First Recorded	1999
Source	Ex. Canada, USA (CA) via Russia
Deliberately Redistributed	N
Established	Yes
Abundance	Rare
General Impact	None
Research Organization	AUPPI, AAFC, ZIAS, State (5)
References	628, 640, 1014, 1015, 1020, 1168, 1520, 1568

AGENT	
Species	*Pustula tragopogonis* (Pers.) Thines
Past Names/Synonyms	*Albugo tragopogonis* (Pers.) Gray
Incorrect Past Names/Synonyms	*Pustula obtusata* (Link) Rost, *Albugo tragopogi* (Pers.) S. F. Gray
Classification	(Incertae sedis: Albuginales)
References	538, 987, 1714, 1792

INTRODUCTION	
Country Found	Russia
Year First Recorded	1965
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Early reports described 90% reduction in plant weight and 95-100% reduction in seed production following field applications. More recently damage levels of 12% to 17% have been reported when used as a bioherbicide.
References	624, 750, 1017, 1568, 1923

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Ambrosia trifida* L.
Origin	North America
Common Name	giant ragweed

AGENT	
Species	*Ophraella communa* LeSage
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Japan
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Prefers *Ambrosia artemisiifolia* but will attack/reproduce on *A. trifida* when *A. artemisiifolia* completely defoliated. Adults will feed only slightly on *Xanthium strumarium* for survival in absence of preferred *Ambrosia* spp.
Other Species Attacked	Prefers *Ambrosia artemisiifolia* L. but will attack/reproduce on the exotic *A. trifida* L. and adults will feed slightly on the exotic *Xanthium strumarium* L. Introduced *Helianthus* spp. attacked rarely.
References	483, 1271, 1938, 2043

TABLE 3

ASTERACEAE
Ambrosia trifida; Ophraella communa (continued)

INTRODUCTION	
Country Found	South Korea
Year First Recorded	2000
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Currently everywhere in Korea; not intentionally redistributed as doing very well without human intervention.
References	697, 1316, 1708, 1709, 2043

AGENT	
Species	*Puccinia xanthii* Schwein. f.sp. *ambrosiae-trifidae* S.W.T. Batra
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	People's Republic of China
Year First Recorded	2002
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Initially only occurred in restricted localities. A subsequent outbreak caused withering of foliage and significant reduction of weed populations due to premature death. At high concentrations, serious dieback occurs.
References	624, 1118

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Campuloclinium macrocephalum* (Less.) DC.
Origin	South America
Common Name	pompom weed

AGENT	
Species	*Puccinia eupatorii* Dietel
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	2008
Established	Yes
Abundance	High
General Impact	Too early post release
Notes	Under investigation as potential agent when discovered already established. Has since spread widely. A study initiated to measure field impact of the rust included deliberate augmentation to boost abundance and ensure equitable levels of infection at each of the study sites. Though now widely dispersed, still too early to determine overall impact.
Research Organization	ARC-PPRI
References	471, 992, 1198, 1200, 2006

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Carduus tenuiflorus* Curtis
Origin	western Europe, northern Africa
Common Name	winged thistle, slenderflower thistle
AGENT	
Species	*Puccinia carduorum* Jacky
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1951
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	This strain specific to *Carduus tenuiflorus* though its overall impact on this species unknown.
Research Organization	State (14)
References	183, 620, 621, 1506, 1943

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea cyanus* L.
Origin	Eurasia
Common Name	cornflower, bachelor's button
AGENT	
Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1979
Source	Ex. Russia via Canada
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Found infesting *Centaurea* spp., spread naturally to *C. cyanus*. Attacks more than 30% of capitula in WA. Reduced seed production at this rate not likely to impact overall population as higher attack rates by *Urophora* spp. on more preferred *Centaurea* hosts insufficient to reduce stand densities. Impact minimal in OR.
Research Organization	State (9,15)
References	332, 334, 335, 1502, 1509, 1735, 1736

TABLE 3

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea diffusa* Lam.
Origin	Eurasia
Common Name	diffuse knapweed

AGENT	
Species	*Puccinia jaceae* var. *diffusae* Savile
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Widespread in BC; dispersed 1400 km in 7 years. More abundant in moist conditions and only virulent on seedlings on which it decreases root and leaf biomass.
References	117, 2051

ASTERACEAE
Centaurea diffusa; Puccinia jaceae (continued)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1996
Source	Ex. Unknown via Canada
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Erratically infects from 1-62% of plants. Although most infected plants remain vigorous, some plants become severely infected and debilitated. Overall impact on population minor.
References	332, 929, 2018

ASTERACEAE
Centaurea diffusa *(continued)*

AGENT

Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

INTRODUCTION

Country Found	United States of America
Year First Recorded	1979
Source	Ex. Russia via Canada
Deliberately Redistributed	Y
Year Redistributed	post 1979
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Spread naturally from releases made in Canada. Officially approved for redistribution in the USA in 1989. Well established throughout most *Centaurea diffusa* and *C. stoebe* sens. lat.-infested areas of USA, particularly the Northwest. More widely distributed than *Urophora affinis* but less abundant. Together they contribute to seed reduction of more than 50% at some sites. Seed reduction may retard rate at which weed spreads, but has not appreciably lowered stand density because sufficient seeds remain. Not considered as important or effective as *Larinus* spp. on this weed, and frequently inferior competitor to *Larinus* spp. and *Metzneria*.
Limiting Factors	Interspecific competition
Research Organization	State (6,7,9,14,15), USDA (10)
References	39, 332, 335, 929, 1501, 1509, 1512, 1578, 1635, 1735, 2018

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Centaurea jacea* L. nothosubsp. *pratensis* (W.D.J. Koch) Čelak.
Past Names/Synonyms	*Centaurea ×moncktonii* C. E. Britton, *Centaurea jacea* x *nigra*
Incorrect Past Names/Synonyms	*Centaurea pratensis* auct. N. Amer.
Notes	Meadow knapweed represents an array of intermediates derived by hybridization and backcrossing among the various cytotypes of the *Centaurea jacea* complex.
Origin	Europe
Common Name	meadow knapweed, Protean knapweed, Bemis grass
References	974

AGENT

Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

INTRODUCTION

Country Found	United States of America
Year First Recorded	1979
Source	Ex. Russia via Canada
Deliberately Redistributed	Y
Year Redistributed	1983
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Localized

(continued on next page)

TABLE 3

ASTERACEAE
Centaurea jacea; Urophora quadrifasciata *(continued)*

Country Found	United States of America (continued)
Notes	Spread naturally from releases made in Canada. Officially approved for redistribution in the USA in 1989. Well established at one site in CA where impact on seed production only minor and less than *Larinus* spp. Infests up to 40% seed heads in OR where impact is insignificant. More effective and widespread in WA. Differentiation between brown and meadow knapweed often difficult in WA and other parts of Pacific Northwest. Additional attention required to confirm identities of past reported infestations.
Research Organization	State (9,15)
References	38, 39, 332, 334, 335, 1502, 1509, 1578, 2020, 2033

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea jacea* L. subsp. *jacea*
Past Names/Synonyms	*Centaurea jacea* L.
Origin	Europe
Common Name	brown knapweed
AGENT	
Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)
INTRODUCTION	
Country Found	United States of America
Year First Recorded	1979
Source	Ex. Russia via Canada
Deliberately Redistributed	Y
Year Redistributed	1983
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Spread naturally from releases made in Canada. Officially approved for redistribution in the USA in 1989. Widespread in OR where larvae feed on seeds but do not harm plant. Reduced seed production at this rate not likely to impact overall population as higher attack rates by *Urophora* spp. on more preferred *Centaurea* hosts insufficient to reduce stand densities. Abundance limited in WA. Differentiation between brown and meadow knapweed often difficult in WA and other parts of Pacific Northwest. Additional attention required to confirm identities of past reported infestations.
Research Organization	State (15)
References	38, 332, 335, 1509, 1736

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea solstitialis* L.
Origin	Eurasia, Mediterranean
Common Name	yellow starthistle
AGENT	
Species	*Chaetorellia succinea* (Costa)
Classification	(Diptera: Tephritidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1991
Source	Ex. Greece
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

ASTERACEAE
Centaurea solstitialis; Chaetorellia succinea (continued)

Country Found	United States of America (continued)
Notes	Unintended introduction via contaminated seed heads thought to contain *Chaetorellia australis*. Redistributed unknowingly along with *C. australis*. Often considered a more voracious seed predator than *Eustenopus villosus*. Larval feeding typically destroys up to 80% of seeds within attacked seed heads and decreases pollinator visitation. *E. villosus* oviposition deters *C. succinea* oviposition. In conjunction with *E. villosus*, can reduce seed production by >70% overall. Only at low initial plant densities can this impact the population growth; at many study sites plants compensate for decreased seedling density by growing larger and producing more seeds. Consumes higher proportion of seeds when plants uninfected with *Puccinia jacea* var. *solstitialis*.
Limiting Factors	Interspecific competition
Other Species Attacked	Found causing minimal damage to an uncommon variety of safflower in CA. Also attacks the exotic *Centaurea melitensis* L. and *C. sulfurea* Willd. Not approved for redistribution.
Research Organization	USDA (7), State (6,9,14,15)
References	76, 78, 79, 124, 616, 1369, 1514, 1515, 1765, 1767

TABLE 3

TABLE 3

ASTERACEAE
Centaurea solstitialis (continued)

AGENT	
Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1991
Source	Ex. Russia via Canada
Deliberately Redistributed	N
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	First identified on other *Centaurea* spp., spread naturally to *C. solstitialis*. May attack *C. solstitialis* elsewhere in its range, but only documented doing so in SW Oregon where it infests less than 1% of plants.
Research Organization	State (15)
References	332, 334, 335, 335, 1509

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea* spp.
Notes	Spans several species including *Centaurea jacea* L. subsp. *jacea*, *Centaurea jacea* L. subsp. *nigra* (L.) Bonnier & Layens, and *Centaurea jacea* L. nothosubsp. *pratensis* (W.D.J. Koch) Čelak.
Origin	Eurasia
Common Name	black knapweed, brown knapweed, meadow knapweed

AGENT	
Species	*Urophora jaceana* L.
Classification	(Diptera: Tephritidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1937
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1987
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

ASTERACEAE
Centaurea spp.; *Urophora jaceana* (continued)

Country Found	Canada (continued)
Notes	Adventively established in Maritimes on *Centaurea jacea* and *C. jacea* subsp. *nigra*, most likely from Europe. Intentionally redistributed to BC on what was believed to be *C. jacea* subsp. *jacea* but has since been identified as *C. jacea* nothosubsp. *pratensis*. Initially established in BC for one year following release but not seen subsequently. In NS, 75% seed heads attacked. Similar to other *Urophora* spp., galls stunt plant growth and decrease seed production. In other knapweed systems in Canada, high fly populations led to no apparent decline in plant density even though flies reduced knapweed seed production substantially. Parasitism helps regulate populations of this agent.
Limiting Factors	Parasitism
Research Organization	AAFC
References	117, 153, 205, 727, 739, 742, 1299, 1645

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Centaurea stoebe* L. sens. lat.
Past Names/Synonyms	*Centaurea stoebe* L. subsp. *micranthos* (Gulger) Hayek, *Centaurea maculosa* Lam.
Notes	The two cytotypes of *Centaurea stoebe* L. sens. lat. are recognized as different species: *C. stoebe* L. is the appropriate name for the diploid form present throughout Europe while the appropriate nomenclature for the tetraploid form invasive in North America remains to be resolved. The editors of this catalogue will refer to this species as *Centaurea stoebe* sens. lat. until the resolution is made.
Origin	Eurasia
Common Name	spotted knapweed
References	1296

AGENT

Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)

INTRODUCTION

Country Found	United States of America
Year First Recorded	1979
Source	Ex. Russia via Canada
Deliberately Redistributed	Y
Year Redistributed	post 1979
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

ASTERACEAE
Centaurea stoebe; Urophora quadrifasciata (continued)

Country Found	United States of America (continued)
Notes	Spread naturally from releases made in Canada. Officially approved for redistribution in the USA in 1989. Well established throughout most *Centaurea diffusa* and *C. stoebe* sens. lat.-infested areas of USA, particularly the Northwest. More widely distributed than *Urophora affinis* but less abundant. Together they contribute to seed reduction of more than 50% at some sites. Seed reduction may retard rate at which weed spreads, but has not appreciably lowered stand density because sufficient seeds remain. At other sites, direct effect of *Urophora* galls on seed production negligible. Not considered as important or effective as *Larinus* spp. on this weed, and frequently inferior competitor to *Larinus* spp. and *Metzneria*.
Limiting Factors	Interspecific competition
Research Organization	State (6,7,9,14,15), USDA (7,10,14)
References	39, 332, 335, 1005, 1501, 1509, 1512, 1578, 1635, 1728, 1732, 1735, 1736, 1992, 2001, 2025

TABLE 3

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Centaurea virgata* Lam. subsp. *squarrosa* (Boiss.) Gugler
Past Names/Synonyms	*Centaurea squarrosa* Willd.
Origin	Eurasia, Asia Minor
Common Name	squarrose knapweed
AGENT	
Species	*Urophora quadrifasciata* (Meigen)
Classification	(Diptera: Tephritidae)
INTRODUCTION	
Country Found	United States of America
Year First Recorded	1979
Source	Ex. Russia via Canada
Deliberately Redistributed	Y
Year Redistributed	1989
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Spread naturally from releases made in Canada. Officially approved for redistribution in the USA in 1989. Though widely distributed, populations not as high as *Urophora affinis*. Only somewhat effective causing seed reductions in CA. Seed reduction may retard rate at which weed spreads, but has not appreciably lowered stand density of other more highly attacked knapweed spp. because sufficient seeds remain.
Research Organization	State (9,14,15,21), USDA (10)
References	332, 335, 1509, 1572, 1580, 1736, 1912, 2016, 2017, 2031, 2033

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Chondrilla juncea* L.
Notes	There are three forms of this weed in Australia: narrow-leaf (A) which was initially most common, intermediate-leaf (B), broad-leaf (C). Seven genotypes of this weed are recognized in North America; five in the Pacific Northwest and two on the East Coast.
Origin	Eurasia
Common Name	skeleton weed, rush skeletonweed

AGENT	
Species	*Aceria chondrillae* (Canestrini)
Past Names/Synonyms	*Eriophyes chondrillae* (Canestrini)
Classification	(Acari: Eriophyidae)
References	32, 1698

INTRODUCTION	
Country Found	Canada
Year First Recorded	1993
Source	Ex. Italy via USA
Deliberately Redistributed	Y
Year Redistributed	1993
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

ASTERACEAE
Chondrilla juncea; Aceria chondrillae (continued)

Country Found	Canada (continued)
Notes	Spread naturally to Canada following releases made in USA in 1977 and redistributed intentionally within BC though it was not a deliberately petitioned and introduced agent. Though established at multiple locations in BC, weed populations are persisting. Mite abundance is low and overall abundance is limited.
Research Organization	BCME
References	117, 437, 735, 1698

AGENT	
Species	*Puccinia chondrillina* Bubák & Syd.
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1992
Source	Ex. Italy via USA
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Can stunt and reduce density of young plants. More effective in high moisture areas and in regions where infected overwintering rosettes are not killed by harsh temperatures. Though widespread in BC, weed populations are persisting.
Limiting Factors	Climate
References	117, 437

TABLE 3

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Chromolaena odorata* (L.) R. M. King & H. Rob.
Past Names/Synonyms	*Eupatorium odoratum* (L.)
Notes	Two biotypes of *Chromolaena odorata* have been identified. The form in southern Africa (SA) differs substantially both morphologically and in its higher cold tolerance from the more widespread invasive form found in Asia and West and Central Africa (A/WA). While the widespread A/WA biotype can be found throughout the tropical Americas and the Caribbean, recent molecular studies provide strong support for a Cuban or Jamaican origin for the SA biotype.
Origin	Caribbean, tropical and subtropical Americas
Common Name	chromolaena, Siam weed, triffid weed, paraffienbos, kirinyu, kumpai jepang, rumput gol kar, sam-solokh, sap sua, ya-su'a-mop, Akyeampong weed, hagonoy, agonoi, huluhagonoi, pokok Tjerman, Awolowo weed, cò hoi

AGENT

Species	*Acalitus adoratus* Keifer
Classification	(Acari: Eriophyidae)
Notes	Likely accidentally introduced to Malaysia along with the intentionally released *Apion brunneonigrum* from Trinidad, from where it spread throughout Southeast Asia and the Pacific.
References	1221

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION

Country Found	Bangladesh
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 2054

INTRODUCTION

Country Found	Federated States of Micronesia
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 1306, 1309, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Guam
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1309, 2054

INTRODUCTION	
Country Found	India
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1309, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Indonesia
Year First Recorded	1991
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 2054

INTRODUCTION	
Country Found	Laos
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Malaysia
Year First Recorded	1970s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 2054

INTRODUCTION	
Country Found	Myanmar
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Northern Mariana Islands
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	418, 1213, 1304, 1309, 2054

INTRODUCTION	
Country Found	Palau
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1304, 1306, 1309, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Papua New Guinea
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	419, 1213, 1309, 2054

INTRODUCTION	
Country Found	People’s Republic of China
Year First Recorded	1991
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Philippines
Year First Recorded	1987
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 2054

INTRODUCTION	
Country Found	Singapore
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	418, 1213, 2054

TABLE 3

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Taiwan
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1048, 1213, 2054

INTRODUCTION	
Country Found	Thailand
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 1221, 1309, 1332, 2054

ASTERACEAE
Chromolaena odorata; Acalitus adoratus *(continued)*

INTRODUCTION	
Country Found	Timor Leste
Year First Recorded	2003
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 2054

INTRODUCTION	
Country Found	Vietnam
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though rapidly established and dispersed throughout Southeast Asia and the Pacific, efficacy in reducing vigor and growth of the plant limited.
References	1213, 2054

ASTERACEAE
Chromolaena odorata (continued)

AGENT	
Species	*Pareuchaetes pseudoinsulata* Rego Barros
Classification	(Lepidoptera: Erebidae)

INTRODUCTION	
Country Found	Brunei
Year First Recorded	1985
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	288, 1939, 2054

INTRODUCTION	
Country Found	Philippines
Year First Recorded	1985
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1995
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Spread naturally throughout Philippines by 1994 but also redistributed intentionally by 1995. Populations typically low. Causes massive defoliation during outbreaks, however outbreaks infrequent and sporadic and possibly limited by parasitism. Inflicts most damage in conjunction with *Cecidochares connexa*.
Limiting Factors	Parasitism
References	1210, 1211, 1216, 1305, 1309, 1819, 1939, 2054

ASTERACEAE (continued)

WEED	
Family	Asteraceae
Species	*Cirsium arvense* (L.) Scop.
Origin	Eurasia
Common Name	Canada thistle, creeping thistle, Californian thistle, field thistle

AGENT	
Species	*Aceria anthocoptes* (Nalepa)
Classification	(Acari: Eriophyidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Can cause significant thinning and deformation of leaves under laboratory conditions, but has not been properly evaluated under field conditions where observational evidence suggests it has minimal impact.
Other Species Attacked	Has been collected from numerous *Cirsium* spp. native to North America.
References	361, 1372, 1698

TABLE 3

ASTERACEAE
Cirsium arvense (continued)

AGENT	
Species	*Cassida rubiginosa* O.F. Müller
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1901
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes local defoliation and, in presence of competing vegetation, can decrease thistle biomass. High larval parasitism. Though can cause stress to individual plants, overall impact minimal.
Limiting Factors	Predation; Parasitism
Other Species Attacked	Also feeds on the exotic *Carduus acanthoides* L., *C. nutans* L., and *Cirsium vulgare* L. though overall impact minimal.
Research Organization	AAFC
References	49, 361, 432, 1186, 1467, 1628, 1841, 1937

ASTERACEAE
Cirsium arvense; Cassida rubiginosa (continued)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1900s
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1973
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	In some areas, can significantly reduce biomass and survival of *Cirsium arvense*, with effects of feeding stronger than those of plant competition. In other regions overall impact appears minimal, likely hindered by predation and parasitism.
Limiting Factors	Parasitism; Predation
Other Species Attacked	Feeds on a wide array of plant species within the Cardueae, many of which are native or of economic importance in North America. Not approved and not recommended for redistribution. Also feeds on *Carduus acanthoides* L., *C. nutans* L., and *Cirsium vulgare* L. though overall impact minimal.
Research Organization	USDA (1), State (1)
References	38, 49, 334, 361, 473, 1008, 1105, 1182, 1937, 2002

ASTERACEAE
Cirsium arvense *(continued)*

AGENT	
Species	*Cleonis pigra* (Scopoli)
Past Names/Synonyms	*Cleonus piger* (Scopoli)
Classification	(Coleoptera: Curculionidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1933
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Root mining by this insect may kill plants, but regeneration typically observed. Overall impact limited.
Other Species Attacked	Also attacks other exotic *Cirsium*, *Carduus*, *Cynara*, *Onopordum*, *Arctium*, and *Silybum* spp.
References	1138, 1186, 1467, 1628

ASTERACEAE
Cirsium arvense; Cleonis pigra *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1919
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	None
Notes	Not frequent or destructive enough to exert a regulating impact.
Other Species Attacked	Also attacks numerous other species in the Cardueae (including globe artichoke and *Cirsium vulgare* (Savi) Ten.)
References	34, 361, 1182

TABLE 3

ASTERACEAE
Cirsium arvense *(continued)*

AGENT

Species	*Larinus carlinae* (Olivier)
Past Names/Synonyms	*Larinus planus* (Fabricius)
Classification	(Coleoptera: Curculionidae)
References	694

INTRODUCTION

Country Found	Canada
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1989
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though an inadvertent introduction, spread rapidly and then intentionally redistributed to four other Canadian provinces. Abundance and survival hindered by harsh overwintering conditions and parasitism. A second population was later intentionally introduced.
Limiting Factors	Parasitism; Climate
Other Species Attacked	Also attacks native thistle spp.
References	117, 361, 432, 1138, 1186

ASTERACEAE
Cirsium arvense; Larinus carlinae *(continued)*

INTRODUCTION

Country Found	United States of America
Year First Recorded	1968
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1991
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Redistributed repeatedly though never officially approved for redistribution. *Cirsium arvense* thrives even where agent is in high density. In some areas, native thistles attacked to much greater extent than *C. arvense*.
Other Species Attacked	Attacks numerous native *Cirsium* spp.; not recommended and not approved for redistribution.
Research Organization	State (9,15)
References	332, 334, 361, 473, 1116, 1182, 1502, 1506, 1960

ASTERACEAE
Cirsium arvense *(continued)*

AGENT

Species	*Puccinia punctiformis* (F. Strauss) Röhl.
Classification	(Pucciniomycetes: Pucciniales)
Notes	*Puccinia punctiformis* is present in at least three other countries (Australia, Canada and the USA) though not listed. It has not been utilized intentionally for biological control in any country, but is a species of interest in New Zealand, hence its inclusion in this country only.
References	761

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1881
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Appears restricted to *Cirsium arvensis* on which it stunts growth and reproduction. Widely established but usually only some plants in a patch will be diseased; occasionally more widespread outbreaks occur.
References	361, 1062, 1064

ASTERACEAE
Cirsium arvense *(continued)*

AGENT

Species	*Terellia ruficauda* (Fabricius)
Past Names/Synonyms	*Orellia ruficauda* (Fabricius)
Classification	(Diptera: Tephritidae)

INTRODUCTION

Country Found	Canada
Year First Recorded	1873
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Destroys some seed but less effective against weed than other seed feeding agents. Populations limited by parasitism and disease. Overall impact insufficient to control weed.
Limiting Factors	Parasitism; Disease
Other Species Attacked	Also found attacking exotic *Cirsium palustre* (L.) Scop. though impact assumed to be negligible.
References	117, 361, 580, 1180, 1186, 1628

TABLE 3

ASTERACEAE
Cirsium arvense; Terellia ruficauda *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1873
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Usually infrequent. Seed reduction not significant and does not impact population.
References	361, 1075, 1182, 1556

TABLE 3

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Elephantopus mollis* Kunth
Incorrect Past Names/Synonyms	*Elephantopus scaber* L.
Notes	In the 4th edition of this catalogue, *Elephantopus scaber* L. was listed as a synonym for *Elephantopus mollis* Kunth. Though some release records indicate releases were made on both species in various regions, it is unclear if two species were truly present, or if both names were used for the same species. More recent references indicate the species are indeed separate and that the weed targeted for biological control is *E. mollis*. Consequently, the editors of this version of the catalogue refer to *E. mollis* alone, and list *E. scaber* as a name that has been incorrectly applied to *E. mollis*.
Origin	Central America, Caribbean
Common Name	elephant's foot, tobacco weed, lata hina, tobacco weed, tavoko ni veikau
References	817, 846

AGENT	
Species	*Tetraeuaresta obscuriventris* (Loew)
Classification	(Diptera: Tephritidae)

ASTERACEAE
Elephantopus mollis; Tetraeuaresta obscuriventris (continued)

INTRODUCTION	
Country Found	Niue
Year First Recorded	1985
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Recorded on Niue though there is no record of this weed on Niue.
References	1940

INTRODUCTION	
Country Found	Tonga
Year First Recorded	1958
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	None
Notes	The weed is still abundant and widespread, with little biocontrol activity observed.
References	288, 289, 962, 1940

INTRODUCTION	
Country Found	Vanuatu
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	None
Notes	No significant impact on weed throughout established islands.
References	288, 289, 1940

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Jacobaea vulgaris* Gaertn.
Past Names/Synonyms	*Senecio jacobaea* L.
Origin	Eurasia, northern Africa
Common Name	ragwort, tansy ragwort
References	434, 891, 1064, 1450, 1777

AGENT	
Species	*Longitarsus flavicornis* (Stephens)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1971
Source	Ex. England
Deliberately Redistributed	N
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Initially reported as established only on Vancouver Island in mixed populations with *Longitarsus jacobaeae* where it reportedly had limited impact on the weed. Molecular analyses of recently collected material revealed only *L. jacobaeae*; *L. flavicornis* may have died out. Additional evaluation needed to confirm presence.
Limiting Factors	Climate
Research Organization	AAFC
References	432, 434, 437

TABLE 3

ASTERACEAE
Jacobaea vulgaris (continued)

AGENT	
Species	*Longitarsus ganglbaueri* Heikertinger
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1978
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on native *Senecio* spp.
Research Organization	AAFC
References	434, 437, 822, 1088

AGENT	
Species	*Longitarsus gracilis* Kutschera
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Year Redistributed	
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued at top of next column)

ASTERACEAE
Jacobaea vulgaris; Longitarsus gracilis (continued)

Country Found	Canada (continued)
Notes	Identified in NS; most likely inadvertently introduced in mixed shipments of *Longitarsus jacobaeae* from Europe. What was believed to be a population of *L. jacobaeae* was redistributed from NS to BC in 2005. Subsequent monitoring of the BC release site yielded only *L. gracilis*.
Research Organization	AAFC
References	434, 437

AGENT	
Species	*Longitarsus succineus* (Foudras)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	AAFC
References	434, 437, 1088

ASTERACEAE *(continued)*

WEED	
Family	Asteraceae
Species	*Parthenium hysterophorus* L.
Origin	North America, Central America, South America
Common Name	parthenium weed, parthenium, congress grass

AGENT	
Species	*Puccinia abrupta* Dietel & Holw. var. *partheniicola* (H.S. Jacks.) Parmelee
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	Ethiopia
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Occurs commonly in cool and humid areas at mid to high altitudes where rainfall varies from 400 to 700 mm. Significantly reduces plant height, number of leaves, number of branches, and total biomass. Reduces seed production up to 40%.
Limiting Factors	Climate
References	499, 1781

ASTERACEAE
Parthenium hysterophorus; Puccinia abrupta *(continued)*

INTRODUCTION	
Country Found	India
Year First Recorded	1994
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Strain does not appear to be either widespread or aggressive.
References	499, 555, 1032, 1034

INTRODUCTION	
Country Found	Kenya
Year First Recorded	1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Found only at higher elevations in Central; abundant in Nairobi. Strain does not appear to be aggressive.
Limiting Factors	Elevation
References	499, 1431, 1781, 2005, 2008

ASTERACEAE
Parthenium hysterophorus; Puccinia abrupta (continued)

INTRODUCTION	
Country Found	Mauritius
Year First Recorded	1967
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Strain does not appear to be either widespread or aggressive.
References	499, 1433, 2008

INTRODUCTION	
Country Found	Nepal
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Observed in limited locations during dry summer but disappearing during rainy season when population and growth of *Parthenium hysterophorus* is highest. Abundance and impact thus limited.
References	1664, 1667

ASTERACEAE
Parthenium hysterophorus; Puccinia abrupta (continued)

INTRODUCTION	
Country Found	People's Republic of China
Year First Recorded	2002
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	499

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1995
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Possibly present in South Africa for many years prior to 1995. Better suited to cooler, high altitude areas in South Africa than warmer, low altitude areas where the weed is more problematic. Overall not abundant. Impact not measured.
Limiting Factors	Climate
References	499, 1738, 1739, 2006, 2006, 2008

ASTERACEAE
Parthenium hysterophorus (continued)

AGENT	
Species	*Zygogramma bicolorata* Pallister
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Nepal
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Too early post release
General Impact	Too early post release
Notes	Some feeding damage observed from east to west along the Terai Plain and inner valleys; also found in a few valleys in hills such as Kathmandu. Recently introduced so still spreading and increasing in abundance. Though additional time needed before overall impact can be assessed, efficacy likely to be limited by shorter period of defoliating activity of the beetle, prolific seed production by parthenium year round, and environmental pollution.
Limiting Factors	Pollution
Other Species Attacked	Also found feeding on the exotic *Xanthium strumarium* L.
References	1665, 1666, 1667

ASTERACEAE
Parthenium hysterophorus; Zygogramma bicolorata (continued)

INTRODUCTION	
Country Found	Pakistan
Year First Recorded	2007
Source	Ex. Mexico via India
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Larval feeding observed to cause defoliation, though overall impact to weed populations unknown.
References	499, 903

TABLE 3

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Pilosella officinarum* Vaill.
Past Names/Synonyms	*Hieracium pilosella* L.
Origin	Eurasia
Common Name	mouse-ear hawkweed

AGENT

Species	*Puccinia hieracii* var. *piloselloidarum* (Probst) Jørst.
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1995
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1995
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Redistributed throughout both North and South Islands. *Pilosella officinarum* populations vary in their susceptibility to the rust; many resistant to this strain. Susceptible patches have growth suppressed by 10-20%. Two additional strains were later deliberately introduced from Ireland to aid in control.
Limiting Factors	Climate
References	761, 1064, 1270, 1702

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Rhaponticum repens* (L.) Hidalgo
Past Names/Synonyms	*Centaurea repens* L., *Acroptilon repens* (L.) DC.
Origin	Central Asia
Common Name	Russian knapweed
References	792

AGENT

Species	*Puccinia acroptili* P. Syd. & Syd.
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	Canada
Year First Recorded	1970
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1985
Established	Yes
Abundance	High
General Impact	Variable
Notes	At all sites, some plants appear resistant with no negative impact while others adjacent have heavy infection and collapse. In combination with *Subanguina picridis* galls, severely stunts plants and can cause death.
Research Organization	AAFC
References	117, 1290

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Sonchus arvensis* L.
Origin	Eurasia
Common Name	perennial sow-thistle

AGENT

Species	*Cystiphora sonchi* (Bremi)
Classification	(Diptera: Cecidomyiidae)

INTRODUCTION

Country Found	United States of America
Year First Recorded	2012
Source	Ex. Austria via Canada
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Galls were found on only a second investigated site, and with two plants infested.
References	1196, 1473

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Tripleurospermum inodorum* (L.) Sch. Bip.
Past Names/Synonyms	*Tripleurospermum maritimum* (L.) W. D. J. Koch subsp. *inodorum* (L.) Appleq., *Matricaria perforata* Mérat
Notes	Diploid and tetraploid forms occur in both Europe and North America.
Origin	Eurasia
Common Name	scentless chamomile
References	60, 1195

AGENT

Species	*Omphalapion hookerorum* (Kirby)
Past Names/Synonyms	*Apion hookeri* Kirby
Incorrect Past Names/Synonyms	*Omphalapion hookeri* (Kirby)
Classification	(Coleoptera: Brentidae)
References	1195, 1286, 1934

INTRODUCTION

Country Found	Canada
Year First Recorded	1990
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1992
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

TABLE 3

TABLE 3

ASTERACEAE; *Tripleurospermum inodorum* *Omphalapion hookerorum* (continued)

Country Found	Canada (continued)
Notes	Additional releases of this population were intermixed in populations of those intentionally introduced from Germany and subsequently not distinguished. Up to 78% seed heads attacked by *Omphalapion hookerorum* and up to 32% by *Rhopalomyia tripleurospermi*. Estimated seed production reduced up to 19% by combination of both species. Up to 17 *O. hookerorum* adults found per seed head (mean 3.9); dispersing up to 2.8 km/yr.
Research Organization	ARC, AAFC
References	117, 432, 1139, 1185, 1188, 1195, 1197, 1482

ASTERACEAE (continued)

WEED	
Family	Asteraceae
Species	*Xanthium spinosum* L.
Origin	South America
Common Name	Bathurst burr
AGENT	
Species	*Colletotrichum orbiculare* (Berk.) Arx
Incorrect Past Names/Synonyms	*Colletotrichum xanthii* Halst.
Classification	(Sordariomycetes: Incertae sedis)
INTRODUCTION	
Country Found	Australia
Year First Recorded	1948
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1948
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Observed killing large numbers of seedlings and plants, and greatly reducing bur production in northern NSW. Favored by wet summer and autumn. Dispersal and efficacy hindered by hot, dry conditions. Redistributed then patented for use and commercial partner produced prototype. Commercial development ceased due to inconsistent results in field. Further investment on improved formulation abandoned because of potentially high production costs and limited market for product.
Limiting Factors	Climate
Research Organization	NSW State
References	206, 1262, 1989

ASTERACEAE
Xanthium spinosum *(continued)*

AGENT

Species	*Euaresta bullans* (Wiedemann)
Past Names/Synonyms	*Camaromyia bullans* (Wiedemann)
Classification	(Diptera: Tephritidae)

INTRODUCTION

Country Found	Australia
Year First Recorded	1928
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Generally ineffective but may destroy local weed stands.
References	1262, 1989

INTRODUCTION

Country Found	Republic of South Africa
Year First Recorded	1971
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Infests up to 20% of burs.
References	668

ASTERACEAE *(continued)*

WEED

Family	Asteraceae
Species	*Xanthium strumarium* L.
Past Names/Synonyms	*Xanthium pungens* Wallroth, *Xanthium occidentale* Bertol., *Xanthium italicum* Moretti, *Xanthium canadense* Mill.
Notes	A dozen or more taxa (treated as species, subspecies, varieties, and/or forms) are often referred to as *Xanthium strumarium* sens. lat. in Europe and America and are lumped as well by the editors of this catalogue/database. Four of these species are recognized in Australia within the Noogoora burr complex (*Xanthium occidentale* Bertol., *X. italicum* Moretti, *X. orientale* L., and *X. cavanillesii* Schouw). All Australian entries under this complex pertain to releases made against what Australian biological control workers referred to as *X. occidentale*. The *Euaresta aequalis* Loew entry in Fiji pertains to observations on *X. strumarium* L. and *X. canadensis* Mill. The *Ophraella communa* LeSage entry in Japan pertains to observations on *X. strumarium* L., *X. canadensis* Mill., and *X. italicum* Moretti.
Origin	North America, South America, Central America
Common Name	noogoora burr, cocklebur

TABLE 3

ASTERACEAE
Xanthium strumarium (continued)

AGENT	
Species	*Ophraella communa* LeSage
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Japan
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Prefers *Ambrosia artemisiifolia* but will attack/reproduce on *A. trifida* when *A. artemisiifolia* completely defoliated. Adults will feed only slightly on *Xanthium strumarium* for survival in absence of preferred *Ambrosia* spp.
Other Species Attacked	Prefers *Ambrosia artemisiifolia* L. but will attack/reproduce on the exotic *A. trifida* L. and adults will feed slightly on the exotic *Xanthium strumarium* L. Introduced *Helianthus* spp. attacked rarely.
References	483, 1271, 1938, 2042, 2043

ASTERACEAE
Xanthium strumarium (continued)

AGENT	
Species	*Puccinia xanthii* Schweinitz
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	Australia
Year First Recorded	1974
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	pre 1986
Established	Yes
Abundance	High
General Impact	Variable
Notes	Rapidly established throughout range of weed in Australia following natural spread and intentional redistribution. Progressive reduction in seed bank has resulted in excellent control in wetter areas, so that the weed is no longer a problem in most of eastern Australia. No control in the drier far north of NT.
Limiting Factors	Climate
References	940, 1263, 1880, 1881

AZOLLACEAE

WEED	
Family	Azollaceae
Species	*Azolla filiculoides* Lam.
Origin	North America, Central America, South America
Common Name	Azolla, water fern, red water fern, fairy fern

AGENT	
Species	*Stenopelmus rufinasus* Gyllenhal
Incorrect Past Names/Synonyms	*Degorsia champenoisi* Bedel
Classification	(Coleoptera: Erirhinidae)

INTRODUCTION	
Country Found	Belgium
Year First Recorded	1921
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Highly effective at one pond in West Flanders.
References	48, 391, 1660, 1723, 1867

AZOLLACEAE
Azolla filiculoides; Stenopelmus rufinasus (continued)

INTRODUCTION	
Country Found	England
Year First Recorded	1921
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	post 2002
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Because of its long occupancy, it is now considered to be ordinarily resident, with no licensing restrictions. Weevils deliberately mass-produced and released throughout country post 2002. Has proven very efficient at controlling populations of weed in England.
Limiting Factors	Climate
Research Organization	IIBC
References	64, 619, 797, 901, 1526, 1647

INTRODUCTION	
Country Found	France
Year First Recorded	1901
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	901, 1723

TABLE 3

AZOLLACEAE
Azolla filiculoides; Stenopelmus rufinasus *(continued)*

INTRODUCTION	
Country Found	Germany
Year First Recorded	1927
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	391, 1723

INTRODUCTION	
Country Found	Hungary
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1517, 1723

INTRODUCTION	
Country Found	Italy
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Less effective in the colder regions of Europe than South Africa, where the weevil was intentionally and successfully used to control Azolla.
References	391, 1660, 1723

AZOLLACEAE
Azolla filiculoides; Stenopelmus rufinasus *(continued)*

INTRODUCTION	
Country Found	Mozambique
Year First Recorded	2003
Source	Ex. USA (FL) via Republic of South Africa
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	The weed no longer poses a threat to aquatic ecosystems in southern Africa.
References	804

INTRODUCTION	
Country Found	Netherlands
Year First Recorded	1921
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	391, 559, 1723, 1884

INTRODUCTION	
Country Found	Northern Ireland
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Limiting Factors	Climate
References	64, 1647

AZOLLACEAE
Azolla filiculoides; Stenopelmus rufinasus *(continued)*

INTRODUCTION	
Country Found	Portugal
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	225

INTRODUCTION	
Country Found	Republic of Ireland
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Populations now widespread throughout the country. As Azolla populations increase, weevil populations explode but subsequently decrease after weed population successfully controlled. Weed now restricted to remnant populations with small weevil populations ever present.
Limiting Factors	Climate
Research Organization	UCD
References	63, 64, 1647

AZOLLACEAE
Azolla filiculoides; Stenopelmus rufinasus *(continued)*

INTRODUCTION	
Country Found	Slovakia
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1723

INTRODUCTION	
Country Found	Spain
Year First Recorded	2002
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Increasing its range on the Iberian Peninsula. To date not redistributed intentionally for control of water fern in Spain, but likely reduces invasive potential of this weed throughout Europe.
References	225, 391, 545, 619

INTRODUCTION	
Country Found	Ukraine
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1723

TABLE 3

BORAGINACEAE

WEED	
Family	Boraginaceae
Species	*Cynoglossum officinale* L.
Origin	Eurasia
Common Name	houndstongue

AGENT	
Species	*Mogulones crucifer* (Pallas)
Past Names/Synonyms	*Mogulones cruciger* Herbst
Classification	(Coleoptera: Curculionidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	2008
Source	Ex. Hungary, Serbia via Canada
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Denied release in USA due to concerns of nontarget feeding but intentionally released in Canada in 1997. Insects have since crossed border naturally. Though overall populations still low, very high near border and increasing steadily south. Where weevil populations high, *Cynoglossum officinale* infestations completely destroyed. Spillover attack documented on numerous species.

(continued at top of next column)

BORAGINACEAE
Cynoglossum officinale; Mogulones crucifer *(continued)*

Country Found	United States of America (continued)
Other Species Attacked	Found attacking the native *Hackelia ciliata* (Douglas ex Lehm.) I.M. Johnst., *Lithospermum ruderale* Douglas ex Lehm., and *Amsinckia* spp. and the exotic *Buglossoides arvensis* (L.) I. M. Johnst., though attack appeared to be minor and temporary spillover.
References	440, 473, 1999, 2000

BORAGINACEAE *(continued)*

WEED	
Family	Boraginaceae
Species	*Echium candicans* L. f.
Origin	Macaronesia
Common Name	pride of Madeira

AGENT	
Species	*Dialectica scalariella* (Zeller)
Classification	(Lepidoptera: Gracillariidae)

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Mines disfigure attacked plants, though overall impact to weed populations unknown.
Other Species Attacked	The mines disfigure attacked plants including several native species. Also feeds on other introduced Boraginaceae in New Zealand, including *Echium pininana* Webb & Berthel. and *E. vulgare* L., *Anchusa* spp., *Borago* spp., *Myosotis* spp. and *Symphytum* spp.
References	761, 818, 1062

CACTACEAE

WEED	
Family	Cactaceae
Species	Cactoideae spp.
Notes	Includes several species in the Cactoideae such as *Pilosocereus royenii* (L.) Byles & G. D. Rowley, *Leptocereus quadricostatus* (Bello) Britton & Rose, *Melocactus intortus* (Mill.) Urb., *Cereus hexagonus* (L.) Mill., and *Stenocereus fimbriatus* (Lam.) Lourteig.
Origin	Caribbean
Common Name	columnar cacti

AGENT	
Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)

(continued on next page)

TABLE 3

CACTACEAE
Cactoideae spp. *(continued)*

AGENT

Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

CACTACEAE
Cactoideae spp.; *Hypogeococcus festerianus* *(continued)*

INTRODUCTION

Country Found	Puerto Rico
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Causing extensive damage to numerous columnar cacti species throughout the country, including severe attack to *Pilosocereus royenii*, *Leptocereus quadricostatus*, *Melocactus intortus*, and *Cereus hexagonus* and minor damage to *Stenocereus fimbriatus*.
Other Species Attacked	Found severely attacking the native *Pilosocereus royenii* (L.) Byles & G. D. Rowley, *Leptocereus quadricostatus* (Bello) Britton & Rose, *Melocactus intortus* (Mill.) Urb., and *Cereus hexagonus* (L.) Mill. and causing minor damage on *Stenocereus fimbriatus* (Lam.) Lourteig.
References	1113, 1637, 2078

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Cereus* spp.
Origin	South America
Common Name	columnar cacti
AGENT	
Species	*Hypogeococcus festerianus* (Lizer y Trelles)
Incorrect Past Names/Synonyms	*Hypogeococcus pungens* Granara de Willink
Classification	(Hemiptera: Pseudococcidae)
Notes	The cactus mealybug first utilized for biological control of weedy cacti species was collected from cacti in Argentina and identified as *Hypogeococcus festerianus* (Lizer y Trelles). A later review redescribed this species as *Hypogeococcus pungens* Granara de Willink, though the type specimen was collected from *Alternanthera pungens* Kunth (Amaranthaceae) and the host range was described to also include species in the Portulacaceae. Recent taxonomic work has clarified that the species attacking cacti is *H. festerianus*, while *H. pungens* is a distinct species attacking plants in the Amaranthaceae, Portulacaceae, and additional species, but not the Cactaceae. *Hypogeococcus pungens* has not been intentionally utilized anywhere in the world as a biological control agent. It is mentioned in this catalogue only as an incorrect synonym for *H. festerianus*, the true cactus mealybug biological control agent.

CACTACEAE
Cereus* spp.; *Hypogeococcus festerianus *(continued)*

INTRODUCTION	
Country Found	Italy
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Infesting *Cereus* spp. (largely intentionally cultivated) though scale populations had decreased by 2009 surveys.
References	819, 1176

TABLE 3

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida*
Incorrect Past Names/Synonyms	*Cylindropuntia rosea* (DC.) Backeb.
Notes	In South Africa, *Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *fulgida* was known for many years incorrectly as *C. rosea* (DC.) Backeb., which is similar and closely related.
Origin	Mexico, southern USA
Common Name	chain-fruit cholla
AGENT	
Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

CACTACEAE; *Cylindropuntia fulgida* var. *fulgida* *Dactylopius tomentosus* *(continued)*

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	post 2009
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Cholla biotype. Likely spread from South Africa where it was intentionally released. Actively redistributed throughout Zimbabwe post 2009 on *Cylindropuntia fulgida* var. *fulgida*. Extremely effective in killing infested plants. All cactus plants infested in southernmost regions of Zimbabwe. Because formal evaluation lacking, unknown if insect has spread to all weed populations in country.
References	418, 993

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Cylindropuntia fulgida* (Engelm.) F.M. Knuth var. *mamillata* (A. Schott ex Engelm.) Backeb.
Origin	Mexico, southern USA
Common Name	boxing glove cactus (applied only to the crested morphotype, *forma monstrosa*), coral cactus

AGENT	
Species	*Dactylopius tomentosus* (Lamark)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius tomentosus* have been identified based on the source species from which they were collected.
References	1167

CACTACEAE; *Cylindropuntia fulgida* var. *mamillata* *Dactylopius tomentosus* (continued)

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Unknown
Notes	Cholla biotype. Likely spread from South Africa were it was intentionally released. Actively redistributed throughout Zimbabwe post 2009 on *Cylindropuntia fulgida* var. *fulgida*; spread naturally to *Cyl. fulgida* var. *mamillata* by 2011. Extremely effective in killing infested plants. All cactus plants infested in southernmost regions of Zimbabwe. Because formal evaluation lacking, unknown if insect has spread to all weed populations in country.
References	418, 993

TABLE 3

TABLE 3

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia ficus-indica* (L.) Mill.
Past Names/Synonyms	*Opuntia cordobensis* Spegazzini, *Opuntia megacantha* Salm-Dyck
Notes	Previous literature referred to this release as occurring on *Opuntia cordobensis* Spegazzini which has since been synonymized with *O. ficus-indica* (L.) Mill. While some authors consider *O. ficus-indica* to be a spineless cultivar derived from *O. megacantha*, many other authors consider *O. megacantha* to also be a cultivated taxon or a name applied to multiple ruderal reversions to spininess from the escaped, cultivated *O. ficus-indica* and they treat *O. megacantha* as a later synonym. The editors of this catalogue are in the latter group.
Origin	Mexico
Common Name	Indian fig, mission prickly pear, grootdoringturksvy
AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

CACTACEAE
Opuntia ficus-indica; Cactoblastis cactorum *(continued)*

INTRODUCTION	
Country Found	Cuba
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also found attacking the native *Consolea moniliformis* (L.) A. Berger, *O. auberi* Pfeiffer, *O. dejecta* Salm-Dyck, and *O. cubensis* Britton & Rose and the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	2079

INTRODUCTION	
Country Found	Puerto Rico
Year First Recorded	1966
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also recorded on *Opuntia antillana* Britton & Rose, *O. repens* Bello, the young growth of *Consolea rubescens* (Salm-Dyck ex. A.P. DC.) and *C. moniliformis* (L.) A. Berger, all native to the Caribbean, as well as the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	610, 2079

CACTACEAE
Opuntia ficus-indica; Cactoblastis cactorum (continued)

INTRODUCTION	
Country Found	U.S. Virgin Islands
Year First Recorded	1963
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Other Species Attacked	Also recorded on *Opuntia antillana* Britton & Rose, *O. repens* Bello, *Consolea rubescens* (Salm-Dyck ex. A.P. DC.) and *C. moniliformis* (L.) A. Berger, all native to the Caribbean.
References	610, 2079

CACTACEAE (continued)

WEED	
Family	Cactaceae
Species	*Opuntia monacantha* (Willd.) Haw.
Incorrect Past Names/Synonyms	*Opuntia vulgaris* Mill., *Opuntia monocantha* (Willd.) Haw.
Origin	Argentina, Brazil, Paraguay, Uruguay
Common Name	prickly pear, drooping prickly pear, smooth tree pear, suurturksvy
References	35, 845, 1091, 1930

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

INTRODUCTION	
Country Found	Cuba
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Causing significant but unquantified damage to this species.
Other Species Attacked	Also found attacking the native *Consolea moniliformis* (L.) A. Berger, *O. auberi* Pfeiffer, *O. dejecta* Salm-Dyck, and *O. cubensis* Britton & Rose and the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	2079

TABLE 3

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Opuntia* spp.
Notes	A few releases now attributed to this group were listed under *Opuntia vulgaris* in previous versions of this catalogue (a species now referred to as *Opuntia monacantha*). However, all references cited then and now do not differentiate which *Opuntia* species it was that received this release. Consequently, the entries have been changed to *Opuntia* spp.
Origin	North and South America adjacent to Caribbean Islands, Caribbean Islands
Common Name	prickly pear, raketa, Malagasy cactus
References	446, 668

AGENT

Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

INTRODUCTION

Country Found	Dominican Republic
Year First Recorded	post 1963
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Small cactus species heavily attacked and under threat of endangerment while old growth on larger cacti less suitable and frequently escapes attack.

(continued at top of next column)

CACTACEAE
Opuntia* spp.; *Cactoblastis cactorum *(continued)*

Country Found	Dominican Republic (continued)
Other Species Attacked	Found commonly attacking the native *Opuntia taylori* Britton & Rose, *O. antillana* Britton & Rose, *O. stricta* (Haw.) Haw., *Cylindropuntia caribaea* (Britton & Rose) F.M. Knuth, the exotic *O. ficus-indica* (L.) Mill., and the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck. Attack to the exotic but cultivated *Opuntia pilifera* F. A. C. Weber and *Opuntia leucotricha* DC. is extensive.
References	1455, 2079

INTRODUCTION

Country Found	Haiti
Year First Recorded	post 1963
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though moth is widespread, surveys not recently conducted in Haiti so impact unknown. Impact most likely similar to the adjacent Dominican Republic where small cactus species heavily attacked and under threat of endangerment while old growth on larger cacti less suitable and frequently escapes attack.
References	1455, 2071, 2079

CACTACEAE
Opuntia* spp.; *Cactoblastis cactorum *(continued)*

INTRODUCTION	
Country Found	Mexico
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	No
Notes	Intercepted from a USA flight originating in Cancún pre-1992, indicating the agent could have been established somewhere in Mexico by then, though this was not confirmed during subsequent surveys. Confirmed established on Isla Mujeres in 2006 and Isla Contoy in 2007. Confirmed populations eradicated following intensive monitoring, trapping and eradication programs. Monitoring programs ongoing.
References	793, 1333, 1334, 1455, 1594, 2077

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1989
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional

(continued at top of next column)

CACTACEAE
Opuntia* spp.; *Cactoblastis cactorum *(continued)*

INTRODUCTION	
Country Found	United States of America (continued)
Notes	Damage to attacked plants extensive, with many frequently disappearing completely shortly after attack. Numerous concerns of spread to southwestern USA and neighboring Mexico where multiple *Opuntia* species endemic and/or of commercial importance. Surveillance and eradication programs terminated in 2011.
Other Species Attacked	Attacks all six of the native *Opuntia* spp. in Florida
Research Organization	FDA, State (3)
References	106, 503, 703, 793, 795, 1455, 1594, 2077

CACTACEAE
***Opuntia* spp.** *(continued)*

AGENT

Species	*Dactylopius opuntiae* (Cockerell)
Classification	(Hemiptera: Dactylopiidae)
Notes	Different biotypes of *Dactylopius opuntiae* exist which are suited to certain *Opuntia* species and not to others.
References	833

INTRODUCTION

Country Found	Kenya
Year First Recorded	1958
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Ficus biotype. Abundant and effective; near one community in Rift Valley has largely wiped out most plants. [Reported in previous edition of this catalogue as an accidental introduction probably from the USA via South Africa via Tanzania in 1958 when *Dactylopius ceylonicus* was intentionally introduced. References cited at the time do not confirm the introduction, so the source of this information remains unknown. An alternative reference (Goeden 1978) indicates the species was introduced intentionally. Because current researchers are unsure of the avenue of introduction, it is possible the species was introduced via both channels.

(continued at top of next column)

CACTACEAE
Opuntia* spp.; *Dactylopius opuntiae *(continued)*

Country Found	Kenya (continued)
Notes (continued)	Consequently two entries are given for this species, and the editors of this new version of the catalogue assume the different source populations (if more than one) have since intermixed and are no longer differentiated.]
References	446, 635, 944, 970, 2005

INTRODUCTION

Country Found	Zambia
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Ficus biotype. Only moderately abundant at observed site where environment is too wet to be optimal.
Limiting Factors	Climate
References	2005

CACTACEAE
Opuntia spp. *(continued)*

AGENT	
Species	*Dactylopius* sp.
Classification	(Hemiptera: Dactylopiidae)

INTRODUCTION	
Country Found	La Réunion
Year First Recorded	early 1900s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Successfully controlled *Opuntia* spp.
References	668

CACTACEAE *(continued)*

WEED	
Family	Cactaceae
Species	*Opuntia stricta* (Haw.) Haw.
Past Names/Synonyms	*Opuntia dillenii* (Ker Gawler) Haw., *Opuntia stricta* (Haw.) Haw. var. *dillenii* (Ker Gawl.) L. D. Benson, *Opuntia inermis* DC., *Opuntia stricta* (Haw.) Haw. var. *stricta*
Notes	This species is sometimes split in various ways by different taxonomists and is currently under debate. The editors of this version of the catalogue currently support the idea it is all one highly variable *Opuntia stricta* (Haw.) Haw.
Origin	North and South America adjacent to Caribbean Islands, Caribbean Islands
Common Name	spiny pest pear, common prickly pear, prickly pear, sweet prickly pear, Australian pest pear, prickly pear
References	135, 845, 846, 1459

AGENT	
Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

INTRODUCTION	
Country Found	Bahamas
Year First Recorded	1983
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	503, 1455, 1720, 2071

CACTACEAE
Opuntia stricta; Cactoblastis cactorum *(continued)*

INTRODUCTION	
Country Found	Cuba
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Dramatically reduced vast infestations of this species; also found on many other cactus species.
Other Species Attacked	Also found attacking the native *Consolea moniliformis* (L.) A. Berger, *O. auberi* Pfeiffer, *O. dejecta* Salm-Dyck, and *O. cubensis* Britton & Rose and the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	2077, 2079

INTRODUCTION	
Country Found	Guadeloupe
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Found attacking 100% of plants and 70% of cladodes during 2005 survey. Target plant considered native to Guadeloupe.
Other Species Attacked	Also found attacking the native *O. tuna* (L.) Mill.
References	2079

CACTACEAE
Opuntia stricta; Cactoblastis cactorum *(continued)*

INTRODUCTION	
Country Found	Jamaica
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Found attacking *Opuntia stricta* (native) in 2005 survey, along with attack to numerous other native/endemic species.
Other Species Attacked	Also found attacking the endemic *Opuntia jamaicensis* Britton & Harris, the native *O. tuna* (L.) Mill., possibly the endemic *O. sanguinea* Proctor, heavily attacking the young growth of the native *Consolea spinosissima* (Mill.) Lem., as well as the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	35, 2079

INTRODUCTION	
Country Found	Puerto Rico
Year First Recorded	1966
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Target weed considered native.

(continued on next page)

CACTACEAE
Opuntia stricta; Cactoblastis cactorum (continued)

Country Found	Puerto Rico (continued)
Other Species Attacked	Also recorded on *Opuntia antillana* Britton & Rose, *O. repens* Bello, the young growth of *Consolea rubescens* (Salm-Dyck ex. A.P. DC.) and *C. moniliformis* (L.) A. Berger, all native to the Caribbean, as well as the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	35, 610, 2079

INTRODUCTION

Country Found	U.S. Virgin Islands
Year First Recorded	1963
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Target considered native.
Other Species Attacked	Also recorded on *Opuntia antillana* Britton & Rose, *O. repens* Bello, *Consolea rubescens* (Salm-Dyck ex. A.P. DC.) and *C. moniliformis* (L.) A. Berger, all native to the Caribbean.
References	35, 610, 2079

CACTACEAE *(continued)*

WEED

Family	Cactaceae
Species	*Opuntia triacantha* (Willd.) Sweet
Origin	Puerto Rico, Lesser Antilles
Common Name	suckers

AGENT

Species	*Cactoblastis cactorum* (Berg)
Classification	(Lepidoptera: Pyralidae)

INTRODUCTION

Country Found	Cuba
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Causing significant but unquantified damage to this species.
Other Species Attacked	Also found attacking the native *Consolea moniliformis* (L.) A. Berger, *O. auberi* Pfeiffer, *O. dejecta* Salm-Dyck, and *O. cubensis* Britton & Rose and the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	2077, 2079

TABLE 3

CACTACEAE
Opuntia triacantha; Cactoblastis cactorum *(continued)*

INTRODUCTION	
Country Found	Guadeloupe
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Found attacking 100% of plants and 40% of cladodes during 2005 survey. Target plant considered native to Guadeloupe.
Other Species Attacked	Also found attacking the native *O. tuna* (L.) Mill.
References	35, 2079

INTRODUCTION	
Country Found	Puerto Rico
Year First Recorded	1966
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Target weed considered native.

(continued at top of next column)

CACTACEAE
Opuntia triacantha; Cactoblastis cactorum *(continued)*

Country Found	Puerto Rico (continued)
Other Species Attacked	Also recorded on *Opuntia antillana* Britton & Rose, *O. repens* Bello, the young growth of *Consolea rubescens* (Salm-Dyck ex. A.P. DC.) and *C. moniliformis* (L.) A. Berger, all native to the Caribbean, as well as the cultivated and naturalized *Nopalea cochenillifera* (L.) Salm-Dyck.
References	35, 610, 2079

INTRODUCTION	
Country Found	U.S. Virgin Islands
Year First Recorded	1963
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Target considered native.
Other Species Attacked	Also recorded on *Opuntia antillana* Britton & Rose, *O. repens* Bello, *Consolea rubescens* (Salm-Dyck ex. A.P. DC.) and *C. moniliformis* (L.) A. Berger, all native to the Caribbean.
References	35, 99, 610, 2079

TABLE 3

CYPERACEAE

WEED	
Family	Cyperaceae
Species	*Cyperus rotundus* L.
Origin	cosmopolitan
Common Name	nut grass, purple nutsedge, vucesa, soronakabani, oni ani, pakopako

AGENT	
Species	*Bactra venosana* (Zeller)
Classification	(Lepidoptera: Tortricidae)

INTRODUCTION	
Country Found	New Caledonia
Year First Recorded	1987
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	No record of introduction and current status unknown.
References	1940

EUPHORBIACEAE

WEED	
Family	Euphorbiaceae
Species	*Euphorbia esula* L.
Notes	A controversial and morphologically variable species considered to represent a complex of forms, species and hybrids.
Origin	Eurasia
Common Name	leafy spurge
References	149, 622

AGENT	
Species	*Spurgia capitigena* (Bremi)
Past Names/Synonyms	*Bayeria capitigena* Bremi
Classification	(Diptera: Cecidomyiidae)
Notes	Previously included with *Spurgia esulae* Gagné under *Bayeria capitigena* Bremi. The agent was transferred to *Spurgia* and separated into two distinct species in 1990 by the entomologist R.J. Gagné. More recent studies with these species revealed no evidence for two fly species, or two fly species separated by host plant. However, a revision of this group has not been published, so the two names created by Gagné remained valid at the time of publication of this version of the catalogue.

EUPHORBIACEAE
Euphorbia esula; Spurgia capitigena *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1986
Source	Ex. Italy
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Believed to have been a contaminant of one population of *Spurgia esulae* collected in Italy and released in ND in 1986. Intentionally released in ND beginning in 2001. Believed to have proliferated following release, though current abundance and impact not formally evaluated. Impact most likely slight to none, similar to *Spurgia* spp. on *Euphorbia* spp. elsewhere in North America.
Research Organization	USDA (7,10,12,14), State (7,11,13,15,28), USDA-APHIS
References	1106, 1338, 1456, 1706

TABLE 3

FABACEAE

WEED	
Family	Fabaceae
Species	*Acacia mearnsii* De Wild.
Origin	Australia
Common Name	black wattle

AGENT	
Species	*Dasineura rubiformis* Kolesik
Classification	(Diptera: Cecidomyiidae)

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	761, 1067

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	2001
Source	Ex. Australia
Deliberately Redistributed	Y
Year Redistributed	2010
Established	Yes
Abundance	Moderate
General Impact	Heavy
Geographical Scale of Impact	Localized

(continued on next page)

FABACEAE
Acacia mearnsii; Dasineura rubiformis (continued)

Country Found	Republic of South Africa (continued)
Notes	Established during 2001 field host-specificity testing, though not identified as such until 2006. Official approval for release subsequently obtained in 2010 with a proviso there is consultation and agreement with representatives of the wattle industry when releases are proposed in the vicinity of the important wattle growing areas of KZN and in MP. Unlike *Dasineura dielsi*, dispersal of *D. rubiformis* has only been gradual, prior to redistributions. Though still limited in distribution, impact is extensive locally, where pod production at original site of establishment has virtually ceased.
Research Organization	ARC-PPRI
References	869, 870, 871, 992

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Cytisus scoparius* (L.) Link
Past Names/Synonyms	*Cytisus scoparius* (L.) Link subsp. *scoparius*, *Sarothamnus scoparius* (L.) Wimm. ex W. D. J. Koch
Origin	Europe
Common Name	Scotch broom, broom

AGENT

Species	*Aceria genistae* (Nalepa)
Classification	(Acari: Eriophyidae)
Notes	Research indicates *Aceria genistae* includes a number of distinct strains, each of which is specific to one species of plant.

INTRODUCTION

Country Found	Canada
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Identified recently in coastal communities where impact is minor thus far.
References	38, 282, 1698

TABLE 3

TABLE 3

FABACEAE
Cytisus scoparius; Aceria genistae (continued)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Abundant in WA where impact medium as reduces flowering and plant biomass, although this has not been officially quantified. Widespread in OR but of localized abundance with slight impact. Very limited in CA where impact negligible. Predatory mites found associated with galls, though impact of these predators unknown. Currently undergoing host specificity testing in WA with the intent of future intentional redistribution if approved.
Limiting Factors	Possibly Predation
Other Species Attacked	Also attacks ornamental varieties of *Cytisus scoparius* (L.) Link and hybrids derived from *C. scoparius*.
References	38, 334, 335, 1698

FABACEAE
Cytisus scoparius (continued)

AGENT	
Species	*Agonopterix nervosa* (Haworth)
Past Names/Synonyms	*Depressaria nervosa* Haw., *Depressaria costosa* Haw.
Classification	(Lepidoptera: Oecophoridae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1920s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread in OR and WA, attacking up to 40% of new terminal shoots and potentially reducing seed production, though is heavily parasitized. Present in CA and NV but uncommon. Most effective in sunny locations below 800m. Not as effective on this species as on *Ulex europaeus*.
Limiting Factors	Parasitism
Other Species Attacked	Also attacks the exotic *Cytisus striatus* (Hill) Rothm.
Research Organization	USDA (7), State (9,15)
References	42, 332, 333, 334, 535, 820

FABACEAE
Cytisus scoparius *(continued)*

AGENT	
Species	*Arytainilla spartiophila* (Förster)
Past Names/Synonyms	*Arytaina spartiophila* (Förster)
Classification	(Hemiptera: Psyllidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1935
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Most common and abundant of *Cytisus scoparius* agents. In OR, high densities observed may weaken plants under stress from competition and make them vulnerable to opportunistic pathogens. Impact elsewhere unknown.
Research Organization	State (14,15)
References	332, 334, 340, 1462, 1842, 1928

FABACEAE
Cytisus scoparius *(continued)*

AGENT	
Species	*Bruchidius villosus* (Fabricius)
Past Names/Synonyms	*Bruchidius ater* Marsh.
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	2001
Source	Ex. Unknown via USA (WA) via USA (NC)
Deliberately Redistributed	Y
Year Redistributed	2006
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	More active and common than another adventive beetle, *Exapion fuscirostre*.
Research Organization	BCME
References	117, 337, 339, 437

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1918
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1998
Established	Yes
Abundance	Variable
General Impact	Variable

(continued on next page)

TABLE 3

TABLE 3

FABACEAE
Cytisus scoparius; Bruchidius villosus (continued)

Country Found	United States of America (continued)
Notes	Abundant in NC where seed reduction measured at more than 80% at two sites. Intentionally redistributed to Pacific Northwest. Widespread in OR and WA where abundance is increasing but variable; 10-90% pods attacked and 20-80% seeds destroyed within attacked pods. More study needed, but suspected that densities and attack rates not yet high enough to decrease plant populations. Parasitism typically low but may limit populations in some regions.
Limiting Factors	Parasitism
Research Organization	State (9,15)
References	39, 141, 141, 339, 340, 1555, 1752

AGENT

Species	*Exapion fuscirostre* (Fabricius)
Past Names/Synonyms	*Apion fuscirostre* Fabricius
Classification	(Coleoptera: Brentidae)

INTRODUCTION

Country Found	Canada
Year First Recorded	2007
Source	Ex. Italy via USA (WA)
Deliberately Redistributed	Y
Year Redistributed	2007
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Less active and common than another adventive beetle, *Bruchidius villosus*.
Research Organization	BCME
References	117, 340, 437

FABACEAE
Cytisus scoparius (continued)

AGENT

Species	*Leucoptera spartifoliella* (Hübner)
Classification	(Lepidoptera: Lyonetiidae)

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1950
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1987
Established	Yes
Abundance	High
General Impact	Variable
Notes	Large outbreaks in recent years cause significant damage by reducing new growth, killing branches and sometimes complete plants at some sites. Damage only slight in other areas.
Research Organization	DSIR/MWLR
References	720, 761, 1064, 1616, 1772

INTRODUCTION

Country Found	United States of America
Year First Recorded	1960
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

FABACEAE
Cytisus scoparius; Leucoptera spartifoliella (continued)

Country Found	United States of America (continued)
Notes	Intentionally introduced in 1960 but found to have already been present. Both populations subsequently not differentiated in the literature. Widespread in CA and OR but present at limited sites in WA. High population numbers can deform plants and cause stem dieback but plant density not affected and overall impact is negligible. Heavily parasitized and does not do well in hot, dry sites.
Limiting Factors	Parasitism; Habitat
Research Organization	USDA (7), State (9,15)
References	39, 42, 332, 335, 339, 340, 593, 1928

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Galega officinalis* L.
Origin	western Asia, southern Europe
Common Name	goat's rue

AGENT

Species	*Uromyces galegae* (Opiz) Sacc.
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	Argentina
Year First Recorded	1982
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Hyperparasite observed in rust pustules may impair efficacy.
Limiting Factors	Parasitism
References	84, 979, 1356

FABACEAE *(continued)*

WEED

Family	Fabaceae
Species	*Genista monspessulana* (L.) L. A. S. Johnson
Origin	northern Africa, Mediterranean
Common Name	French broom, cape broom

AGENT

Species	*Arytinnis hakani* (Loginova)
Classification	(Hemiptera: Psyllidae)

INTRODUCTION

Country Found	Australia
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	2009
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Found established after being tested in quarantine (after the only shipment of this insect ever made from France to Australia). Subsequently redistributed intentionally. Abundance and impact increasing with redistribution efforts. Effective and kills stands of the weed wherever released. No other control efforts required. Young plants still recruiting from seed bank. Needs proper evaluation, damage levels visually high. Populations can crash during hot summers.
Limiting Factors	Climate
Research Organization	CSIRO, SA State
References	782, 883, 1656, 1657, 1795

FABACEAE
Genista monspessulana *(continued)*

AGENT

Species	*Bruchidius villosus* (Fabricius)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION

Country Found	United States of America
Year First Recorded	2001
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Unintentionally introduced populations (pre 1918) found on *Cytisus scoparius* in NC were tested for specificity following USDA-APHIS TAG protocols and then deliberately transferred from NC to OR, WA and ID in the Pacific Northwest onto *C. scoparius* in 1998. Subsequently found attacking *Genista monspessulana* in low numbers in OR by 2001. Impact on *G. monspessulana* not yet evaluated.
References	334, 339, 340

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Leucaena leucocephala* (Lam.) de Wit
Origin	Mexico, Central America
Common Name	leucaena, lead tree
AGENT	
Species	*Acanthoscelides macrophthalmus* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Australia
Year First Recorded	1996
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	95% or more of seed may be infested but impacts patchy and seasonal. Unlikely to have negative influence on leucaena demography.
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	1545, 1833, 1931

FABACEAE; *Leucaena leucocephala* *Acanthoscelides macrophthalmus* *(continued)*

INTRODUCTION	
Country Found	India
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	1833

INTRODUCTION	
Country Found	Japan
Year First Recorded	2000
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	1833

TABLE 3

FABACEAE; *Leucaena leucocephala*
Acanthoscelides macrophthalmus (continued)

INTRODUCTION

Country Found	People's Republic of China
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	1833

INTRODUCTION

Country Found	Republic of Cyprus
Year First Recorded	2008
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Recent surveys indicate the distribution of this agent in the Republic of Cyprus has not increased since its initial discovery. Abundance and impact remain unknown.
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	1833, 1886, 1887

FABACEAE; *Leucaena leucocephala*
Acanthoscelides macrophthalmus (continued)

INTRODUCTION

Country Found	République Togolaise
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	532, 1646

INTRODUCTION

Country Found	Senegal
Year First Recorded	1996
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Seed attack rates up to 67%. Populations limited by parasitism.
Limiting Factors	Parasitism
References	468, 1388, 1833

INTRODUCTION

Country Found	Taiwan
Year First Recorded	1995
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown

(continued on next page)

FABACEAE; *Leucaena leucocephala* *Acanthoscelides macrophthalmus* (continued)

Country Found	Taiwan (continued)
Other Species Attacked	Also feeds on the exotic *Falcataria moluccana* (Miq.) Barneby & J. W. Grimes and other members of the Mimoseae tribe.
References	1833

INTRODUCTION

Country Found	Thailand
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	1833

INTRODUCTION

Country Found	Vietnam
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on other members of the Mimoseae tribe.
References	976, 1833

FABACEAE (continued)

WEED

Family	Fabaceae
Species	*Mimosa pigra* L.
Past Names/Synonyms	*Mimosa pigra* L. var. *pigra*
Origin	tropical Americas
Common Name	giant sensitive plant, mimosa, giant mimosa

AGENT

Species	*Acanthoscelides puniceus* Johnson
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION

Country Found	Indonesia
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC
References	774, 1328, 1329

TABLE 3

TABLE 3

FABACEAE
Mimosa pigra; Acanthoscelides puniceus (continued)

INTRODUCTION	
Country Found	Laos
Year First Recorded	1991
Source	Ex. Mexico via Australia via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread naturally from Thailand, where it was intentionally introduced, across the Mekong River to Laos. Overall status unknown.
Research Organization	NBCRC
References	774, 1326, 1328, 1329

INTRODUCTION	
Country Found	Malaysia
Year First Recorded	1989
Source	Ex. Mexico via Australia via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Increasingly spreading from release sites and Thailand border where separate group has crossed naturally. Populations no longer differentiated. Overall attack rates minimal (less than 12% damage to pods) and have limited impact on weed population.
Research Organization	NBCRC
References	765, 774, 1326, 1327, 1329

FABACEAE
Mimosa pigra; Acanthoscelides puniceus (continued)

INTRODUCTION	
Country Found	Myanmar
Year First Recorded	1987
Source	Ex. Mexico via Australia via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread naturally from Thailand where it was intentionally introduced. Also intentionally introduced with both populations subsequently not differentiated. Overall status unknown.
Research Organization	NBCRC
References	774, 1326, 1327, 1329

INTRODUCTION	
Country Found	Singapore
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Detected outside Changhi Airport.
Research Organization	NBCRC
References	774, 1328, 1329

FABACEAE
Mimosa pigra *(continued)*

AGENT

Species	*Acanthoscelides quadridentatus* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION

Country Found	Indonesia
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Research Organization	NBCRC
References	774, 1328, 1329

INTRODUCTION

Country Found	Laos
Year First Recorded	1991
Source	Ex. Mexico via Australia via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread naturally from Thailand, where it was intentionally introduced, across the Mekong River to Laos. Overall status unknown.
Research Organization	NBCRC
References	774, 1326, 1328, 1329

FABACEAE
Mimosa pigra; Acanthoscelides quadridentatus *(continued)*

INTRODUCTION

Country Found	Malaysia
Year First Recorded	1989
Source	Ex. Mexico via Australia via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Increasingly spreading from release sites and Thailand border where it crossed naturally; however attack rates minimal (less than 12% damage to pods) and have limited impact on weed population.
Research Organization	NBCRC
References	765, 774, 1326, 1327, 1329

INTRODUCTION

Country Found	Myanmar
Year First Recorded	1987
Source	Ex. Mexico via Australia via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread naturally from Thailand where it was intentionally introduced. Also intentionally introduced with both populations subsequently not differentiated. Overall status unknown.
Research Organization	NBCRC
References	774, 1326, 1327, 1329

FABACEAE
Mimosa pigra; Acanthoscelides quadridentatus *(continued)*

INTRODUCTION	
Country Found	Singapore
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Detected outside Changhi Airport.
Research Organization	NBCRC
References	774, 1328, 1329

TABLE 3

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Prosopis juliflora* (Sw.) DC.
Origin	Colombia, Ecuador, Mexico, Peru, Venezuela
Common Name	Mexican thorn

AGENT	
Species	*Heteropsylla reducta* Caldwell & Martorell
Classification	(Hemiptera: Psyllidae)

INTRODUCTION	
Country Found	Ascension Island
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Along with *Rhinocloa* sp., contributing to large scale stunting and moderate dieback of attacked trees.
References	97, 582, 584

FABACEAE
Prosopis juliflora (continued)

AGENT

Species	*Rhinocloa* sp.
Classification	(Hemiptera: Miridae)

INTRODUCTION

Country Found	Ascension Island
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Along with (but more effective than) *Heteropsylla reducta*, contributing to large scale stunting, reduction of seed production, and moderate dieback of attacked trees.
References	97, 582, 584, 585

FABACEAE (continued)

WEED

Family	Fabaceae
Species	*Prosopis* spp.
Notes	Comprises a complex of taxa occurring in mixed stands and often hybridizing freely. In Australia, these include *Prosopis glandulosa* Torrey (including both varieties, *glandulosa* and *torreyana*), *Prosopis pallida* (Humboldt & Bonpland ex Willd.) Kunth, and *Prosopis velutina* Wooton. A fourth species, *Prosopis juliflora* (Sw.) DC., has been documented at a few sites in Australia but may no longer be present there. Species invasive in South Africa are *Prosopis velutina* Wooton, *Prosopis glandulosa* Torrey (including both varieties, *glandulosa* and *torreyana*), *Prosopis juliflora* (Sw.) DC., and *Prosopis* hybrids. Egypt species include *Prosopis juliflora* (Sw.) DC. and *Prosopis glandulosa* Torr. Species in Namibia include *Prosopis chilensis* (Molina) Stuntz, *Prosopis glandulosa* Torr. var. *torreyana* (L. D. Benson) M. C. Johnst., and *Prosopis velutina* Wooton. In Yemen, the nonnative species include *Prosopis chilensis* (Molina) Stuntz, *Prosopis glandulosa* Torrey var. *glandulosa*, and *Prosopis juliflora* (Sw.) DC.
Origin	Americas
Common Name	mesquite, prosopis, algaroba

TABLE 3

FABACEAE
***Prosopis* spp.** *(continued)*

AGENT

Species	*Algarobius prosopis* (Le Conte)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION

Country Found	Botswana
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though common and abundant throughout range of *Prosopis* in southern parts of country, impact unknown.
References	823

INTRODUCTION

Country Found	Egypt
Year First Recorded	2001
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	The sample size and scope of a survey were too small and limited to determine overall abundance and impact.
References	467, 1879

FABACEAE
Prosopis* spp.; *Algarobius prosopis *(continued)*

INTRODUCTION

Country Found	Namibia
Year First Recorded	1988
Source	Ex. USA (AZ) via Republic of South Africa
Deliberately Redistributed	Y
Year Redistributed	1988
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Pods with *Algarobius prosopis* were left in bags at strategic points in South Africa for farmers to take to their farms 1988-1989. Some Namibian farmers collected bags for their properties, though this was done unofficially. Livestock and game ingest most seeds soon after pods fall to the ground and before larvae are able to fully colonize pods. When plants are fenced from grazing animals, larvae can attack over 90% of seed pods. Even at high attack rates, sufficient seeds escape herbivory to maintain weed populations.
Research Organization	ARC-PPRI
References	113, 445, 2070, 2072

INTRODUCTION

Country Found	Oman
Year First Recorded	1985
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	54, 1879

FABACEAE
Prosopis* spp.; *Algarobius prosopis *(continued)*

INTRODUCTION	
Country Found	Saudi Arabia
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	54, 1879

INTRODUCTION	
Country Found	United Arab Emirates
Year First Recorded	1983
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Widely distributed and abundant, though impact on *Prosopis* populations unknown.
References	54, 466, 1869, 1879

FABACEAE
Prosopis* spp.; *Algarobius prosopis *(continued)*

INTRODUCTION	
Country Found	Yemen
Year First Recorded	1987
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Widely distributed and abundant. Inflicting extensive damage to exotic mesquite, but has not been recorded on its native congener, *Prosopis cinerea*, growing in close proximity. Overall impact to exotic *Prosopis* populations unknown.
References	26, 54, 1869, 1879

TABLE 3

TABLE 3

FABACEAE
Prosopis spp. *(continued)*

AGENT	
Species	*Neltumius arizonensis* (Schaeffer)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Botswana
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though common and abundant throughout range of *Prosopis* in southern parts of country, impact unknown.
References	823

INTRODUCTION	
Country Found	Namibia
Year First Recorded	2002
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed, far less common than *Algarobius prosopis*. Inferior competitor to *A. prosopis*. Seed damage by *Neltumius arizonensis* alone and in combination with *A. prosopis* insufficient to control mesquite populations.
Limiting Factors	Interspecific competition
Research Organization	ARC-PPRI
References	113, 445, 2070

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Senna surattensis* (Burm. f.) H. S. Irwin & Barneby
Past Names/Synonyms	*Cassia surattensis* Burm. f.
Origin	tropical Asia, tropical Australia
Common Name	kolomona

AGENT	
Species	*Acremonium* sp.
Past Names/Synonyms	*Cephalosporium* sp.
Classification	(Sordariomycetes: Hypocreales)

INTRODUCTION	
Country Found	Hawaii USA
Year First Recorded	1967
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1968
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Initially widespread throughout KA and killed target weeds within one year of original purposeful inoculation. Host dieback led to decreased availability of pathogen.
References	1826, 1829

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Sesbania punicea* (Cav.) Benth.
Origin	South America
Common Name	red sesbania
AGENT	
Species	*Trichapion lativentre* (Béguin-Billecocq)
Classification	(Coleoptera: Brentidae)
INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1985
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Had been brought into quarantine and was undergoing host testing when already established populations discovered. Quarantine insectary colony destroyed and field populations subsequently redistributed. Can reduce seed set by >98%, markedly reducing *Sesbania punicea* immature density throughout South Africa. Unsuccessful control agent when used alone, but in combination with *Rhyssomatus marginatus* and *Neodiplogrammus quadrivittatus*, successfully controls *Sesbania punicea* throughout South Africa.
Research Organization	ARC-PPRI
References	824, 826, 827, 829, 830, 992, 1257

FABACEAE *(continued)*

WEED	
Family	Fabaceae
Species	*Ulex europaeus* L.
Origin	western Europe
Common Name	gorse, furze
AGENT	
Species	*Aceria genistae* (Nalepa)
Classification	(Acari: Eriophyidae)
Notes	Research indicates *Aceria genistae* includes a number of distinct strains, each of which is specific to one species of plant.
INTRODUCTION	
Country Found	New Zealand
Year First Recorded	1985
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Although widespread, growth deformities it causes have little overall impact. A different strain of this species was intentionally released in 2007 but is specific to *Cytisus scoparius*.
References	720, 1064, 1144, 1698

TABLE 3

FABACEAE
Ulex europaeus *(continued)*

AGENT	
Species	*Agonopterix nervosa* (Haworth)
Past Names/Synonyms	*Depressaria nervosa* Haw., *Depressaria costosa* Haw.
Classification	(Lepidoptera: Oecophoridae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1915-1920
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Also feeds on the exotic *Cytisus scoparius* (L.) Link
References	42, 437, 820, 1634

FABACEAE
Ulex europaeus; Agonopterix nervosa *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1920s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread in OR and WA, attacking up to 40% of new terminal shoots and potentially reducing seed production, though is heavily parasitized. Present in CA and NV but uncommon. Most effective in sunny locations below 800m. More effective on this species than on *Cytisus scoparius*.
Limiting Factors	Parasitism
Other Species Attacked	Also attacks the exotic *Cytisus striatus* (Hill) Rothm.
Research Organization	USDA (7)
References	42, 332, 333, 334, 535, 820

HALORAGACEAE

WEED	
Family	Haloragaceae
Species	*Myriophyllum aquaticum* (Vell.) Verdc.
Origin	South America
Common Name	parrot's feather

AGENT	
Species	*Lysathia* sp.
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Found suppressing the weed at two lakes in Mashonaland West.
References	276, 297, 418

HALORAGACEAE *(continued)*

WEED	
Family	Haloragaceae
Species	*Myriophyllum spicatum* L.
Origin	Europe, northern Africa, Asia
Common Name	Eurasian watermilfoil

AGENT	
Species	*Acentria ephemerella* (Denis & Schiffermüller)
Past Names/Synonyms	*Acentria nivea* (Olivier)
Classification	(Lepidoptera: Crambidae)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1927
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed in northeastern North America, abundance varies. High populations successfully control weed in some lakes by preventing formation of weed canopy growth. Effects on native macrophyte communities unknown.
References	923, 1412

TABLE 3

HALORAGACEAE
Myriophyllum spicatum; Acentria ephemerella *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1949
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1999
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Though widely distributed in northeastern North America, abundance varies. High populations successfully control the weed in some lakes by preventing formation of weed canopy growth. Impact could be due to combination of this species and *Euhrychiopsis lecontei*, as damage caused by the two often difficult to differentiate. Augmentative releases in NY did not increase total moth numbers nor cause a pond-wide decline in the weed during the year of release. Fish predation may hinder augmentation efforts.
Limiting Factors	Predation
Other Species Attacked	Feeds on other aquatic species, including many native, but prefers *Myriophyllum spicatum*.
Research Organization	USDA (3), State (29,30)
References	198, 201, 359, 923, 1233, 1412

HYDROCHARITACEAE

WEED	
Family	Hydrocharitaceae
Species	*Hydrilla verticillata* (L. f.) Royle
Notes	Two biotypes (dioecious and monoecious) are present in the continental USA.
Origin	Africa, Asia, Australia, portions of Europe
Common Name	hydrilla, Florida elodea

AGENT	
Species	*Cricotopus lebetis* Sublette
Classification	(Diptera: Chironomidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Rare
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Damages the plant's apical meristems, which causes stunting and prevents hydrilla from growing to the surface.
Limiting Factors	Climate
Research Organization	State (3,35)
References	367, 368, 370, 371, 543

HYDROCHARITACEAE
Hydrilla verticillata *(continued)*

AGENT

Species	*Parapoynx diminutalis* Snellen
Classification	(Lepidoptera: Crambidae)

INTRODUCTION

Country Found	United States of America
Year First Recorded	1975
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Studied as potential biocontrol agent before its broad host range precluded its release. Subsequently arrived in USA accidentally. Larval feeding on leaves and stems can heavily damage hydrilla populations locally. However, this agent only occurs sporadically so overall impact typically low. Populations limited by cold weather.
Limiting Factors	Climate
Other Species Attacked	Feeds on numerous nontarget species.
Research Organization	USDA (3), USDA (4)
References	77, 194, 459, 590, 1292

HYPERICACEAE

WEED

Family	Hypericaceae
Species	*Hypericum androsaemum* L.
Origin	Asia Minor, Europe, northern Africa
Common Name	tutsan

AGENT

Species	*Melampsora hypericorum* (DC.) J. Schröt.
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	Australia
Year First Recorded	1991
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	post 1991
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Infection occurs readily on some weed populations but not others, likely due to genetic variation in rust and weed.
Limiting Factors	Specificity
References	228

TABLE 3

TABLE 3

HYPERICACEAE
Hypericum androsaemum; Melampsora hypericorum (continued)

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	1952
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Variable
Notes	Infection discolors and may defoliate plants. Though common and widespread throughout New Zealand, more effective on South Island than on North Island where infection rarely severe enough to have significant impact.
References	75, 761, 1054, 1058

HYPERICACEAE *(continued)*

WEED	
Family	Hypericaceae
Species	*Hypericum perforatum* L.
Origin	Asia, Europe, northern Africa
Common Name	St John's wort, St Johnswort, klamath weed, goatweed, San Juan herb

AGENT	
Species	*Chrysolina hyperici* (Forster)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Hawaii USA
Year First Recorded	1965
Source	Ex. England via Australia via USA (CA)
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Introduced accidentally with *Chrysolina quadrigemina*. Damage only minor.
Other Species Attacked	Also found feeding (though minor) on the introduced *Hypericum degeneri* Fosberg, which has since been synonymized with *H. parvulum* Greene
Research Organization	HDOA
References	402, 404, 612, 635, 1149, 1579

HYPERICACEAE
Hypericum perforatum *(continued)*

AGENT	
Species	*Chrysolina quadrigemina* (Suffrian)
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Argentina
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Only present at few infestations and in low numbers, though populations likely increasing.
References	1356, 1834

MYRTACEAE

WEED	
Family	Myrtaceae
Species	*Leptospermum laevigatum* (Gaertn.) F. Muell.
Origin	Australia
Common Name	Australian myrtle

AGENT	
Species	*Dasineura strobila* Dorchin
Classification	(Diptera: Cecidomyiidae)

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1980s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced and redistributed, though was then found to be already established. Both populations subsequently not differentiated in the literature. Initially developed very dense populations until it acquired several species of local predatory mites and parasitic wasps that caused a marked decline in population levels. In combination with *Aristaea thalassias*, at some sites may contribute to a reduction in the growth and stature of *Leptospermum laevigatum* seedlings, but overall suppression of the weed is negligible.
Limiting Factors	Predation
References	517, 654, 657, 992

TABLE 3

MYRTACEAE *(continued)*

WEED

Family	Myrtaceae
Species	*Leptospermum scoparium* J. R. Forst. & G. Forst.
Origin	Australasia
Common Name	manuka

AGENT

Species	*Eriococcus leptospermi* (Maskell)
Classification	(Hemiptera: Eriococcidae)

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1948
Source	Ex. Australia
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	More prevalent but less damaging than *Eriococcus orariensis*. Associated with sooty mold fungus (*Capnodium walteri* Sacc.) that does not kill the weed. Target plant native to New Zealand.
References	1866, 1947

MYRTACEAE
Leptospermum scoparium *(continued)*

AGENT

Species	*Eriococcus orariensis* Hoy
Classification	(Hemiptera: Eriococcidae)

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1937
Source	Ex. Australia
Deliberately Redistributed	Y
Year Redistributed	1946
Established	Yes
Abundance	Limited
General Impact	Variable
Notes	Redistributed throughout both North and South Islands. Initially widespread and caused severe damage but then declined likely due to infection by a fungus *Myriangium thwaitesii*. Now far less prevalent but still more damaging to *Leptospermum scoparium* than the related *Eriococcus leptospermi*. Associated with sooty mold fungus (*Capnodium walteri* Sacc.) that does not kill *L. scoparium*. Target plant native to New Zealand.
Limiting Factors	Disease
References	761, 1866, 1947

TABLE 3

MYRTACEAE *(continued)*

WEED	
Family	Myrtaceae
Species	*Melaleuca quinquenervia* (Cav.) S. T. Blake
Origin	Australia, New Caledonia, New Guinea
Common Name	melaleuca, broad-leaved paperbark

AGENT	
Species	*Boreioglycaspis melaleucae* Moore
Classification	(Hemiptera: Psyllidae)

INTRODUCTION	
Country Found	Puerto Rico
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Populations widely distributed throughout main island. Causes greatest damage nearest San Juan Airport and Rio Piedros, decreasing outwards.
References	1529, 1532

MYRTACEAE
Melaleuca quinquenervia (continued)

AGENT	
Species	*Oxyops vitiosa* Pascoe
Classification	(Coleoptera: Curculionidae)

INTRODUCTION	
Country Found	Bahamas
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	60% of trees experienced 25-50% damage at one site, but damage less than 10% in trees attacked at 5 other sites.
References	1529, 1533

MYRTACEAE
Melaleuca quinquenervia *(continued)*

AGENT

Species	*Puccinia psidii* G. Winter
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	United States of America
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	In combination with *Boreioglycaspis melaleucae* and *Oxyops vitiosa*, causes severe damage to mature melaleuca trees through reduced plant height, branching and biomass of surviving coppices as well as increased seedling mortality.
Other Species Attacked	Survives on numerous other native and exotic host species.
References	245, 1549, 1550, 1551

PLANTAGINACEAE

WEED

Family	Plantaginaceae
Species	*Linaria dalmatica* subsp. *dalmatica* (L.) Mill.
Past Names/Synonyms	*Linaria genistifolia* (L.) Mill. subsp. *dalmatica* (L.) Maire & Petitm., *Linaria dalmatica* (L.) Mill.
Incorrect Past Names/Synonyms	*Linaria genistifolia* (L.) Mill.
Notes	Dalmatian and yellow toadflax can both be highly variable in North America, which is compounded by their ability to hybridize. The taxonomic status of this group of species and their hybrids remains uncertain. The editors of the current catalogue follow the interpretation that *Linaria genistifolia* (L.) Mill. is distinct from *L. dalmatica* (L.) Mill. and that *L. dalmatica* consists of two subspecies, of which only one (*L. dalmatica* subsp. *dalmatica*) is invasive and weedy in North America.
Origin	Eurasia
Common Name	Dalmatian toadflax, broad-leaved toadflax
References	1534, 1687, 1820

PLANTAGINACEAE
Linaria dalmatica subsp. *dalmatica* (continued)

AGENT	
Species	*Brachypterolus pulicarius* (L.)
Classification	(Coleoptera: Kateridae)
Notes	It was initially believed different biotypes of *Brachypterolus pulicarius* had evolved sufficiently to be suited differently to *Linaria vulgaris* and *L. dalmatica*. Studies have since found no evidence to suggest that genetic variability between the host races has advanced to the point of speciation. *B. pulicarius* prefers and performs better on *L. vulgaris*; the use of *L. dalmatica* is incidental.
References	861

INTRODUCTION	
Country Found	Canada
Year First Recorded	1953
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1989
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

PLANTAGINACEAE; *Linaria dalmatica* subsp. *dalmatica*
Brachypterolus pulicarius (continued)

Country Found	Canada (continued)
Notes	Redistributed within BC on both *Linaria dalmatica* and *L. vulgaris* prior to determining it was already widespread in the province. Though widespread in Canada, prefers *Linaria vulgaris*. Found sporadically on *L. dalmatica* but appears to be too rare to have major impact on seed production. Competition between *Rhinusa antirrhini* and *Brachypterolus pulicarius* prevents additive impact in many locations.
Limiting Factors	Interspecific competition
Research Organization	AAFC
References	117, 438, 441, 724, 731, 737, 1137, 1689, 1697, 1922

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1919
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

PLANTAGINACEAE; *Linaria dalmatica* subsp. *dalmatica*
Brachypterolus pulicarius *(continued)*

Country Found	United States of America (continued)
Notes	Initially found as an unintentional introduction on *Linaria vulgaris* in NY in 1919, from where it spread throughout the USA where it has been reported on both *L. vulgaris* and *L. dalmatica*. A population found feeding exclusively on *L. dalmatica* in Canada was subsequently redistributed to *L. dalmatica* and *L. vulgaris* in the USA. The two populations are not genetically different and are likely moving between the two *Linaria* species on their own so are indistinguishable for establishment, abundance and efficacy. Though widespread in USA, prefers *Linaria vulgaris*. Even beetles collected from *L. dalmatica* preferred *L. vulgaris* in trials. Found in only limited amounts on *L. dalmatica* throughout USA, except portions of ID OR WA where much more abundant. At high densities, stunts height and causes increased branching. Overall impact to flowering and seed production minimal at most sites.
References	39, 332, 335, 861, 1105, 1127, 1364, 1365, 1689, 1697, 1991

TABLE 3

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica *(continued)*

AGENT	
Species	*Rhinusa antirrhini* (Paykull)
Past Names/Synonyms	*Gymnetron antirrhini* (Paykull)
Incorrect Past Names/Synonyms	*Gymnaetron antirrhini* (Paykull)
Classification	(Coleoptera: Curculionidae)
Notes	It is believed two “strains” of this species exist in Canada, with the intentionally introduced population preferring *Linaria dalmatica* over *L. vulgaris*, attacking even the broad-leaved form of *L. dalmatica*. Conversely, the adventive population prefers *L. vulgaris* over *L. dalmatica*. One may in fact be an unnamed sibling species.
References	213, 214, 1689

INTRODUCTION	
Country Found	Canada
Year First Recorded	1917
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1957
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued on next page)

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica; Rhinusa antirrhini *(continued)*

Country Found	Canada (continued)
Notes	Though widespread in Canada, this strain prefers *Linaria vulgaris*. Found sporadically on narrow-leaved form of *L. dalmatica*, which is least common of the two forms, but appears to be too rare to have a major impact on seed production. Competition between *Rhinusa antirrhini* and *Brachypterolus pulicarius* prevents additive impact in many locations. Parasitism may also limit impact. Additional strain introduced intentionally on *L. dalmatica* in 1993.
Limiting Factors	Specificity; Parasitism; Interspecific competition
Research Organization	AAFC
References	432, 438, 737, 784, 1689, 1697

INTRODUCTION

Country Found	United States of America
Year First Recorded	1957
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1986
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized

(continued at top of next column)

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica; Rhinusa antirrhini *(continued)*

Country Found	United States of America
Notes	This unintentional introduction referred to as the vulgaris biotype was found on *Linaria vulgaris* in 1909 and *L. dalmatica* (narrow-leaved form) by 1957. Intentionally redistributed from *L. vulgaris* to *L. dalmatica* at some locations. Only recorded accepting narrow-leaved form of *L. dalmatica*. Though attack rates on this form can be high locally, it is the least common and problematic form of *L. dalmatica*. Overall impact minimal. An additional strain (dalmatica biotype) was intentionally released against *L. dalmatica* in 1996.
Limiting Factors	Specificity
Research Organization	State (13)
References	332, 335, 1105, 1364, 1689, 1697, 1991

TABLE 3

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica *(continued)*

AGENT	
Species	*Rhinusa neta* (Germar)
Past Names/Synonyms	*Gymnetron netum* (Germar)
Incorrect Past Names/Synonyms	*Gymnaetron netum* (Germar)
Classification	(Coleoptera: Curculionidae)
References	213, 214, 441

INTRODUCTION	
Country Found	Canada
Year First Recorded	1957
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though widespread in western Canada on *Linaria vulgaris*, found only sporadically on *L. dalmatica*. Appears to be too rare to have major impact on seed production.
Research Organization	AAFC
References	432, 438, 441, 1689, 1697

PLANTAGINACEAE
Linaria dalmatica* subsp. *dalmatica*; *Rhinusa neta *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1937
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Larval feeding destroys high proportion of seeds in attacked capsules. Occurs only in scattered populations in northeastern and northwestern USA, and prefers *Linaria vulgaris* over *L. dalmatica*. Only recorded accepting narrow-leaved form of *L. dalmatica*.
Limiting Factors	Specificity
References	1364, 1697, 1991

PLANTAGINACEAE *(continued)*

WEED	
Family	Plantaginaceae
Species	*Linaria vulgaris* Mill.
Notes	Yellow and Dalmatian toadflax can both be highly variable in North America, which is compounded by their ability to hybridize. The taxonomic status of this group of species and their hybrids remains uncertain.
Origin	Eurasia
Common Name	yellow toadflax, common toadflax, butter-and-eggs

AGENT	
Species	*Brachypterolus pulicarius* (L.)
Classification	(Coleoptera: Kateridae)
Notes	It was initially believed different biotypes of *Brachypterolus pulicarius* had evolved sufficiently to be suited differently to *Linaria vulgaris* and *L. dalmatica*. Studies have since found no evidence to suggest that genetic variability between the host races has advanced to the point of speciation. *B. pulicarius* prefers and performs better on *L. vulgaris*; the use of *L. dalmatica* is incidental.
References	861

PLANTAGINACEAE
Linaria vulgaris; Brachypterolus pulicarius (continued)

INTRODUCTION	
Country Found	Canada
Year First Recorded	1953
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1989
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Redistributed within BC on both *Linaria dalmatica* and *L. vulgaris* prior to determining it was already widespread in the province. Delays flowering and seed production but has not truly changed scope or prevalence of problems associated with *Linaria vulgaris*. Competition between *Rhinusa antirrhini* and *Brachypterolus pulicarius* prevents additive impact in many locations.
Limiting Factors	Interspecific competition
Research Organization	AAFC
References	117, 439, 724, 731, 737, 1137, 1181, 1190, 1689

TABLE 3

PLANTAGINACEAE
Linaria vulgaris; Brachypterolus pulicarius (continued)

INTRODUCTION

Country Found	United States of America
Year First Recorded	1919
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Initially found as an unintentional introduction on *Linaria vulgaris* in NY in 1919, from where it spread throughout the USA where it has been reported on both *L. vulgaris* and *L. dalmatica*. A population found feeding exclusively on *L. dalmatica* in Canada was subsequently redistributed to *L. dalmatica* and *L. vulgaris* in the USA. The two populations are not genetically different and are likely moving between the two *Linaria* species on their own so are indistinguishable for establishmnet, abundance and efficacy. Widespread and abundant, preferring *Linaria vulgaris* over *L. dalmatica*. Can delay flowering and reduce seed production of *L. vulgaris* by 80% to 90% at some locations. However, overall impact minimal.
References	39, 332, 861, 1105, 1127, 1364, 1365, 1689, 1697, 1991

PLANTAGINACEAE
Linaria vulgaris (continued)

AGENT

Species	*Rhinusa antirrhini* (Paykull)
Past Names/Synonyms	*Gymnetron antirrhini* (Paykull)
Incorrect Past Names/Synonyms	*Gymnaetron antirrhini* (Paykull)
Classification	(Coleoptera: Curculionidae)
Notes	It is believed two "strains" of this species exist in Canada, with the intentionally introduced population preferring *Linaria dalmatica* over *L. vulgaris*, attacking even the broad-leaved form of *L. dalmatica*. Conversely, the adventive population prefers *L. vulgaris* over *L. dalmatica*. One may in fact be an unnamed sibling species.
References	213, 214, 1689

INTRODUCTION

Country Found	Canada
Year First Recorded	1917
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1957
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range

(continued on next page)

PLANTAGINACEAE
Linaria vulgaris; Rhinusa antirrhini *(continued)*

Country Found	Canada (continued)
Notes	This accidental strain spread naturally and artificially to all provinces but AB, MB, SK. Decreases seed production. Though widespread on *Linaria vulgaris*, satisfactory control has yet to be achieved. Competition between *Rhinusa antirrhini* and *Brachypterolus pulicarius* prevents additive impact in many locations. Parasitism may also limit impact.
Limiting Factors	Interspecific competition; Parasitism
Research Organization	AAFC
References	117, 432, 439, 724, 735, 1138, 1181, 1190, 1689, 1697

INTRODUCTION

Country Found	United States of America
Year First Recorded	1909
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Larval feeding destroys some seeds in attacked capsules. Seed reduction between 85% and 90% reported in WA, though typically much lower in other areas. Attack rates from 30% to 40% in OR had minimal impact on plant density. Overall impact limited.
Limiting Factors	Interspecific competition; Parasitism
Research Organization	State (7,9,13,15)
References	192, 332, 334, 335, 1364, 1365, 1512, 1689, 1697, 1991

PLANTAGINACEAE
Linaria vulgaris *(continued)*

AGENT

Species	*Rhinusa neta* (Germar)
Past Names/Synonyms	*Gymnetron netum* (Germar)
Incorrect Past Names/Synonyms	*Gymnaetron netum* (Germar)
Classification	(Coleoptera: Curculionidae)
References	213, 214, 441

INTRODUCTION

Country Found	Canada
Year First Recorded	1957
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread in western Canada on *Linaria vulgaris*, satisfactory control has yet to be achieved.
Research Organization	AAFC
References	117, 432, 437, 439, 1689, 1697, 1922

TABLE 3

PLANTAGINACEAE
Linaria vulgaris; Rhinusa neta *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1937
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Larval feeding destroys high proportion of seeds in attacked capsules. Occurs only in scattered populations in northeastern and northwestern USA, and prefers *Linaria vulgaris* over *L. dalmatica*.
References	1697, 1991

TABLE 3

POACEAE

WEED	
Family	Poaceae
Species	*Arundo donax* L.
Origin	Mediterranean Europe, Asia
Common Name	giant reed, carrizo cane
AGENT	
Species	*Tetramesa romana* Walker
Classification	(Hymenoptera: Eurytomidae)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Regional
Notes	Restricted to southern CA and southwestern TX. Populations slowly dispersing from two likely accidental release locations in TX. Attack rates in CA often high though variables measured indicate impact not substantial. Additional studies required.
References	525, 651, 653, 1543

PONTEDERIACEAE

WEED

Family	Pontederiaceae
Species	*Eichhornia crassipes* (Mart.) Solms
Origin	South America
Common Name	water hyacinth, waterhyacinth, Majavani, keladi bunting, phak top chawaa, sawah, ècèng, etjeng padi, luc bình, beda bin, ye padauk

AGENT

Species	*Alternaria eichhorniae* Nag Raj & Ponnappa
Classification	(Dothideomycetes: Pleosporales)

INTRODUCTION

Country Found	Egypt
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Localized

(continued at top of next column)

PONTEDERIACEAE
Eichhornia crassipes; Alternaria eichhorniae *(continued)*

Country Found	Egypt (continued)
Notes	Extensive research in glasshouse and controlled field settings indicate the pathogen can be highly virulent to attacked leaves, providing up to 100% of control. It is a poor disperser on its own and requires an extended dew period in the field, which limits its efficacy. However applications of the pathogen in oil emulsions overcame the dew requirements and were highly effective. Additional host specificity testing indicated the possibility of nontarget attack to numerous species. This pathogen has not been successfully developed into a commercial bioherbicide.
Limiting Factors	Climate
Research Organization	MUE
References	389, 937, 1044, 1642, 1643

INTRODUCTION

Country Found	Republic of South Africa
Year First Recorded	1985
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1989
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Though may be widespread in an area and may cause the death of entire leaves, appears to affect mainly older leaves with little effect on the size and density of the plants.
Research Organization	ARC-PPRI
References	273, 278, 1284

TABLE 3

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Cercospora piaropi* Tharp
Past Names/Synonyms	*Cercospora rodmanii* Conway
Classification	(Dothideomycetes: Capnodiales)
Notes	Historically two species of *Cercospora* were recognized in discussions regarding fungal biological control of *Eichhornia crassipes* (Mart.) Solms: *C. piaropi* Tharp and *C. rodmanii* Conway. Recent studies suggest the pathogens may be the same, and *C. rodmanii* should be recognized as a later synonym for the currently accepted *C. piaropi*. Though disagreements and difficulties remain in this taxonomic group, the editors of this catalogue support the idea that the *Cercospora* pathogens utilized for biological of *E. crassipes* are the same. *Cercospora piaropi* is among the most widespread and commonly found pathogens of *E. crassipes* worldwide. Consequently, only those countries where this species has been utilized/distributed intentionally are listed in this catalogue.
References	987, 1284, 1789

PONTEDERIACEAE
Eichhornia crassipes; Cercospora piaropi *(continued)*

INTRODUCTION

Country Found	Republic of South Africa
Year First Recorded	1986
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1989
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Found to be present in 1986, though not introduced intentionally. A second population was intentionally introduced (under the name *Cercospora rodmanii* Conway) in 1987. Both populations can no longer be differentiated in South Africa and have been redistributed. Severe infections can lead to death of attacked leaves. Although it occurs extensively, there has been no significant decline in weed populations.
Research Organization	ARC-PPRI
References	273, 278, 1280, 1284, 1789, 2006

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT

Species	*Neochetina bruchi* Hustache
Classification	(Coleoptera: Erirhinidae)

INTRODUCTION

Country Found	Cote d'Ivoire
Year First Recorded	1997
Source	Ex. Argentina via USA (FL) via Australia via Benin via Ghana
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Spread to the Cote d'Ivoire side of shared lagoon system by 1997 following release on the Ghana side in 1994. Introduced intentionally from Benin in 1998. Weevils have had visible impact on water hyacinth populations.
References	21, 448, 450, 939, 946, 2060

PONTEDERIACEAE
Eichhornia crassipes; Neochetina bruchi *(continued)*

INTRODUCTION

Country Found	Nigeria
Year First Recorded	1994
Source	Ex. Argentina via USA (FL) via Australia via Benin
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	This population found in southern Nigeria in 1994 from populations naturally spreading from Benin. Status unknown. Different population intentionally released in northwestern Nigeria beginning in 1995.
References	12, 388, 946

TABLE 3

PONTEDERIACEAE
Eichhornia crassipes (continued)

AGENT

Species	*Neochetina eichhorniae* Warner
Classification	(Coleoptera: Erirhinidae)

INTRODUCTION

Country Found	Cote d'Ivoire
Year First Recorded	1997
Source	Ex. Argentina via USA (FL) via Australia via Benin via Ghana
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Spread to the Cote d'Ivoire side of shared lagoon system by 1997 following release on the Ghana side in 1994. Introduced intentionally from Benin in 1998. Weevils have had visible impact on water hyacinth populations.
References	21, 448, 450, 939, 946, 2060

INTRODUCTION

Country Found	Cuba
Year First Recorded	1976
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though present in nearly all reservoirs throughout the country, overall impact unknown.
References	576, 670, 1044

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae (continued)

INTRODUCTION

Country Found	Malaysia
Year First Recorded	early 1980s
Source	Ex. Argentina via USA (FL) via Thailand
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Individuals of this unintentional population migrating from Thailand subsequently established in same regions as intentionally introduced group and populations are no longer differentiated. Though widespread throughout range, established only in low numbers; insufficient to control weed.
Research Organization	MARDI, PLANTI, DOAM
References	55, 56, 57, 71, 1326, 1327, 2040

INTRODUCTION

Country Found	Mexico
Year First Recorded	1967
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Variable

(continued on next page)

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

Country Found	Mexico (continued)
Notes	Approved and intentionally released, though was already present inadvertently since 1967. Intentional and inadvertent populations subsequently not differentiated in the literature. *Neochetina* spp. in combination provide excellent control in some water bodies, but have limited impact in others unless additional agents/control methods utilized.
References	699, 1161, 1163, 1164, 1368

INTRODUCTION	
Country Found	Mozambique
Year First Recorded	post 1985
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Spread from South Africa following releases along Crocodile River in 1985. A different population intentionally introduced into the Cahora Bassa in 1972 from unknown origins. Overall status of either population unknown.
References	798, 1494

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae *(continued)*

INTRODUCTION	
Country Found	Niger Republic
Year First Recorded	post 1993
Source	Ex. Argentina via USA (FL) via Australia
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Spread from releases on Niger River in Nigeria in 1993 700 km upstream to capital Niamey where the weevils have had visual impact on water hyacinth. Also intentionally introduced in 2011 from Benin though status of that population unknown.
References	17, 279, 946

INTRODUCTION	
Country Found	Nigeria
Year First Recorded	1994
Source	Ex. Argentina via USA (FL) via Australia via Benin
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Variable

(continued on next page)

TABLE 3

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae (continued)

Country Found	Nigeria (continued)
Notes	This population found in southern Nigeria in 1994 from populations naturally spreading from Benin. Different population intentionally released in northwestern Nigeria beginning in 1993 and southwestern Nigeria in 1996. Intentional and naturally spread populations subsequently not differentiated in the literature. Dispersed and established rapidly; within 2 years, recovered from sites as far as 200 km from closest release point along River Niger. By 2001, water hyacinth infestations visibly reduced compared to 1995 observations. In southwestern states, *Neochetina eichhorniae* widespread but not effectively controlling the weed. Formal evaluation lacking throughout Nigeria.
References	21, 946, 1499, 1510

PONTEDERIACEAE
Eichhornia crassipes; Neochetina eichhorniae (continued)

INTRODUCTION

Country Found	Republic of South Africa
Year First Recorded	1996
Source	Ex. Argentina via USA (FL) via Zimbabwe
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Variable
Notes	The first introductions had low establishment and efficacy. The second intentional introduction and this accidental third introduction increased success, though were no longer differentiated in the literature. *Neochetina eichhorniae* is now the most widespread and abundant of *Eichhornia crassipes* agents in South Africa. Control success variable by site; very successful in some areas while ineffective in others. Flooding, low winter temperatures, and high water nutrient levels limit weevil populations.
Limiting Factors	Flooding; Habitat; Climate
Research Organization	ARC-PPRI
References	208, 297, 801, 946, 1340

TABLE 3

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT	
Species	*Niphograpta albiguttalis* (Warren)
Past Names/Synonyms	*Sameodes albiguttalis* (Warren)
Classification	(Lepidoptera: Crambidae)

INTRODUCTION	
Country Found	Cuba
Year First Recorded	1995
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	242, 1044

INTRODUCTION	
Country Found	Mexico
Year First Recorded	1993
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	236, 242, 1162

PONTEDERIACEAE
Eichhornia crassipes; Niphograpta albiguttalis *(continued)*

INTRODUCTION	
Country Found	Nigeria
Year First Recorded	2008
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Likely a natural spread from neighboring Benin where this agent was intentionally released but believed to have failed establishment (additional monitoring in Benin thus warranted). To date, Nigeria populations low but spreading.
References	1383

INTRODUCTION	
Country Found	Puerto Rico
Year First Recorded	1995
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	242

TABLE 3

PONTEDERIACEAE
Eichhornia crassipes *(continued)*

AGENT	
Species	*Orthogalumna terebrantis* Wallwork
Classification	(Acari: Galumnidae)

INTRODUCTION	
Country Found	Cuba
Year First Recorded	1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Abundant and causes bronzing of hyacinth in water bodies near Havana, though overall impact unknown.
References	102, 576, 670

INTRODUCTION	
Country Found	Jamaica
Year First Recorded	1969
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	102

PONTEDERIACEAE
Eichhornia crassipes; Orthogalumna terebrantis *(continued)*

INTRODUCTION	
Country Found	Malawi
Year First Recorded	1991
Source	Ex. South America via USA (FL) via Zambia
Deliberately Redistributed	Y
Year Redistributed	1996
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Accompanied weed from Zambezi River where it was released in Zambia in 1970s. Occurs extensively and redistributed regularly. Has significant impact on water hyacinth throughout Shire, along with *Neochetina* spp., though the weed remains a problem.
Research Organization	MFD
References	103, 242, 882, 1496, 1788

INTRODUCTION	
Country Found	Mozambique
Year First Recorded	post 1971
Source	Ex. South America via USA (FL) via Zambia
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Accompanied weed from Zambezi River where it was released in Zambia in 1970s.
References	1494

PONTEDERIACEAE
Eichhornia crassipes; Orthogalumna terebrantis *(continued)*

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1989
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1990
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Imported into quarantine where died out under insectary conditions and nothing released. Adventive population discovered from unknown sources and redistributed thereafter. Patchy distribution, though abundant where present. Damage can be high locally at some sites, but overall appears not very damaging. Population spread appears limited by cold winter temperatures.
Limiting Factors	Climate
Research Organization	ARC-PPRI
References	273, 275, 297, 801, 992

PONTEDERIACEAE
Eichhornia crassipes; Orthogalumna terebrantis *(continued)*

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1968
Source	Ex. South America
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Widespread and sporadic but provides no substantial control. In combination with the fungus *Acremonium zonatum* can have locally severe but temporary impact. In combination with *Neochetina eichhorniae* can significantly reduce size and density of waterhyacinth in natural situations locally.
Research Organization	USDA (4)
References	242, 345, 452

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	1996
Source	Ex. South America via USA (FL) via Zambia
Deliberately Redistributed	Y
Year Redistributed	2012
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Spread naturally from Zambia, recently redistributed. Though well established in some locations, overall impact minimal.
References	103, 259, 345, 418, 1159

TABLE 3

TABLE 3

ROSACEAE

WEED

Family	Rosaceae
Species	*Rosa multiflora* Thunb.
Origin	Asia
Common Name	multiflora rose

AGENT

Name	Rose Rosette Disease
Classification	Virus
Notes	The etiology of this disease has not been determined. Due to conflicting reports on whether it is native to the USA or not, the editors of this catalogue are erring on the side of caution and supporting the idea the disease is not native.

INTRODUCTION

Country Found	United States of America
Year First Recorded	1941
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	post 1968
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

ROSACEAE
***Rosa multiflora;* Rose Rosette Disease** *(continued)*

Country Found	United States of America (continued)
Notes	Transmitted by *Phyllocoptes fructiphilus* and by grafting/mechanical movement. Both the mite and disease have spread widely on their own and by artificial means. Mites can only effectively transmit the disease when feeding on rapidly growing plants, which only occurs in the spring or after abundant rainfall. Dispersing mites do not infect many plants that are greater than ~100 m from heavily infested plants, so geographic spread of the disease is relatively slow except within densely populated patches. The disease takes ~ 2-6 years to kill *Rosa multiflora*. Large infected plants can still successfully produce seed that can remain viable for 40+ years. Even if new plants become infected with the disease, they will reseed before they can be killed. Therefore the disease is not an effective biocontrol agent for this weed problem. Public concern over risk of damage to commercial, ornamental and native roses has prevented efforts to further distribute the disease or mite, though both are continuing to spread on their own.
Other Species Attacked	Also infects native, ornamental and commercial roses.
Research Organization	State (47,44,46,41)
References	31, 518, 546, 547, 1448, 1806, 1897, 1995

ROSACEAE *(continued)*

WEED

Family	Rosaceae
Species	*Rubus armeniacus* Focke
Notes	*Rubus armeniacus* is part of the *Rubus fruticosus* aggregate. Though the most common form in North America presently keys to *R. armeniacus*, there is evidence that several species in the *R. fruticosus* agg. are present in North America; these are currently being defined and clarified.
Origin	Armenia
Common Name	Himalaya blackberry, Armenian blackberry

AGENT

Species	*Phragmidium violaceum* (Schultz) G. Winter
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	Canada
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Damage to date consists of small patches with foliar infections along with even smaller patches of winter defoliation. Does not yet extend through entire distribution of its host in Canada.

(continued at top of next column)

ROSACEAE
Rubus armeniacus; Phragmidium violaceum (continued)

Country Found	Canada (continued)
Limiting Factors	Climate
Other Species Attacked	Also infects the invasive *Rubus laciniatus* Willd.
References	217, 1133, 1407

INTRODUCTION

Country Found	United States of America
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Causes partial to complete defoliation and reduces tip rooting, thus decreasing canopy cover and giving competing vegetation increased opportunity for establishment. Disease severity greatest in coastal areas were extended periods of fog common. High humidity and moderate temperatures required for optimal spread and to prevent entering early dormancy. Efficacy may be impaired by parasitic fungus. This information combined with climate data indicate severe blackberry rust epidemics will be sporadic and of minor importance in most years.
Limiting Factors	Climate; Parasitism
Other Species Attacked	Also infects the invasive *Rubus laciniatus* Willd. as well as one cultivated variety of the same species. Genotypes and crosses of *R. insularis* F. Aresch. were also highly susceptible.
References	334, 1133, 1266, 1407, 1488

TABLE 3

ROSACEAE *(continued)*

WEED

Family	Rosaceae
Species	*Rubus fruticosus* L. agg.
Notes	Group of closely related species whose frequent interspecific hybridization and high phenotypic plasticity make taxonomic designations difficult. For convenience these are dealt with herein under the name *Rubus fruticosus* aggregate.
Origin	Asia, Europe
Common Name	European blackberry, blackberry

AGENT

Species	*Phragmidium violaceum* (Schultz) G. Winter
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION

Country Found	Australia
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Illegal or accidental introduction; spread naturally throughout southern Australia. Attacks all species of European blackberry in VIC except some *Rubus ulmifolius* hybrids, *R. erythrops* (=*R. rosaceus*) or *R. cissburiensis*. Disease intensity varies by *Rubus* species, location and time, rarely exceeding 40% of leaves on infected stems.

(continued at top of next column)

ROSACEAE
Rubus fruticosus; Phragmidium violaceum (continued)

Country Found	Australia (continued)
Notes (continued)	Only under ideal conditions (sufficient rainfall and humidity and mild maximum temperatures) is there significant reduction in daughter plant production and total biomass.
Limiting Factors	Climate
Research Organization	VIC State
References	188, 189, 558, 648, 886, 1158, 1261, 1264

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1990
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Impact patchy because various species under aggregate name *Rubus fruticosus* range from highly susceptible to resistant to this strain. Does not do well in areas with low rainfall (< 750 mm per year), in shade, or on plants under stress from other factors (e.g. high or low temperatures).
Limiting Factors	Climate; Habitat
Other Species Attacked	Minor spillover damage only observed once on the native *Rubus cissoides* A. Cunn.
References	1064, 1069, 1264, 1888, 1926

ROSACEAE
Rubus fruticosus *(continued)*

AGENT

Species	*Priophorus morio* (Lepeletier)
Classification	(Hymenoptera: Tenthredinidae)

INTRODUCTION

Country Found	Australia
Year First Recorded	1959
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Attacks numerous species of *Rubus* (including raspberry, blackberry, youngberry, loganberry) as well as *Sorbus* spp. Consequently the deliberate use of this species as a biological control agent should be done with caution.
References	218, 1336

ROSACEAE
Rubus fruticosus; Priophorus morio *(continued)*

INTRODUCTION

Country Found	New Zealand
Year First Recorded	1936
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Other Species Attacked	Attacks numerous species of *Rubus* (including raspberry, blackberry, youngberry, loganberry) as well as *Sorbus* spp. Consequently its deliberate use as a biological control agent should be done with caution.
References	218, 1336

ROSACEAE *(continued)*

WEED	
Family	Rosaceae
Species	*Rubus ulmifolius* Schott
Origin	Europe, northern Africa
Common Name	zarzamora, blackberry

AGENT	
Species	*Phragmidium violaceum* (Schultz) G. Winter
Classification	(Pucciniomycetes: Pucciniales)

INTRODUCTION	
Country Found	Argentina
Year First Recorded	2008
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	212, 548, 1356

SALVINIACEAE

WEED	
Family	Salviniaceae
Species	*Salvinia minima* Baker
Incorrect Past Names/Synonyms	*Salvinia rotundifolia* Willd.
Origin	Mexico, Central America, South America
Common Name	common salvinia, water fern, salvinia

AGENT	
Species	*Cyrtobagous salviniae* Calder & Sands
Past Names/Synonyms	*Cyrtobagous singularis* Hustache pars
Classification	(Coleoptera: Erirhinidae)
Notes	When first collected from salvinia in southeastern Brazil it was thought to be a biotype of *Cyrtobagous singularis* adapted to *Salvinia molesta*. Detailed comparative studies following releases in Australia helped researchers determined that it was a new, undescribed species, later to be named *Cyrtobagous salviniae*. Two ecotypes of this species are known: the larger Brazilian ecotype was intentionally released in Australia and from there to numerous other countries, including Florida USA. The second, smaller ecotype was adventively introduced to Florida.

SALVINIACEAE
Salvinia minima; Cyrtobagous salviniae (continued)

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1960
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	2005
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Intentionally redistributed on *Salvinia minima* as well as *S. molesta*. In stable *S. minima* populations, populations can grow sufficiently large to suppress plant growth. This can improve water quality and increase nutrient cycling in invaded drainages. Smaller FL ecotype more effective than Brazilian ecotype during trials. Predation by red imported fire ants may decrease weevil populations below threshold needed to provide control.
Limiting Factors	Predation
Research Organization	USDA (3)
References	216, 899, 989, 1436, 1790, 1798, 1800, 1803, 1804

SALVINIACEAE *(continued)*

WEED	
Family	Salviniaceae
Species	*Salvinia molesta* D.S. Mitch.
Incorrect Past Names/Synonyms	*Salvinia auriculata* Aubl.
Origin	Brazil
Common Name	salvinia, water fern, Kariba weed, African payal, giant salvinia

AGENT	
Species	*Cyrtobagous salviniae* Calder & Sands
Past Names/Synonyms	*Cyrtobagous singularis* Hustache pars, *Cyrtobagous* sp.
Classification	(Coleoptera: Erirhinidae)
Notes	When first collected from salvinia in southeastern Brazil it was thought to be a biotype of *Cyrtobagous singularis* adapted to *Salvinia molesta*. Detailed comparative studies following releases in Australia helped researchers determined that it was a new, undescribed species, later to be named *Cyrtobagous salviniae*. Two ecotypes of this species are known: the larger Brazilian ecotype was intentionally released in Australia and from there to numerous other countries, including Florida USA. The second, smaller ecotype was adventively introduced to Florida.

TABLE 3

SALVINIACEAE
Salvinia molesta; Cyrtobagous salviniae *(continued)*

INTRODUCTION

Country Found	United States of America
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1999
Established	No
Notes	This FL ecotype inadvertently introduced onto *Salvinia minima* by 1960 and redistributed to *S. molesta*. Initial redistributions failed due to low agent fitness following shipment and to destruction of release sites. A second population from Brazil intentionally introduced onto *S. molesta* in 2001. Accidental FL ecotype subsequently found to be more effective than Brazilian ecotype during trials; future releases of this species recommended to be of FL ecotype.
Limiting Factors	Land use
Research Organization	USDA (3,4)
References	1800, 1801, 1802, 1804

SALVINIACEAE
Salvinia molesta *(continued)*

AGENT

Species	*Cyrtobagous salviniae* Calder & Sands
Classification	(Coleoptera: Erirhinidae)
Notes	Two ecotypes of this species are known: the larger Brazilian ecotype was intentionally released in Australia and from there to numerous other countries, including Florida USA. The second, smaller ecotype was adventively introduced to Florida.

INTRODUCTION

Country Found	Zimbabwe
Year First Recorded	1991
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Observed on Lake Kariba in 1991, but a population imported from Botswana intentionally introduced to other parts of Lake in 1992. Both populations subsequently not differentiated in the literature. Brought about up to 99% control in different river systems within 2 years. *Salvinia molesta* no longer considered problematic in Zimbabwe.
References	255, 258, 262, 418, 800

SALVINIACEAE
Salvinia molesta *(continued)*

AGENT	
Species	*Cyrtobagous singularis* Hustache
Classification	(Coleoptera: Erirhinidae)

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	1984
Source	Ex. Trinidad via Zambia
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Spread naturally from releases made on the Zambian side of Lake Kariba. Although the weed has declined in some areas, evidence suggests other factors were responsible and this agent has not contributed significantly to control.
References	101, 312, 948, 1160, 1174

SALVINIACEAE
Salvinia molesta *(continued)*

AGENT	
Species	*Paulinia acuminata* (De Geer)
Classification	(Orthoptera: Pauliniidae)

INTRODUCTION	
Country Found	Mozambique
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Carried down Zambezi River from Lake Kariba on border of Zambia and Zimbabwe where this agent was intentionally released. Populations possibly contain progeny of Uruguay introduction, though most likely they arose from Trinidad population. Considered ineffective in Mozambique.
References	103, 938

TABLE 3

SCROPHULARIACEAE

WEED	
Family	Scrophulariaceae
Species	*Verbascum thapsus* L.
Origin	Eurasia
Common Name	common mullein

AGENT	
Species	*Rhinusa tetra* (Fabricius)
Past Names/Synonyms	*Gymnetron tetrum* (Fabricius)
Incorrect Past Names/Synonyms	*Gymnaetron teter* (Fabricius)
Classification	(Coleoptera: Curculionidae)
References	213, 214

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1919
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	1995
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Well established in WA where it causes extensive seed destruction. Also widespread in OR but impact unknown. Present in CA but having negligible impact. Populations limited in MT.
Other Species Attacked	Also attacks the exotic *Verbascum blattaria* L.
Research Organization	State (9,13,14,15)
References	192, 332, 333, 334, 473, 1105, 1497, 1502, 1636

TAMARICACEAE

WEED	
Family	Tamaricaceae
Species	*Tamarix* spp.
Notes	Spans several species including (among other less frequent species) *Tamarix parviflora* DC., *Tamarix canariensis* Willd., *Tamarix gallica* L., *Tamarix chinensis* Lour., *Tamarix ramosissima* Ledeb., and their hybrids. *T. chinensis*, *T. ramosissima*, and their hybrids are by far the most common species invading the southwestern USA.
Origin	Eurasia, northern Africa
Common Name	saltcedar, tamarisk

AGENT	
Species	*Diorhabda sublineata* (Lucas)
Past Names/Synonyms	*Diorhabda elongata* (Brullé) pars
Classification	(Coleoptera: Chrysomelidae)

(continued on next page)

TAMARICACEAE
***Tamarix* spp.** *(continued)*

Species	*Diorhabda sublineata* (Lucas)
Notes	Tamarisk leaf beetles were initially believed to be multiple species or subspecies that were later synonymized and differentiated only according to ecotype. These have recently been reassigned to five species, four of which have been introduced to the USA for tamarisk biological control. The different species of tamarisk leaf beetles are suited to different habitats/locations in the USA. Ecotype distinctions are retained here for the ease of combining information from different references. In 2009, a lawsuit was filed against USDA APHIS due to the possible negative impacts this biocontrol program could have on the endangered southwestern willow flycatcher by destroying some of the adventive tamarisk it utilizes where its natural habitat has been encroached. Redistributions of the tamarisk leaf beetles have been discontinued until this is resolved.
References	1644, 1822

TAMARICACEAE
Tamarix* spp.; *Diorhabda sublineata *(continued)*

INTRODUCTION	
Country Found	Mexico
Year First Recorded	2009
Source	Ex. Tunisia via USA (TX)
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Regional
Notes	Tunisian ecotype. Not intentionally released in Mexico, but spread naturally to Mexican side of Rio Grande after USA released insects on USA side. Releases occurred only following meetings where Mexican scientists and officials agreed not to oppose releases in west Texas. After crossing Rio Grande, have established strongly deep into Mexico.
Limiting Factors	Predation
References	89, 90, 461, 465

TABLE 3

VERBENACEAE

WEED	
Family	Verbenaceae
Species	*Lantana camara* L. sens. lat.
Past Names/Synonyms	*Lantana camara* subsp. *aculeata* Moldenke, *Lantana camara* var. *aculeata* (L.) Moldenke, *Lantana aculeata* L., *Lantana camara aculeata*
Notes	Comprises a complex of horticultural/ weedy hybrids and closely related species within the section Camara
Origin	Original parent species likely native to tropical Americas
Common Name	lantana, kauboica, tataramoa, bands, guphul, nagaairi, phullaki, putus, tantbi, vieille fille, chiponiwe (Shona), tick berry, bahug-bahug, sapinit, pha-ka-krong, talamoa, prickly lantana

AGENT	
Species	*Calycomyza lantanae* (Frick)
Classification	(Diptera: Agromyzidae)

INTRODUCTION	
Country Found	Cambodia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	431, 1641

VERBENACEAE
Lantana camara; Calycomyza lantanae (continued)

INTRODUCTION	
Country Found	Ethiopia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1198

INTRODUCTION	
Country Found	Federated States of Micronesia
Year First Recorded	1995
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
References	431, 451, 1302, 1308

INTRODUCTION	
Country Found	Guam
Year First Recorded	1992
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 1302, 1308

VERBENACEAE
Lantana camara; Calycomyza lantanae (continued)

INTRODUCTION	
Country Found	Indonesia
Year First Recorded	post 1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 1397

INTRODUCTION	
Country Found	Kenya
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Observed around Nairobi but likely more widespread than that.
References	418, 418

VERBENACEAE
Lantana camara; Calycomyza lantanae (continued)

INTRODUCTION	
Country Found	Madagascar
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Symptoms recognized on lantana plants by 2009, though the agent was only confirmed established in 2010. Current overall status unknown.
References	1738, 1846

INTRODUCTION	
Country Found	Malaysia
Year First Recorded	post 1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Causes severe defoliation, leading to partial control.
References	429, 431, 1397

TABLE 3

VERBENACEAE
Lantana camara; Calycomyza lantanae *(continued)*

INTRODUCTION	
Country Found	Palau
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	451, 1302

INTRODUCTION	
Country Found	Papua New Guinea
Year First Recorded	post 1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Causes only minor damage.
References	418, 418, 429, 431, 1397

INTRODUCTION	
Country Found	Philippines
Year First Recorded	1983
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Though moderately common, effect on lantana populations unknown.
References	291, 429, 515

VERBENACEAE
Lantana camara; Calycomyza lantanae *(continued)*

INTRODUCTION	
Country Found	Singapore
Year First Recorded	post 1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 1397

INTRODUCTION	
Country Found	Solomon Islands
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes only minor damage.
References	418, 429

VERBENACEAE
Lantana camara; Calycomyza lantanae (continued)

INTRODUCTION	
Country Found	Swaziland
Year First Recorded	1998
Source	Ex. Trinidad via Australia via Republic of South Africa; Ex. USA (FL, TX) via Republic of South Africa
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Two populations were released from different sources into South Africa and subsequently not differentiated in the literature or the field. The species subsequently spread naturally to neighboring Swaziland where low numbers observed, causing only minor damage.
References	280, 418, 429, 1340

INTRODUCTION	
Country Found	Taiwan
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Numbers are limited and causes only minor damage.
References	418, 431

VERBENACEAE
Lantana camara; Calycomyza lantanae (continued)

INTRODUCTION	
Country Found	Tanzania
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 2074

INTRODUCTION	
Country Found	Thailand
Year First Recorded	mid 1980s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread, impact has only been minor.
Research Organization	NBCRC
References	418, 426, 429, 1327, 1329

TABLE 3

VERBENACEAE
Lantana camara; Calycomyza lantanae *(continued)*

INTRODUCTION	
Country Found	Timor Leste
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Only causes minor damage.
References	418, 431

INTRODUCTION	
Country Found	Uganda
Year First Recorded	1997
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 2074

INTRODUCTION	
Country Found	Vanuatu
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes only minor damage.
References	204, 418

VERBENACEAE
Lantana camara; Calycomyza lantanae *(continued)*

INTRODUCTION	
Country Found	Vietnam
Year First Recorded	2002
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Numbers are limited and causes only minor damage.
References	418, 429, 431

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed, numbers low and damage appears minor.
References	418

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Cremastobombycia lantanella* Busck
Classification	(Lepidoptera: Gracillariidae)

INTRODUCTION

Country Found	Republic of South Africa
Deliberately Redistributed	N
Notes	The widespread, indigenous, African *Aristaea onychota* (Meyrick) has been incorrectly referred to as the exotic *Cremastobombycia lantanella* Busck numerous times in the biocontrol literature. Because it has not been redistributed intentionally throughout the Republic of South Africa, *A. onychota* does not warrant mention in this catalogue under the current ruling for including native organisms. However, this entry is intentionally included herein to help clarify the taxonomic confusion of *C. lantanella* in Africa.
References	1848

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Crocidosema lantana* Busck
Past Names/Synonyms	*Epinotia lantana* (Busck)
Classification	(Lepidoptera: Tortricidae)

INTRODUCTION

Country Found	Guam
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	With *Lantanophaga pusillidactyla* causes 70-80% decline in fruit production.
References	429, 481, 482

INTRODUCTION

Country Found	India
Year First Recorded	1986
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	None
Notes	Attacks high percentage of fruits, but ineffective.
References	1034, 1312, 1542

TABLE 3

VERBENACEAE
Lantana camara; Crocidosema lantana *(continued)*

INTRODUCTION	
Country Found	Northern Mariana Islands
Year First Recorded	post 1949
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Contributing to control and in conjunction with *Lantanophaga pusillidactyla* is the most effective agent in the region.
References	429, 481, 482

INTRODUCTION	
Country Found	Palau
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	In conjunction with *Lantanophaga pusillidactyla* is the most effective lantana agent in region.
References	429, 481, 482

VERBENACEAE
Lantana camara; Crocidosema lantana *(continued)*

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1961
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced in 1984, though now believed this species already present accidentally prior to 1961. Both populations not differentiated in the literature. Though widely distributed throughout South Africa, populations typically low, due at least in part to parasitism. Contributes to the damage of lantana flowers throughout its range, although insufficient to reduce the plant's weed status.
References	62, 65, 66, 429, 992

INTRODUCTION	
Country Found	Vanuatu
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Only observed in low numbers; unlikely to be very damaging. Additional surveys warranted.
References	204, 418

VERBENACEAE
Lantana camara; Crocidosema lantana *(continued)*

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed, numbers low and damage appears minor.
References	418

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Hypena laceratalis* Walker
Incorrect Past Names/Synonyms	*Hypena strigata* (Fabricius), *Hypena jussalis* Walker, *Hypena strigalis*
Classification	(Lepidoptera: Erebidae)

INTRODUCTION	
Country Found	Cape Verde Islands
Year First Recorded	2003
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 1869, 1940

INTRODUCTION	
Country Found	New Caledonia
Year First Recorded	1979
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread, causes only minor damage.
References	418, 429, 698, 1940

VERBENACEAE
Lantana camara; Hypena laceratalis *(continued)*

INTRODUCTION	
Country Found	Northern Mariana Islands
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	None
Notes	Overall impact insignificant.
References	429, 481, 482, 1940

INTRODUCTION	
Country Found	Papua New Guinea
Year First Recorded	2003
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Causes only minor damage.
References	418, 429, 431, 1940

INTRODUCTION	
Country Found	Philippines
Year First Recorded	2003
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Causes only minor damage.
References	418, 429, 1940

VERBENACEAE
Lantana camara; Hypena laceratalis *(continued)*

INTRODUCTION	
Country Found	Taiwan
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Suspected present, but not formally confirmed.
References	418

INTRODUCTION	
Country Found	Vanuatu
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Populations limited and localized, causing minimal damage.
References	418

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Lantanophaga pusillidactyla* (Walker)
Past Names/Synonyms	*Platyptilia pusillidactyla* Walker
Classification	(Lepidoptera: Pterophoridae)

INTRODUCTION	
Country Found	Australia
Year First Recorded	1936
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed throughout range of weed. Populations fluctuate seasonally, peaking in summer and autumn in warm, moist areas but waning over winter and in temperate areas. Causes only minor damage.
References	414, 422, 429

INTRODUCTION	
Country Found	Guam
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	With *Crocidosema lantana* causes 70-80% decline in fruit production.
Research Organization	UOG
References	429, 481, 482, 1300, 1317

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Hong Kong
Year First Recorded	1900
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Intentionally introduced, though the agent was already established inadvertently. Populations subsequently not differentiated. Current overall status unknown.
References	429, 635, 1940

INTRODUCTION	
Country Found	India
Year First Recorded	1919
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Densities too low to provide any significant control, likely a result of natural enemies.
Limiting Factors	Parasitism; Predation
Other Species Attacked	Also breeds in the native *Lantana indica* Roxb. and the exotic *Lippia geminata* H. B. & K.
References	1034, 1312, 1542, 1546

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Israel
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	96

INTRODUCTION	
Country Found	Italy
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	96

INTRODUCTION	
Country Found	Morocco
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	96

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Myanmar
Year First Recorded	1920
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though populations widespread when first documented in Myanmar, abundance and impact already greatly hindered by parasitoids and predators.
Limiting Factors	Parasitism; Predation
Other Species Attacked	Also breeds in the native *Lantana indica* Roxb. and the exotic *Lippia geminata* H. B. & K.
References	418, 429, 431, 1546

INTRODUCTION	
Country Found	New Zealand
Year First Recorded	1982
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	While both adults and larvae feed on flowers, thought to have limited impact in New Zealand.
References	526, 761, 1055, 1072

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Northern Mariana Islands
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Contributes to partial or seasonal control.
References	429, 481, 482, 1302, 1940

INTRODUCTION	
Country Found	Papua New Guinea
Year First Recorded	2003
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Causes only minor damage.
References	429

INTRODUCTION	
Country Found	People’s Republic of China
Year First Recorded	2011
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Having only minor impact.
References	418, 1221

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Portugal
Year First Recorded	2004
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	96

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1904
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Present adventively since at least 1904. Abundance varies from rare to frequent, but is typically low throughout South Africa. Damage restricted to only a section of entire flower head, allowing undamaged flowers on the infested cluster to mature and set fruit. Consequently impact is negligible. Populations limited by parasitism in some places. A different population was intentionally introduced in 1984 but failed to establish.
Limiting Factors	Parasitism
Other Species Attacked	Also attacks native *Lippia* spp.
References	62, 66, 429, 992, 1340

TABLE 3

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Spain
Year First Recorded	2000
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	96, 985

INTRODUCTION	
Country Found	Sri Lanka
Year First Recorded	1920
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	418, 1546, 2044

INTRODUCTION	
Country Found	Taiwan
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Having only minor impact.
References	418, 431

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Thailand
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Having only minor impact.
References	418

INTRODUCTION	
Country Found	Timor Leste
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Only causes minor damage.
References	418, 431

VERBENACEAE
Lantana camara; Lantanophaga pusillidactyla *(continued)*

INTRODUCTION	
Country Found	Zambia
Year First Recorded	1982
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Impact typically negligible.
References	1117

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2012
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed, numbers low and damage appears minor.
References	418

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Neogalea sunia* (Guenée)
Classification	(Lepidoptera: Noctuidae)

INTRODUCTION	
Country Found	New Caledonia
Year First Recorded	1977
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Rare
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Single specimen collected. Causes only minor damage.
References	429, 698

TABLE 3

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Octotoma scabripennis* Guérin-Méneville
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Swaziland
Year First Recorded	2005
Source	Ex. Mexico via Hawaii USA via Australia via Republic of South Africa
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Plant damage rare to occasional; establishment and abundance limited.
References	280, 1132

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Ophiomyia camarae* Spencer
Classification	(Diptera: Agromyzidae)

INTRODUCTION	
Country Found	Argentina
Year First Recorded	1976
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1865

INTRODUCTION	
Country Found	Ethiopia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Impact has not been formally evaluated but is likely minimal due to the sparse abundance observed and to its recent introduction.
References	1847, 1849

VERBENACEAE
Lantana camara; Ophiomyia camarae *(continued)*

INTRODUCTION	
Country Found	Kenya
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	2005

INTRODUCTION	
Country Found	Madagascar
Year First Recorded	2009
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1846, 1849

INTRODUCTION	
Country Found	Mozambique
Year First Recorded	2009
Source	Ex. USA (FL) via Republic of South Africa
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Has flourished in the hot and humid, low altitude, coastal regions.
References	1669, 1846, 1848, 1849

VERBENACEAE
Lantana camara; Ophiomyia camarae *(continued)*

INTRODUCTION	
Country Found	Swaziland
Year First Recorded	2005
Source	Ex. USA (FL) via Republic of South Africa
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Established widely throughout range though abundance and damage typically just moderate.
References	1132, 1669, 1846

INTRODUCTION	
Country Found	Tanzania
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1849

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widely distributed, damage appears minor.
References	418, 1738, 1846

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Ophiomyia lantanae* (Froggatt)
Past Names/Synonyms	*Agromyza lantanae* Froggatt
Incorrect Past Names/Synonyms	*Ophiomyia rhodesiensis*
Classification	(Diptera: Agromyzidae)

INTRODUCTION

Country Found	Argentina
Year First Recorded	1976
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1865

INTRODUCTION

Country Found	Ghana
Year First Recorded	1970
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Minor damage only.
References	312, 429, 1618

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION

Country Found	India
Year First Recorded	1921
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	None
Notes	Deliberately released in 1921 without knowledge the agent was already established following this (likely) unintentional introduction. Both populations subsequently not distinguished in the literature. Attacks high percentage of fruits, but ineffective as germination is not affected.
References	1542, 1548, 1747

INTRODUCTION

Country Found	Indonesia
Year First Recorded	1955
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Established but causes only minor damage.
References	418, 429, 939, 1715

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Kenya
Year First Recorded	1958
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Following intentional release in 1958, it was found already present in Kenya. Intentional and unintentional populations were subsequently not differentiated. Though widespread throughout country, impact is minor as fruit attack frequently does not kill the embryo in the seeds. Still present during recent surveys.
References	418, 429, 667, 668

INTRODUCTION	
Country Found	Madagascar
Year First Recorded	1968
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	668, 1846

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Malaysia
Year First Recorded	1973
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widespread but not providing effective control.
References	429, 431, 1397, 1717

INTRODUCTION	
Country Found	Myanmar
Year First Recorded	1934
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Causes only minor damage.
References	429, 1717, 1747

INTRODUCTION	
Country Found	Northern Mariana Islands
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Frequently infests over 50% of pods, contributing to partial or seasonal control.
References	481, 482

TABLE 3

TABLE 3

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Palau
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Medium
Geographical Scale of Impact	Regional
Notes	Abundant on Anagaur where it provides partial or seasonal control.
References	429, 481, 482

INTRODUCTION	
Country Found	Papua New Guinea
Year First Recorded	1973
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 671

INTRODUCTION	
Country Found	Philippines
Year First Recorded	1983
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Relatively little effect upon seed viability.
References	291, 429

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Republic of South Africa
Year First Recorded	1961
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Intentionally introduced in 1961. Following release it was found that a species already present in the country had been wrongly identified as *Ophiomyia rhodesiensis* and was in fact *O. lantanae*. Intentional and unintentional populations were subsequently not differentiated as the unintentional population was already widespread. Now widely established and abundant, despite parasitism. Contributes to seed destruction but unlikely to impact spread of the weed, though additional study is warranted. Shows no preference for different lantana varieties.
Limiting Factors	Parasitism
Research Organization	ARC-PPRI
References	65, 66, 267, 271, 280, 1399

INTRODUCTION	
Country Found	Samoa
Year First Recorded	1940
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1611

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Singapore
Year First Recorded	1973
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 1397, 1717

INTRODUCTION	
Country Found	Sri Lanka
Year First Recorded	1933
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 1312, 1717, 1747

INTRODUCTION	
Country Found	Swaziland
Year First Recorded	1998
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range

(continued at top of next column)

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

Country Found	Swaziland (continued)
Notes	Though this species was intentionally introduced into South Africa in 1961, following release it was found that a species already present had been wrongly identified as *Ophiomyia rhodesiensis* and was in fact *O. lantanae*. Because the unintentional population was already widespread in the 1960s, it is likely this population in Swaziland was already inadvertently present as well and was not a result of natural spread from the 1961 intentional introduction into South Africa. In Swaziland, it is established widely throughout the range of the weed, though abundance and damage typically are limited to moderate.
References	280, 418, 429, 1132

INTRODUCTION	
Country Found	Taiwan
Year First Recorded	1958
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1610

TABLE 3

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Tanzania
Year First Recorded	1960
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Impact only minor; no evidence of checking lantana spread.
References	429, 1676

INTRODUCTION	
Country Found	Thailand
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Damage only minor.
References	418

INTRODUCTION	
Country Found	Timor Leste
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Only causes minor damage.
References	418, 431

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Tonga
Year First Recorded	1956
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1611

INTRODUCTION	
Country Found	Uganda
Year First Recorded	1960
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Impact only minor; no evidence of checking lantana spread.
References	429, 1716

INTRODUCTION	
Country Found	Vanuatu
Year First Recorded	1983
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	289, 418, 429

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Vietnam
Year First Recorded	1960
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Causes only minor damage.
References	418, 429, 431, 1610

INTRODUCTION	
Country Found	Zambia
Year First Recorded	1982
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Impact typically negligible.
References	1117

VERBENACEAE
Lantana camara; Ophiomyia lantanae *(continued)*

INTRODUCTION	
Country Found	Zimbabwe
Year First Recorded	1971
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though widespread, of little importance in Zimbabwe as only a small proportion of berries on any one plant are ever attacked, and fruit is set very freely.
References	418, 429, 668

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Orthezia insignis* Browne
Classification	(Hemiptera: Ortheziidae)
Notes	Though it was used intentionally in Hawaii, it is polyphagous and very damaging to many plant species and should not be considered for additional use as a biocontrol agent.
References	429

INTRODUCTION	
Country Found	Ascension Island
Year First Recorded	1980s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Heavy
Geographical Scale of Impact	Widespread throughout range
Notes	Causes widespread and severe damage; probably adding to control by *Teleonemia scrupulosa*. This agent has a wide host range, but has thus far not been found damaging native species on Ascension. It is polyphagous and very damaging to many plant species and should not be considered for additional use as a biocontrol agent.
References	429, 431, 582, 584

VERBENACEAE
Lantana camara; Orthezia insignis *(continued)*

INTRODUCTION	
Country Found	Cape Verde Islands
Year First Recorded	2003
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	429, 431, 1869

INTRODUCTION	
Country Found	Ethiopia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1198

INTRODUCTION	
Country Found	India
Year First Recorded	1915
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	None

(continued on next page)

VERBENACEAE
Lantana camara; Orthezia insignis *(continued)*

Country Found	India (continued)
Notes	First identified in India in 1915, a second population intentionally introduced in 1921. Both populations subsequently not differentiated in the literature. At one point agent was targeted for eradication once its polyphagous nature determined, but efforts failed and agent now firmly established in India. Does not control weed.
Other Species Attacked	Feeds on several desirable nontarget species.
References	1034, 1312, 1546

INTRODUCTION

Country Found	Kenya
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1302

INTRODUCTION

Country Found	Mauritius
Year First Recorded	1899
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Variable

(continued at top of next column)

VERBENACEAE
Lantana camara; Orthezia insignis *(continued)*

Country Found	Mauritius (continued)
Notes	Polyphagous pest whose populations vary depending on species and location. Causes considerable lasting damage to lantana, especially in drier regions.
Other Species Attacked	Polyphagous scale insect in Mauritius found on some crops such as *Solanum melongena* L. There are no records of *Orthezia insignis* damaging native plant species in Mauritius, but it would not be surprising if this occurred occasionally.
References	469, 586, 1677

INTRODUCTION

Country Found	Republic of South Africa
Year First Recorded	1898
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Medium
Geographical Scale of Impact	Widespread throughout range
Notes	Moderately abundant in South Africa. Sucks sap from stems of various plant species, with a preference for lantana and even certain lantana varieties. Its polyphagous nature precludes intentional use.
Limiting Factors	Specificity
Other Species Attacked	A known polyphagous species, often considered a pest. Found on the native *Priva meyeri* Jaub. & Spach and native *Lippia* spp. growing near *Lantana camara* L. sens. lat.
References	159, 429, 786, 1244, 1849

VERBENACEAE
Lantana camara; Orthezia insignis *(continued)*

INTRODUCTION	
Country Found	Sri Lanka
Year First Recorded	1893
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Heavy
Geographical Scale of Impact	Localized
Notes	Affected shoots turn black and die back, however the variable distribution of the insect in patches not considered effective overall.
References	429, 431, 1034, 1312, 1546

INTRODUCTION	
Country Found	St Helena
Year First Recorded	1980s
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Causing widespread damage to the weed but also to endemic *Commidendrum robustum*. The coccinelid *Hyperaspis pantherina* was released by IIBC in an attempt to save the native tree species. *Orthezia insignis* has been under successful biological control since 1993/94 and is unlikely to have any impact on *L. camara* in the future.
References	429, 582, 583

VERBENACEAE
Lantana camara; Orthezia insignis *(continued)*

INTRODUCTION	
Country Found	Swaziland
Year First Recorded	2005
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Medium
Geographical Scale of Impact	Localized
Notes	Establishment limited, but damage moderate where agents occur.
References	1132

VERBENACEAE
Lantana camara *(continued)*

AGENT

Species	*Phenacoccus parvus* Morrison
Classification	(Hemiptera: Pseudococcidae)
Notes	Recorded from the Caribbean, Central America, and South America on many hosts. It has been recorded recently from Africa, throughout the South Pacific, Australia, and southern Asia. Due to the widespread distribution of this species, only the country where it has been utilized/distributed intentionally (Australia) is listed in this catalogue.
References	1970

INTRODUCTION

Country Found	Australia
Year First Recorded	1988
Source	Ex. Unknown
Deliberately Redistributed	Y
Year Redistributed	post 1988
Established	Yes
Abundance	Variable
General Impact	Variable
Notes	Deliberately redistributed by graziers. During dry years populations increase and cause significant dieback of lantana plants. Populations remain low and found only in isolated areas during normal rainfall patterns.
Limiting Factors	Climate

(continued at top of next column)

VERBENACEAE
Lantana camara; Phenacoccus parvus *(continued)*

Country Found	Australia (continued)
Other Species Attacked	At high population levels in Australia has been reported attacking several economically important plants such as tomato and aubergine and is therefore not recommended for re-distribution or release in other countries. Where it occurs, it is particularly common on Solanaceae and on *Lantana camara* L. sens. lat.
Research Organization	Private
References	414, 418, 422, 429, 1753, 1970

TABLE 3

VERBENACEAE
Lantana camara *(continued)*

AGENT	
Species	*Teleonemia scrupulosa* Stål
Classification	(Hemiptera: Tingidae)

INTRODUCTION	
Country Found	India
Year First Recorded	1941
Source	Ex. Mexico via Hawaii USA via Fiji via Australia
Deliberately Redistributed	Y
Year Redistributed	1972
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Recommendation made not to release this insect but it escaped from the laboratory and established. Spread was assisted between 1972 and 1976 and is now widespread in all parts of the country. Can lead to defoliation but is of limited control value. Populations limited by egg parasitoid.
Limiting Factors	Parasitism
Other Species Attacked	Fed upon teak in laboratory, but not observed on this plant in the field.
Research Organization	FRI
References	615, 1034, 1312, 1542, 1548, 1940

VERBENACEAE
Lantana camara; Teleonemia scrupulosa *(continued)*

INTRODUCTION	
Country Found	Indonesia
Year First Recorded	1940
Source	Ex. Mexico via Hawaii USA via Fiji via Australia
Deliberately Redistributed	Y
Year Redistributed	1954
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Recommendation made not to release this insect, but escaped from laboratory and established well in 10 years. Spread artificially assisted in 1954; now well established but of limited control value.
Other Species Attacked	Fed upon teak in laboratory, but has not significantly damaged this plant in the field.
Research Organization	DAI
References	429, 1548, 1940

INTRODUCTION	
Country Found	Malaysia
Year First Recorded	1971
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	291, 429, 431, 1548

VERBENACEAE
Lantana camara; Teleonemia scrupulosa (continued)

INTRODUCTION	
Country Found	Mauritius
Year First Recorded	1952
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Variable
Notes	Caused extensive damage and prevented spread of the weed until 1964. Biocontrol program expanded when weed began to spread. Now, along with *Hypena laceratalis* and *Salbia haemorrhoidalis*, is commonly found and causes extensive damage to lantana in drier areas and periods.
Research Organization	MAM
References	586, 668, 856, 1677

INTRODUCTION	
Country Found	Namibia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1672

VERBENACEAE
Lantana camara; Teleonemia scrupulosa (continued)

INTRODUCTION	
Country Found	Philippines
Year First Recorded	1983
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Variable
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Abundance varies by region. Overall impact unknown.
References	291, 429

INTRODUCTION	
Country Found	Swaziland
Year First Recorded	1998
Source	Ex. Unknown via Republic of South Africa
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Localized
Notes	Spread naturally from South Africa where numerous populations deliberately introduced from variety of sources. Unclear which population (or mixture of all) spread to Swaziland. Establishment very limited with minimal damage attributed to this insect.
References	280, 418, 429, 1132

VERBENACEAE
Lantana camara; Teleonemia scrupulosa (continued)

INTRODUCTION	
Country Found	Thailand
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Limited
General Impact	Slight
Geographical Scale of Impact	Unknown
Notes	Impact only minor in the few regions surveyed.
References	288, 418

INTRODUCTION	
Country Found	Timor Leste
Year First Recorded	2006
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Variable
Notes	Damage is seasonal.
References	418, 431

VERBENACEAE
Lantana camara (continued)

AGENT	
Species	*Uroplata girardi* Pic
Classification	(Coleoptera: Chrysomelidae)

INTRODUCTION	
Country Found	Ethiopia
Year First Recorded	2010
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1198

VERBENACEAE *(continued)*

WEED	
Family	Verbenaceae
Species	*Lantana montevidensis* (Spreng.) Briq.
Origin	South America
Common Name	creeping lantana

AGENT	
Species	*Lantanophaga pusillidactyla* (Walker)
Past Names/Synonyms	*Platyptilia pusillidactyla* Walker
Classification	(Lepidoptera: Pterophoridae)

INTRODUCTION	
Country Found	Australia
Year First Recorded	1936
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Widely distributed on both weedy and horticultural forms of *Lantana montevidensis* throughout Australia. Causes only minor damage.
References	414, 415, 422, 429

VERBENACEAE
Lantana montevidensis; Lantanophaga pusillidactyla (continued)

INTRODUCTION	
Country Found	Italy
Year First Recorded	2007
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	96

TABLE 3

ZYGOPHYLLACEAE

WEED

Family	Zygophyllaceae
Species	*Tribulus cistoides* L.
Origin	tropical and sub-tropical Africa, Indo-Australia
Common Name	false puncturevine, nohu, Jamaican feverplant, Jamaican fever vine, puncturevine, bur-not

AGENT

Species	*Microlarinus lareynii* (Jacquelin du Val)
Classification	(Coleoptera: Curculionidae)

INTRODUCTION

Country Found	Mexico
Year First Recorded	1976
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	45

ZYGOPHYLLACEAE
Tribulus cistoides *(continued)*

AGENT

Species	*Microlarinus lypriformis* (Wollaston)
Classification	(Coleoptera: Curculionidae)

INTRODUCTION

Country Found	Bahamas
Year First Recorded	1980
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	104, 105, 288

INTRODUCTION

Country Found	Colombia
Year First Recorded	1973
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	1128

ZYGOPHYLLACEAE
Tribulus cistoides; Microlarinus lypriformis *(continued)*

INTRODUCTION	
Country Found	Curaçao
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	104

INTRODUCTION	
Country Found	Jamaica
Year First Recorded	1979
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	102, 104, 288

INTRODUCTION	
Country Found	Mexico
Year First Recorded	1973
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	45, 102, 104, 288, 1128

ZYGOPHYLLACEAE
Tribulus cistoides; Microlarinus lypriformis *(continued)*

INTRODUCTION	
Country Found	Puerto Rico
Year First Recorded	1987
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	High
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	104

INTRODUCTION	
Country Found	United States of America
Year First Recorded	1971
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Moderate
General Impact	Slight
Geographical Scale of Impact	Widespread throughout range
Notes	Though introduced intentionally against *Tribulus terrestris* in other states in 1961, this population on *T. cistoides* adventive of unknown origin. Causing some damage but suffers attack from native parasites.
Limiting Factors	Parasitism
References	288, 1722

TABLE 3

ZYGOPHYLLACEAE
Tribulus cistoides; Microlarinus lypriformis *(continued)*

INTRODUCTION	
Country Found	Venezuela
Year First Recorded	1984
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Yes
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
References	104

ZYGOPHYLLACEAE *(continued)*

WEED	
Family	Zygophyllaceae
Species	*Tribulus terrestris* L.
Origin	Mediterranean, western Asia, Africa
Common Name	puncturevine, ground bur nut, bull's head, goat head, caltrop

AGENT	
Species	*Microlarinus lareynii* (Jacquelin du Val)
Classification	(Coleoptera: Curculionidae)

INTRODUCTION	
Country Found	La Réunion
Year First Recorded	2001
Source	Ex. Unknown
Deliberately Redistributed	N
Established	Unknown
Abundance	Unknown
General Impact	Unknown
Geographical Scale of Impact	Unknown
Notes	Represented by a single specimen collected in 2001, but establishment has not been confirmed; may just be a short-lived introduction.
References	1465, 1631

TABLE 4. BIOHERBICIDES

*Please note that although some references indicate *Mycoleptodiscus terrestris* (Gerd.) Ostaz. was registered as Aqua Fyte for the control of *Myriophyllum spicatum* L. in the USA, official registration has not occured. Consequently this pathogen/weed system has been intentionally removed from this table.

Registration Information

As stated in the introduction, Table 4 entries are first listed alphabetically according to the name of the biological control agent and secondarily by target weed name. Entries are then listed alphabetically according to the country in which a bioherbicide has been registered and are accompanied by the first year of registration with the appropriate authority. Also included are the name of the registered product(s), the research organization(s) involved, and registration notes, where applicable. The location and host source of isolated material is included for each entry.

Impact Information

Bioherbicide impact is represented by six categories: None, Slight, Medium, Heavy, Variable, and Unknown. All impact is assumed to occur only on a localized scale following the application. Because the choices selected for impact are subjective estimates by the editors, an additional notes section is provided which includes a brief summary of each bioherbicide system.

Commercialization and Current Status

The commercial status of the organism is given, along with the name of the commercialized product, the company or institution responsible and notes, if applicable. If the biocontrol agent has been observed in the field attacking plant species other than those targeted for control, this information is included. Likewise, factors believed to limit the efficacy of any particular release are listed when known.

TABLE 4

Alternaria destruens

BIOHERBICIDE	
Species	*Alternaria destruens* E.G. Simmons
Classification	(Dothideomycetes: Pleosporales)
WEED	
Species	*Cuscuta* spp.
Family	Convolvulaceae
Origin	North America
Common Name	dodder
REGISTRATION/USE	
Country of Registration	United States of America
Year of Registration	2005
Registered Name	Smolder G, Smolder WP
Registration Notes	Registered as bioherbicide formulations Smolder G and Smolder WP.
Isolation Source	*Cuscuta gronovii* Willd., USA (WI)
Research Organization	State (50,3,51)
General Impact	Variable
Impact Notes	Initial trials indicated soil applied granular product suppresses dodder at early stages of growth while spray formulation suppresses dodder vines that have reached top of cash crop canopy. To function effectively, requires moist environment and adequate temperature during infection period. Subsequent field trials unsuccessful.
Commercially Available	No
Commercialization Company or Institution	United Agri-Products
Commercialization Notes	Despite being registered, trials with Smolder were unsuccessful in both MA and WI. No longer registered.
Limiting Factors	Climate
References	252, 330, 1484, 1603, 1856, 1859

Chondrostereum purpureum

BIOHERBICIDE	
Species	*Chondrostereum purpureum* (Pers.) Pouzar
Classification	(Agaricomycetes: Agaricales)
WEED	
Species	*Acer* spp., *Alnus* spp., *Betula* spp., *Populus* spp., *Prunus* spp.
Family	Multiple Families
Origin	North America
Common Name	birch, pin-cherry, poplar/aspen, red maple, sugar maple, speckled alder
REGISTRATION/USE	
Country of Registration	Canada
Year of Registration	2002
Registered Name	Myco-Tech™ Paste, *Chondrostereum purpureum* (HQ1)
Registration Notes	The technical active ingredient *Chondrostereum purpureum* (HQ1) and the end-use product Myco-Tech™ Paste were granted full registration against weedy deciduous brush species in rights-of-way.
Isolation Source	Strain HQ1, *Betula papyrifera* Marshall, Canada (QC)
Research Organization	PFC
General Impact	Heavy
Impact Notes	Highly virulent on freshly cut stumps, significantly reducing re-sprouting.
Commercially Available	Yes
Commercialization Company or Institution	Myco-Forestis Corporation
Other Species Attacked	Pathogen of various deciduous trees including species of *Acer*, *Aesculus*, *Alnus*, *Betula*, *Crataegus*, *Fagus*, *Larix*, *Malus*, *Ostrya*, *Picea*, *Populus*, *Prunus*, *Salix*, and *Sorbus*.
References	156, 1064, 1484

Chondrostereum purpureum (continued)

REGISTRATION/USE

Country of Registration	United States of America
Year of Registration	2005
Registered Name	Myco-Tech™ Paste, HQ1 Concentrate
Registration Notes	Registered as two bioherbicide formulations under the names HQ1 Concentrate and Myco-Tech™ Paste for hardwood species growing in rights-of-way, wood lots and conifer plantations.
Isolation Source	Strain HQ1, *Betula papyrifera* Marshall, Canada (QC)
Research Organization	PFC
General Impact	Heavy
Impact Notes	Highly virulent on freshly cut stumps, significantly reducing re-sprouting.
Commercially Available	Yes
Commercialization Company or Institution	Myco-Forestis Corporation
Other Species Attacked	Pathogen of various deciduous trees including species of *Acer*, *Aesculus*, *Alnus*, *Betula*, *Crataegus*, *Fagus*, *Larix*, *Malus*, *Ostrya*, *Picea*, *Populus*, *Prunus*, *Salix*, and *Sorbus*.
References	156, 1064, 1484, 1855

Chondrostereum purpureum (continued)

WEED

Species	*Alnus rubra* Bong., *Alnus viridis* (Chaix) DC. subsp. *sinuata* (Regel) Á. Löve & D. Löve
Family	Betulaceae
Origin	North America
Common Name	red alder, Sitka alder

REGISTRATION/USE

Country of Registration	Canada
Year of Registration	2004
Registered Name	Chontrol Paste, CP-PFC2139
Registration Notes	Registered as bioherbicide formulations CP-PFC2139 and Chontrol Paste, temporarily in 2004 and fully in 2007.
Isolation Source	Isolate PFC2139, *Alnus rubra* Bong., Canada (BC)
Research Organization	PFC
General Impact	Heavy
Impact Notes	Highly virulent on freshly cut stumps, inhibiting stump resprouting and typically leading to death within two years.
Commercially Available	Yes
Commercialization Company or Institution	MycoLogic Inc.
References	94, 156, 157, 1064, 1485, 1486

Chondrostereum purpureum (continued)

WEED	
Species	*Alnus* spp., *Populus* spp.
Family	Multiple Families
Origin	North America
Common Name	alder, aspen and other hardwood trees and shrubs

REGISTRATION/USE	
Country of Registration	United States of America
Year of Registration	2004
Registered Name	Chontrol Paste, CP-PFC2139
Registration Notes	Registered as bioherbicide formulations CP-PFC 2139 and Chontrol Paste for hardwood trees and shrubs growing in rights-of-way and forests.
Isolation Source	Isolate PFC2139, *Alnus rubra* Bong., Canada (BC)
Research Organization	PFC
General Impact	Heavy
Impact Notes	Highly virulent on freshly cut stumps, inhibiting stump resprouting and typically leading to death within two years.
Commercially Available	Yes
Commercialization Company or Institution	MycoLogic Inc.
References	94, 156, 157, 1064, 1485, 1854

Chondrostereum purpureum (continued)

WEED	
Species	*Prunus serotina* Ehrh.
Family	Rosaceae
Origin	North America
Common Name	black cherry, American bird cherry

REGISTRATION/USE	
Country of Registration	Netherlands
Year of Registration	1997 Market Date
Registered Name	BioChon
Registration Notes	Produced and sold in The Netherlands as BioChon from 1997-2000, but was not formally registered. When registration according to the directive 91/414 EEC was demanded, the company, Koppert B.V., withdrew the product from the market because costs related with the production of safety data required for registration would have outranged the possible commercial turnover by far.
Isolation Source	Unknown species, Netherlands
Research Organization	WUR
General Impact	Heavy
Impact Notes	Generally resulted in death rate of 95% in inoculated plants two years after treatment.
Commercially Available	No
Commercialization Company or Institution	Koppert B.V.
Commercialization Notes	Product withdrawn from market in 2000 due to low sales and regulatory concerns.
Other Species Attacked	Also effective against *Populus* spp.
References	444, 534, 1064

TABLE 4

Colletotrichum acutatum f. sp. *hakeae*

BIOHERBICIDE

Species	*Colletotrichum acutatum* J.H. Simmonds f. sp. *hakeae* Lubbe, Denman, P. F. Cannon, J. Z. Groenew., Lampr. & Crous
Incorrect Past Names/Synonyms	*Colletotrichum gloeosporioides* (Penz.) Sacc., *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f. sp. *aeschynomene*
Classification	(Sordariomycetes: Incertae sedis)
Notes	Listed under *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f. sp. *aeschynomene* in previous versions of the catalogue, though this appears incorrect as f. sp. *aeschynomene* has been isolated from an unrelated plant, *Aeschynomene virginica* (L.) B.S.P. in the USA. All early South African references refer to this pathogen simply as *C. gloeosporioides* (Penz.) Sacc. The pathogen has since been assigned to *Colletotrichum acutatum* J.H. Simmonds f. sp. *hakeae* Lubbe, Denman, P. F. Cannon, J. Z. Groenew., Lampr. & Crous.
References	659, 944, 987, 1120

WEED

Species	*Hakea sericea Schrad.* & J.C. Wendl.
Family	Proteaceae
Origin	Australia
Common Name	silky hakea, needlebush

Colletotrichum acutatum f. sp. *hakeae* *(continued)*

REGISTRATION/USE

Country of Registration	Republic of South Africa
Year of Registration	1990
Registered Name	Hakatak®
Registration Notes	Provisionally registered as Hakatak® in 1990.
Isolation Source	*Hakea sericea* Schrad. & J.C. Wendl., Republic of South Africa
Research Organization	ARC-PPRI
General Impact	Variable
Impact Notes	Causes branch cankers accompanied by gum exudates from infected areas. Cankers gradually girdle the trunk and stems and kill the host plant. Highly effective in some areas, especially under moist and cloudy conditions. Interferes with larval development of *Carposina autologa*.
Commercially Available	No
Commercialization Company or Institution	National Chemical Products, a division of Sentrachem
Commercialization Notes	Registration allowed to lapse in 1991 due to limited market interest. Now produced on request free of charge by ARC-PPRI.
Limiting Factors	Climate
References	655, 659, 1281, 1284

Colletotrichum gloeosporioides f. sp. *aeschynomene*

BIOHERBICIDE

Species	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f. sp. *aeschynomene* J.T. Daniel, G.E. Templeton, R.J. Sm. & W.T. Fox
Classification	(Sordariomycetes: Incertae sedis)
Notes	*Colletotrichum aeschynomenes* B. Weir & P.R. Johnst. has been proposed as the new name for *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f. sp. *aeschynomene* J.T. Daniel, G.E. Tempelton, R.J. Sm. & W.T. Fox. The editors of this catalogue have retained the original name pending further confirmation of the change's acceptance and because it was the original name utilized in the registration of the bioherbicide.
References	1967

TABLE 4

Colletotrichum gloeosporioides. f. sp. *aeschynomene* (continued)

WEED

Species	*Aeschynomene virginica* (L.) B.S.P.
Family	Fabaceae
Incorrect Past Names/Synonyms	*Aeschynomene indica* L.
Notes	The taxonomic history of *Aeschynomene virginica* (L.) BSP is under debate. According to one report, there is a single weedy *Aeschynomene* species (*A. indica* L.) found along the eastern seaboard in North America, while other reports suggest the occurrence of two weedy species (*A. virginica* and *A. indica*) in the Mississippi River Delta region of the US. The bioherbicide listed in this entry is highly virulent on *A. virginica*, but less so on *A. indica*. The name *A. virginica* applies to a species considered threatened or endangered along the eastern seaboard of the US where it is native, while populations of the same species are considered weedy and noxious when growing out of their native range in rice fields in Arkansas and surrounding states. The registration of the bioherbicide listed in this entry applies only to weedy populations of *A. virginica* growing within rice and soybean fields in Arkansas, Louisiana, Mississippi, Texas and Missouri.
Origin	North America
Common Name	northern jointvetch
References	252, 1466, 1703, 1785, 1843, 1860

Colletotrichum gloeosporioides. f. sp. *aeschynomene* (continued)

REGISTRATION/USE	
Country of Registration	United States of America
Year of Registration	1982
Registered Name	Collego™, LockDown™
Registration Notes	Registered in 1982 and 1992 as Collego™, and again in 2006 as LockDown™. All registrations were completed with the same exact strain/isolate used in 1982 formulations. Formulations may differ across time.
Isolation Source	*Aeschynomene virginica* (L.) B.S.P., USA (AR)
Research Organization	State (2)
General Impact	Heavy
Impact Notes	Causes formation of many lesions all over *Aeschynomene virginica* plants, effectively girdling stems and branches. Typically leads to complete control (90% to 100% mortality) of the weed within 4 to 5 weeks in the field to which the product is properly applied. Active over a wide range of environmental conditions. Applications required annually because the fungus does not survive well in soil and or refuse despite being seedborne.
Commercially Available	Yes
Commercialization Company or Institution	Encore Technologies, Inc., Agricultural Research Initiatives, Inc.
Commercialization Notes	Collego™ not produced or distributed since 2003. LockDown™ currently available.
References	227, 251, 392, 592, 1064, 1703, 1785, 1787, 1852, 1858

Colletotrichum gloeosporioides f. sp. *cuscutae*

BIOHERBICIDE	
Species	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f. sp. *cuscutae* T.Y. Zhang
Classification	(Sordariomycetes: Incertae sedis)

WEED	
Species	*Cuscuta australis* R. Br.
Family	Convolvulaceae
Origin	Asia, Europe, Australia
Common Name	dodder

REGISTRATION/USE	
Country of Registration	People's Republic of China
Year of Registration	1966
Registered Name	Lubao No. 1, Lubao No. 1 S22®
Registration Notes	Registered as a bioherbicide under the name Lubao No. 1 in 1966. New strain created in 1987 under the name Lubao No. 1 S22®. Utilized against both *Cuscuta australis* and *C. chinensis*.
Isolation Source	*Glycine max* (L.) Merr., People's Republic of China (Shandong)
Research Organization	CAAS-ISF
General Impact	Heavy
Impact Notes	Used to control weed in soybean fields. Control >85% in all treated fields, reducing yield loss 30-50%.
Commercially Available	Yes
Commercialization Company or Institution	Institute of Soil and Fertilizers, Chinese Academy of Agricultural Sciences
Commercialization Notes	Degradation of Lubao No. 1 strain occurred in 1970s followed by decrease in use. New formulation, Lubao No. 1 S22®, developed with higher virulence and in use since 1987.
References	251, 349, 1064, 1935

Colletotrichum gloeosporioides f. sp. *cuscutae* (continued)

WEED	
Species	*Cuscuta chinensis* Lam.
Family	Convolvulaceae
Notes	Numerous herbarium collections from Asia labeled "*Cuscuta chinensis*" are in fact *C. campestris*—a North American species that has become almost cosmopolitan.
Origin	northern Africa, Asia, Australia
Common Name	dodder
References	348

REGISTRATION/USE	
Country of Registration	People's Republic of China
Year of Registration	1966
Registered Name	Lubao No. 1, Lubao No. 1 S22®
Registration Notes	Registered as a bioherbicide under the name Lubao No. 1 in 1966. New strain created in 1987 under the name Lubao No. 1 S22®. Utilized against both *Cuscuta australis* and *C. chinensis*.
Isolation Source	*Glycine max* (L.) Merr., People's Republic of China (Shandong)
Research Organization	CAAS-ISF
General Impact	Heavy
Impact Notes	Used to control weed in soybean fields. Control >85% in all treated fields, reducing yield loss 30-50%.
Commercially Available	Yes
Commercialization Company or Institution	Institute of Soil and Fertilizers, Chinese Academy of Agricultural Sciences
Commercialization Notes	Degradation of Lubao No. 1 strain occurred in 1970s followed by decrease in use. New formulation, Lubao No. 1 S22®, developed with higher virulence and in use since 1987.
References	251, 349, 1064, 1935

TABLE 4

Colletotrichum gloeosporioides f. sp. *malvae*

BIOHERBICIDE	
Species	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. f. sp. *malvae*
Classification	(Sordariomycetes: Incertae sedis)

WEED	
Species	*Malva pusilla* Sm.
Family	Malvaceae
Past Names/Synonyms	*Malva rotundifolia* L.
Origin	Eurasia
Common Name	round-leaved mallow

REGISTRATION/USE	
Country of Registration	Canada
Year of Registration	1992
Registered Name	BioMal®
Registration Notes	Registered as bioherbicide in field crops.
Isolation Source	*Malva pusilla* Sm., Canada (SK)
Research Organization	AAFC
General Impact	Heavy
Impact Notes	Inoculations effectively control *Malva pusilla* and increase crop yield.
Commercially Available	No
Commercialization Company or Institution	Philom Bios
Commercialization Notes	Commercial production halted in 1994 because changes in the marketplace over the 10 year development period resulted in the market potential being too small to justify further commercialization costs and production expenses.
References	157, 1064, 1287, 1288, 1289

Cylindrobasidium laeve

BIOHERBICIDE	
Species	*Cylindrobasidium laeve* (Pers.) Chamuris
Classification	(Agaricomycetes: Agaricales)
WEED	
Species	*Acacia mearnsii* De Wild.
Family	Fabaceae
Origin	Australia
Common Name	black wattle
REGISTRATION/USE	
Country of Registration	Republic of South Africa
Year of Registration	1997
Registered Name	Stumpout®
Registration Notes	Registered for use against *Acacia mearnsii* and *A. pycnantha*.
Isolation Source	*Acacia mearnsii* De Wild., Republic of South Africa
Research Organization	ARC-PPRI
General Impact	Variable
Impact Notes	When applied to cut stumps, the fungus colonizes the wood and kills the stump, preventing regrowth.
Commercially Available	Yes
Commercialization Company or Institution	ARC-PPRI-Stellenbosch
Commercialization Notes	Limited market for the product has dissuaded large business interest; however there is regular demand from conservation organizations and landowners so the product is produced by PPRI Weed Pathology Unit on request.
Other Species Attacked	Used against *Acacia mearnsii* De Wild. and *A. pycnantha* Benth.; recently found effective against *A. decurrens* (Wendl.) Willd. as well.
References	871, 992, 1086, 1284, 2006

Cylindrobasidium laeve (continued)

WEED	
Species	*Acacia pycnantha* Benth.
Family	Fabaceae
Origin	Australia
Common Name	golden wattle
REGISTRATION/USE	
Country of Registration	Republic of South Africa
Year of Registration	1997
Registered Name	Stumpout®
Registration Notes	Registered for use against *Acacia mearnsii* and *A. pycnantha*.
Isolation Source	*Acacia mearnsii* De Wild., Republic of South Africa
Research Organization	ARC-PPRI
General Impact	Heavy
Impact Notes	When applied to cut stumps, the fungus colonizes the wood and kills the stump, preventing regrowth.
Commercially Available	Yes
Commercialization Company or Institution	ARC-PPRI-Stellenbosch
Commercialization Notes	Limited market for the product has dissuaded large business interest; however there is regular demand from conservation organizations and landowners so the product is produced by PPRI Weed Pathology Unit on request.
Other Species Attacked	Used against *Acacia mearnsii* De Wild. and *A. pycnantha* Benth.; recently found effective against *A. decurrens* (Wendl.) Willd. as well.
References	871, 992, 1086, 1284, 2006

Phoma macrostoma

BIOHERBICIDE

Species	*Phoma macrostoma* Mont.
Classification	(Dothideomycetes: Pleosporales)

WEED

Species	Numerous broadleaved species, including *Taraxacum officinale* F. H. Wigg., *Tripleurospermum inodorum* (L.) Sch. Bip., *Bellis perennis* L., *Trifolium repens* L., *Medicago lupulina* L., *Cirsium arvense* (L.) Scop., *Stellaria media* (L.) Vill., *Plantago major* L., *Ambrosia artemisiifolia* L.
Family	Multiple Families
Origin	cosmopolitan
Common Name	broadleaved weeds

TABLE 4

REGISTRATION/USE

Country of Registration	Canada
Year of Registration	2011
Registered Name	N/A
Registration Notes	Conditionally registered for domestic and commercial use on turfgrass for control and/or suppression of numerous broadleaved weeds. The registered commercial name had not been released by the publication date of this revision.
Isolation Source	Isolate 94-44B, *Cirsium arvense* (L.) Scop., Canada (SK)
Research Organization	AAFC
General Impact	Heavy

(continued at top of next column)

Phoma macrostoma (continued)

Country of Registration	Canada (continued)
Impact Notes	Plants growing from infected soil turn white, have inhibited root growth and often die. Simultaneous application of commercial granular fertilizers may result in 10-15% enhancement in weed control. Extreme moisture events around application will reduce level of weed control attained, especially on sandy soils.
Commercially Available	No
Commercialization Company or Institution	The Scotts Company
Commercialization Notes	Still undergoing testing prior to commercialization and launching of the product.
Limiting Factors	Climate; Land use
References	68, 69, 156, 1516, 1942

REGISTRATION/USE

Country of Registration	United States of America
Year of Registration	2012
Registered Name	N/A
Registration Notes	Conditionally registered for domestic and commercial use on turfgrass for control and/or suppression of numerous broadleaved weeds. The registered commercial name had not been released by the publication date of this revision.
Isolation Source	Isolate 94-44B, *Cirsium arvense* (L.) Scop., Canada (SK)
Research Organization	AAFC
General Impact	Heavy

(continued on next page)

Phoma macrostoma (continued)

Country of Registration	United States of America (continued)
Impact Notes	Plants growing from infected soil turn white, have inhibited root growth and often die. Simultaneous application of commercial granular fertilizers may result in 10-15% enhancement in weed control. Extreme moisture events around application will reduce level of weed control attained, especially on sandy soils.
Commercially Available	No
Commercialization Company or Institution	The Scotts Company
Commercialization Notes	Still undergoing testing prior to commercialization and launching of the product.
Limiting Factors	Climate; Land use
References	68, 69, 156, 1516, 1942

Phytophthora palmivora

BIOHERBICIDE	
Species	*Phytophthora palmivora* (E.J. Butler) E.J. Butler
Incorrect Past Names/Synonyms	*Phytophthora citrophthora* (R.E. & E.H. Smith) Leonian
Classification	(Incertae sedis: Peronosporales)
WEED	
Species	*Morrenia odorata* (Hook. & Arn.) Lindl.
Family	Apocynaceae
Origin	South America
Common Name	milkweed vine, stranglervine
REGISTRATION/USE	
Country of Registration	United States of America
Year of Registration	1981
Registered Name	DeVine®
Registration Notes	A liquid concentrate formula was registered and marketed as DeVine® to control the weed in citrus groves.
Isolation Source	*Morrenia odorata* (Hook. & Arn.) Lindl., USA (FL)
Research Organization	FDA
General Impact	Heavy
Impact Notes	Typically excellent control (90%) of seedlings and large vines through effects of disease on roots, lasting for two years.
Commercially Available	Yes
Commercialization Company or Institution	Valent BioSciences Corporation
Commercialization Notes	Available sporadically.
References	123, 251, 1571, 1857

TABLE 4

Puccinia canaliculata

BIOHERBICIDE	
Species	*Puccinia canaliculata* (Schwein.) Legerh.
Classification	(Pucciniomycetes: Pucciniales)

WEED	
Species	*Cyperus esculentus* L.
Family	Cyperaceae
Origin	cosmopolitan
Common Name	yellow nutsedge

REGISTRATION/USE	
Country of Registration	United States of America
Year of Registration	1987
Registered Name	Dr. BioSedge®
Isolation Source	*Cyperus esculentus* L., USA
Research Organization	State (49)
General Impact	Heavy
Impact Notes	Suppresses flower and tuber formation and can kill plants outright.
Commercially Available	No
Commercialization Company or Institution	Tifton Innovation Corporation
Commercialization Notes	Product failed due to uneconomic production system and resistance in some weed biotypes.
Other Species Attacked	Natural populations of this fungus found infecting commercial *Helianthus annuus* L.
References	182, 695, 1064, 1492, 1502, 1851

Puccinia thlaspeos

BIOHERBICIDE	
Species	*Puccinia thlaspeos* Ficinus & C. Schub.
Classification	(Pucciniomycetes: Pucciniales)
Notes	This rust is closely related to a group of rusts native to the western USA. Experiments suggest a small change in genetic makeup may have resulted in this rust's ability to infect dyer's woad, and its inability to infect other plants.
References	1853

WEED	
Species	*Isatis tinctoria* L.
Family	Brassicaceae
Origin	Mediterranean, Eurasia
Common Name	dyer's woad

REGISTRATION/USE	
Country of Registration	United States of America
Year of Registration	2002
Registered Name	Woad Warrior
Isolation Source	Woad strain, *Isatis tinctoria* L., USA (UT)
Research Organization	State (21)
General Impact	Variable
Impact Notes	Severe infection significantly reduces seed production. Infection maintained naturally in stands, but natural dispersal low and percent infection decreases over time. Repeat inoculations required to maintain high infection rate such that impacts to the weed are significant.
Commercially Available	No
Commercialization Notes	Never commercially available due to lack of commercial backer. Once registered, the fungus was spread by researchers.
References	1029, 1064, 1853

Sclerotinia minor

BIOHERBICIDE	
Species	*Sclerotinia minor* Jagger
Classification	(Leotiomycetes: Helotiales)
WEED	
Species	*Taraxacum officinale* F. H. Wigg. agg.
Family	Asteraceae
Notes	Comprises the whole of T. sect. *Taraxacum* (formerly *Ruderalia*) which consists of agamospermous and sexual common dandelions.
Origin	Eurasia
Common Name	dandelion, common dandelion
References	988
REGISTRATION/USE	
Country of Registration	Canada
Year of Registration	2007
Registered Name	Sarritor®
Registration Notes	Granted conditional registration in 2007 and full registration in 2010 for the sale and use of Sarritor® Technical Herbicide, Sarritor® Granular Biological Herbicide (Commercial) and Sarritor® Selective Biological Lawn Weed Killer (previously referred to as Sarritor® Domestic Granular Biological Herbicide), containing *Sclerotinia minor* strain IMI 344141, to suppress top growth of dandelion, white clover and broadleaf plantain in turf.
Isolation Source	Strain IMI 344141, *Lactuca sativa* L., Canada (QC)
Research Organization	MU
General Impact	Heavy

(continued at top of next column)

Sclerotinia minor (continued)

Country of Registration	Canada (continued)
Impact Notes	Reduces dandelion post-emergent density up to 97%, and above- and below-ground biomass by 94% and 96%, respectively.
Commercially Available	Yes
Commercialization Company or Institution	Sarritor Inc.
Limiting Factors	Climate
Other Species Attacked	Infects other broadleaved species on direct contact.
References	3, 157, 1487, 1541, 1942

Xanthomonas campestris pv. *poae*

BIOHERBICIDE	
Species	*Xanthomonas campestris* pv. *poae*
Classification	(Gammaproteobacteria: Xanthomonadales)
WEED	
Species	*Poa annua* L.
Family	Poaceae
Origin	cosmopolitan
Common Name	annual bluegrass
REGISTRATION/USE	
Country of Registration	Japan
Year of Registration	1997
Registered Name	Camperico
Isolation Source	Strain JT-P482, *Poa annua L.*, Japan
Research Organization	JTI
General Impact	Heavy
Impact Notes	Successfully controls *Poa annua* in turf grass settings.
Commercially Available	Yes
Commercialization Company or Institution	Japan Tobacco Inc.
References	600, 866, 1352

TABLE 4

RESEARCH ORGANIZATION ABBREVIATIONS

* Organization no longer exists

Abbreviation	Research Organization
AAFC	Agriculture and Agri-Food Canada
AC	Agriculture Corporation, Myanmar
ACIAR	Australian Centre for International Agricultural Research
ARC	Alberta Research Council, Edmonton, Alberta, Canada now Alberta Innovates - Technology Futures as of 2010
ARCE	Agricultural Research Center, Department of Biological Control, Giza, Egypt
ARC-PPRI	Agricultural Research Council-Plant Protection Research Institute, Republic of South Africa
ARNZ	AgResearch, New Zealand
AUPPI	All Union Plant Protection Institute, St Petersburg, Russia now All-Russia Institute of Plant Protection
BAF	Board of Agriculture and Forestry, Hawaii, United States of America
BCME	British Colombia Ministry of Environment, Victoria, Canada
BDF	Benin Department of Fisheries
BIOTROP	SEAMEO Regional Centre for Tropical Biology, Indonesia
BMA	Ministry of Agriculture, Breeding & Fishery, Cotonou, Benin
BPI	Bureau of Plant Industry, Philippines
CAAS-BCI	Chinese Academy of Agricultural Sciences, Biological Control Institute, Beijing, People's Republic of China
CAAS-ISF	Chinese Academy of Agricultural Sciences, Institute of Soil and Fertilizers, People's Republic of China
CABI Switzerland	Centre for Agricultural Bioscience International, Delémont, Switzerland
CABI Africa	Centre for Agricultural Bioscience International, Nairobi, Kenya
CABI United Kingdom	Centre for Agricultural Bioscience International, Egham, United Kingdom
CDA	Colorado Department of Agriculture, Lakewood, CO
CI	Cawthron Institute, New Zealand
CIRAD-IRHO	International Center for Agricultural Research for Development, Oil Crops Department

(continued)

Abbreviation	Research Organization
CNR	Centro Nacional de Referencia en Roedores Aves y Malezas, Mexico
COM	College of Micronesia, Pohnpei, Federated States of Micronesia
CPPB*	Commonwealth Prickly Pear Board, Australia
CPPTI	Central Plant Protection Training Institute, Hyderabad, India now National Plant Protection Training Institute NPPTI
CRCWMS	Cooperative Research Centre for Weed Management Systems, Canberra, Australia
CRIG	Crops Research Institute, Ghana
CSC	Commonwealth Scientific Council, United Kingdom
CSIR*	Council for Scientific and Industrial Research, Australia (subsequently CSIRO)
CSIRO	Commonwealth Scientific and Industrial Research Organization, Australia
DAA	Department of Agriculture, Antigua
DAC	Department of Agriculture, Cook Islands
DAF	Department of Agriculture, Fiji
DAI	Department of Agriculture, Indonesia
DAIN	Department of Agriculture, Mysore, India
DAK	Department of Agriculture, Kenya
DAM	Department of Agriculture, Montserrat
DAMA	Department of Agriculture, Malaysia
DASL	Department of Agriculture, Sri Lanka
DAT	Department of Agriculture, Tanzania
DDR	Southern Province Department of Rural Development, Nouvelle-Calédonie
DLQS	Department of Livestock and Quarantine Services, Vanuatu now Vanuatu Biosecurity
DOAM	Department of Agriculture, Malaysia
DOCNZ	Department of Conservation, New Zealand
DPV	Plant Protection Directorate, Dakar, Senegal
DRFP	Délégation à la Recherche French Polynesia, Papeete, Tahiti

(continued)

Abbreviation	Research Organization
DSIR*	Department of Scientific and Industrial Research, New Zealand; used for releases prior to July 1992 (subsequently MWLR)
DWAB	Department of Water Affairs, Botswana
DWAF	Department of Water Affairs and Forestry, Republic of South Africa (responsibilities divided in 2009 into the Department of Agriculture, Forestry and Fisheries and the Department of Water and Environmental Affairs)
DWAN	Department of Water Affairs, Windhoek, Namibia/South West Africa
EAP	Escuela Agricola Panamericana, Honduras
ECZ	Environmental Council of Zambia
EPA	Environment Protection Agency, Ghana
FAO	Food and Agricultural Organization, United Nations
FDA	Florida Department of Agriculture and Consumer Service, Florida, United States of America
FRI	Forest Research Institute, India
GAF	Guangdong Academy of Forestry, People's Republic of China
GDA	Guam Department of Agriculture
GEI	Guangdong Entomological Institute, People's Republic of China
GTZ	Gesellschaft für Technische Zusammenarbeit, Germany
HBFTF	Hubei Five-Three Farm, People's Republic of China
HDOA	Hawaiian Department of Agriculture, United States of America
HFRI	Horticulture and Food Research Institute, New Zealand
IC	Imperial College, University of Wales, Cardiff, United Kingdom
ICAR	Indian Council of Agricultural Research
IDEFOR	Institut des Forêts, Cote d'Ivoire
IIBC	International Institute of Biological Control, United Kingdom
IIHR	Indian Institute of Horticultural Research
IITA	International Institute of Tropical Agriculture
IMTA	Mexican Institute of Water Technology
INIA	Estacion Experimental Carillanca, Temuco, Chile
INTA	Department of Plant Pathology, INTA, Castelar, Argentina
IOPRI	Indonesian Oil Palm Research Institute, North Sumatra, Indonesia
ISAR	Institut des Sciences Agronomique du Rwanda
JTI	Japan Tobacco Inc., Plant Protection Research Laboratory, Kanagawa, Japan

(continued)

Abbreviation	Research Organization
KARI	Kenya Agricultural Research Institute
KAU	Kerala Agricultural University, India
KENGEN	Kenya Electricity Generating Company, Nairobi, Kenya
KFRI	Kerala Forest Research Institute, India
KIEC	Kunming Institute of Ecology, People's Republic of China
KRS	Koronivia Research Station, Ministry of Agriculture and Fisheries, Fiji Islands
KU	Kelaniya University, Kelaniya, Sri Lanka
MAC	Ministry of Agriculture, Chile
MAF	Ministry of Agriculture, Forestry and Fisheries, Japan
MAFF	Ministry of Agriculture, Fisheries and Food, United Kingdom
MAL	Ministry of Agriculture and Lands, Solomon Islands
MAM	Ministry of Agriculture, Mauritius
MAMA	Ministry of Agriculture, Madagascar
MAP	Minstry of Agriculture, Philippines
MAR	Ministry of Agriculture, Zimbabwe
MARDI	Malaysian Agricultural Research and Development Institute, Serdang, Selangor, Malaysia
MAT	Ministry of Agriculture, Tanzania
MAZ	Ministry of Agriculture, Zambia
MFD	Malawian Fisheries Department
MFE	Ministry of Forestry and Environment, Brazzaville, Republic of Congo
MGI	Mysore Government, India
MU	McGill University, Quebec, Canada
MUE	Mansoura University, El-Mansoura, Egypt
MWLR	Manaaki Whenua - Landcare Research, New Zealand; used for releases after July 1992 (previosly DSIR)
NARI	National Agricultural Research Institute, Kerevat, East New Britain, Papua New Guinea
NARO	National Agriculture Research Organization, Uganda
NASENI	National Agency for Science and Engineering Infrastructure, Nigeria
NBCRC	National Biological Control Research Centre, Kasetsart University, Bangkok, Thailand
NCC	Noumea Chamber of Commerce, Noumea, New Caledonia
NIHORT	Nigerian Institute for Horticulture

(continued)

RESEARCH ORG. ABBREVI-ATIONS

Abbreviation	Research Organization
NMC	Northern Marianas College, Saipan, Northern Mariana Islands
NSW State	State Institutions of New South Wales, Australia
NT	Institutions of Northern Territory, Australia
PCA	Philippine Coconut Authority, Davao Research Center, Davao, Philippines
PCC	Panama Canal Commission (Formerly Panama Canal Company)
PFC	Canadian Forest Service, Pacific Forestry Centre
PIJ	Prefecture Ishikawa, Japan
PLANTI	ASEAN Plant Quarantine Centre and Training Institute, Serdang, Selangor, Malaysia
PLC	Palau Community College, Koror, Palau
PNGDAL	Department of Agriculture and Livestock, Papua New Guinea
PPD	Plant Protection Department, Dar es Salaam, Tanzania
PPIB	Plant Protection Institute, Belgrade, Yugoslavia now Institute for Plant Protection and Environment
PPRIZ	Plant Protection Research Institute, Zimbabwe
PPS	Plant Protection Service, Department of Agriculture, Peradeniya, Sri Lanka
PPTC*	Prickly Pear Travelling Commission, Australia
Private	Private Group
QLD State	State Institutions of Queensland, Australia
RSL	Ramu Sugar Ltd, Department of Agriculture and Livestock, Papua New Guinea
RSTO	De La Recherche Scientifique Et Technique Outre Mer, New Caledonia
SA State	State Institutions of South Australia, Australia
SASRI	South African Sugarcane Research Institute, Mount Edgecombe, Republic of South Africa
Scion	Scion, New Zealand
SPC	South Pacific Commission (now Secretariat of the Pacific Community as of 1998)
SRNF	Samuel Roberts Noble Foundation, Oklahoma, United States of America
State (1)	Virginia Polytechnic Institute and State University
State (2)	University of Arkansas, Fayetteville
State (3)	University of Florida, Gainesville
State (4)	University of California, Berkeley

(continued)

Abbreviation	Research Organization
State (5)	University of California, Riverside
State (6)	University of Idaho
State (7)	Montana State University
State (8)	Oregon State University
State (9)	Washington State University
State (10)	Kansas State University, Manhattan
State (11)	University of North Dakota, Fargo
State (12)	University of South Dakota, Brookings
State (13)	University of Wyoming, Laramie
State (14)	California Department of Food and Agriculture, Sacramento
State (15)	Oregon State Department of Agriculture, Salem
State (18)	Florida Department of Natural Resources, Tallahassee
State (19)	South Florida Water Management District, West Palm Beach
State (20)	Maryland Department of Agriculture, Annapolis
State (21)	Utah State University, Logan
State (22)	University of California, Davis
State (23)	Louisiana State University, Baton Rouge
State (24)	Texas A & M University, College Station
State (25)	University of Missouri, Columbia
State (26)	Oklahoma State University, Stillwater
State (27)	North Dakota State University, Grand Forks
State (28)	Auburn University, Alabama
State (29)	Middlebury College, University of Minnesota, Vermont
State (30)	Vermont Department of Environment and Conservation
State (31)	Wisconsin Department of Natural Resources, Madison
State (32)	Minnesota Department of Natural Resources, St Paul
State (33)	University of Minnesota, St Paul
State (35)	University of Florida
State (36)	Florida Fish and Wildlife Commission
State (37)	Illinois Nature Preserve Commission
State (38)	Indiana Department of Natural Resources
State (39)	Michigan Department of Natural Resources
State (40)	New Mexico State University
State (41)	Iowa State University
State (42)	Ohio Department of Natural Resources

(continued)

Abbreviation	Research Organization
State (43)	Vermont Department of Environment and Conservation
State (44)	West Virginia University
State (45)	University of Delaware
State (46)	University of Maryland
State (47)	University of Tennessee
State (48)	University of Washington
State (49)	University of Georgia, Tifton
State (50)	University of Wisconsin, Madison
State (51)	University of Massachusetts, Amherst Cranberry Research Station
State (52)	University of Hawaii
TAS State	State Institutions of Tasmania, Australia
TFB	Taiwan Forest Bureau, Taipei City, Taiwan
TVA	Tennessee Valley Authority, United States of America
UACH	Universidad Austral de Chile, Valdivia, Chile
UAMX	Universidad Autonoma Metropolitana Xochimilco, Mexico
UASA	University of Adelaide, South Australia, Australia
UBC	University of British Columbia, Canada
UCD	University College Dublin, Ireland
UCT	University of Cape Town, Republic of South Africa
UG	University of Guelph, Canada
UGL	University of Ghana, Legon Boundary, Accra, Ghana
UHG	University of Hohenheim, Stuttgart, Germany
UKS	University of Khartoum, Sudan
UKZN	University of KwaZulu-Natal, Republic of South Africa
UNTL	National University of Timor Lorosae, Dili, Timor Leste
UOG	University of Guam, Mangilao, Guam
UPR	University of Puerto Rico
USAE	United State Army Corps of Engineers
USDA	United States Department of Agriculture, United States of America
USDA (1)	Beltsville, Maryland
USDA (2)	Frederick, Maryland
USDA (3)	Gainesville, Florida
USDA (4)	Fort Lauderdale, Florida

(continued)

Abbreviation	Research Organization
USDA (5)	Stoneville, Mississippi
USDA (6)	Lubbock, Texas
USDA (7)	Albany, California
USDA (9)	Temple, Texas
USDA (10)	Bozeman, Montana
USDA (11)	Columbia, Missouri
USDA (12)	Rome, Italy
USDA (13)	Hurlingham, Argentina
USDA (14)	Davis, California
USDA (15)	Townsville, Australia
USDA (16)	Sidney, Montana
USDA (17)	Mission, Texas
USDA (18)	Weslaco, Texas
USDA (19)	Ft Collins, Colorado
USDA-APHIS	United States Department of Agriculture, Animal and Plant Health Inspection Service
USDA-APHIS-PPQ	United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine
USDA-ARS	United States Department of Agriculture, Agricultural Research Station
USDA-FS	United States Department of Agriculture, Forest Service
USDI-BOR	United States Department of the Interior, Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
UZ	University of Zagreb, Croatia
VIC State	State Institutions of Victoria, Australia
VNBCRC	Vietnam Biological Control Research Centre
WA State	State Institutions of Western Australia, Australia
WFW	Working for Water, Republic of South Africa
WRCL	Weed Research Central Laboratory, Egypt
WUR	Wageningen University and Research Centre, Wageningen, The Netherlands
WUSA	Wits University, Johannesburg, Republic of South Africa
ZIAS	Zoological Institute and Academy of Science, St Petersburg, U.S.S.R.

REFERENCES

Code	Reference
1	Ablin, M.P. 1993. Insecticide exclusion with Carbofuran demonstrates the effectiveness of *Heteropsylla spinulosa* as a biological control agent for *Mimosa invisa* in Northern Queensland. Abstract. *In* J.T. Swarbrick, Ed. Proceedings of the 10th Australian and 14th Asian-Pacific weed conference. 6-10 September 1993, Brisbane, Queensland, Australia; Queensland Weed Society. pp. 128.
2	Abreu, E., N. Semidey, and L. Bernier. 1998. Introduction and release of the alligatorweed flea beetle, *Agasicles hygrophila* in Puerto Rico. Reunión Cientifica Anual SOPCA. 1 pp.
3	Abu-Dieyeh, M.H. 2006. Population dynamics of dandelion (*Taraxacum officinale*) in turfgrass as influenced by a biological control agent, *Sclerotinia minor*. Thesis, Doctor of Philosophy. McGill University, Montreal, Quebec, Canada. 324 pp.
4	Adair, R.J. 2005. The biology of *Dasineura dielsi* Rübsaamen (Diptera: Cecidomyiidae) in relation to the biological control of *Acacia cyclops* (Mimosaceae) in South Africa. Australian Journal of Entomology 44(4): 446-456.
5	Adair, R.J. 2013. (personal communication) Australis Biological, PO Box 151, Bittern 2918 Australia.
6	Adair, R.J. and P.B. Edwards. 1996. An attack strategy against *Chrysanthemoides monilifera*, a weed of native vegetation in Australia. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; Cape Town Press. pp. 429-434.
7	Adair, R.J., T. Morley, and L. Morin. 2012. *Chrysanthemoides monilifera* (L.) T. Norl. - bitou bush and boneseed. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 170-183.
8	Adair, R.J. and J.K. Scott. 1997. Distribution, life history and host specificity of *Chrysolina picturata* and *Chrysolina* sp. B (Coleoptera: Chrysomelidae), two biological control agents for *Chrysanthemoides monilifera* (Compositae). Bulletin of Entomological Research 87: 331-341.
9	Adebayo, R.A. and U.O. Uyi. 2010. Biological control of invasive weed species: Nigerian experience. International Journal of Agricultural Research 5(12): 1100-1106.
10	Agaba, P., T. Asiimwe, T.G. Moorhouse, and T.J. McNabb. 2002. Biological control of water hyacinth in the Kagera River headwaters of Rwanda: a review through 2001. Regional Report. Butare, Rwanda. 9 pp.

Code	Reference
11	Aguilar, J.A., O.M. Macarena, T.D. Center, and Bojórquez. 2003. Biological control of waterhyacinth in Sinaloa, Mexico with the weevils *Neochetina eichhorniae* and *N. bruchi*. Biocontrol 48: 595-608.
12	Ajuonu, O. 1997. (personal communication) CAB International Institute of Tropical Agriculture, Biological Control Centre for Africa, B.P. 08 0932 Tri Postal, Cotonou, Republic of Benin.
13	Ajuonu, O. 2007. A study on the interaction between two weevils *Neochetina eichhorniae* and *N. bruchi*, and the mirid *Eccritotarsus catarinensis*, as biological control agents of water hyacinth *Eichhornia crassipes*. Thesis, Master of Science. University of Witwatersrand, Johannesburg, South Africa. 93 pp.
14	Ajuonu, O. 2013. (personal communication) International Institute of Tropical Agriculture-Benin, 08 BP 0932 Tri Postal, Cotonou, Republic of Benin.
15	Ajuonu, O., M.J. Byrne, M.P. Hill, P. Neuenschwander, and S. Korie. 2007. Survival of the mirid *Eccritotarsus catarinensis* as influenced by *Neochetina eichhorniae* and *Neochetina bruchi* feeding scars on leaves of water hyacinth *Eichhornia crassipes*. Biocontrol 52: 193-205.
16	Ajuonu, O. and P. Neuenschwander. 2003. Release, establishment, spread and impact of the weevil *Neohydronomus affinis* (Coleoptera: Curculionidae) on water lettuce (*Pistia stratiotes*) in Benin, West Africa. African Entomology 11(2): 205-211.
17	Ajuonu, O., V. Schade, B. Veltman, K. Sedjro, and P. Neuenschwander. 2003. Impact of the weevils *Neochetina eichhorniae* and *N. bruchi* (Coleoptera: Curculionidae) on water hyacinth, *Eichhornia crassipes* (Pontederiaceae), in Benin, West Africa. African Entomology 11(2): 153-161.
18	Ajuonu, O., M. Tamo, P. Neuenschwander, M. Toko, F. Beed, and C. Hounkpe. 2010. Invasive floating water weeds - killing life and commerce. Technical Innovation Brief 3. SP-IPM Secretariat. 2 pp.
19	Akers, R.P., C. Black, and M.J. Pitcairn. 2006. Biological control of water hyacinth III: above-freezing temperatures as a limiting factor in the effectiveness of the weevil *Neochetina bruchi*. *In* D.M. Woods, Ed. Biological Control Program 2005 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 48-49.

Code	Reference
20	Akers, R.P., M.J. Pitcairn, L. Ragaini, and R. Weaver. 2005. Biological control of water hyacinth: population dynamics of the weevil *Neochetina bruchi* in the Sacramento-San Joaquin Delta, 2003-2004. *In* D.M. Woods, Ed. Biological Control Program 2004 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 33-36.
21	Akpabey, F.J. 2012. Quantification of the cross-sectoral impacts of waterweeds and their control in Ghana. Thesis, Doctor of Philosophy. Rhodes University, Grahamstown, South Africa. 231 pp.
22	Akpabey, F.J. 2013. (personal communication) CSIR Water Research Institute, P.O. Box AH 38, Achimota-Accra, Ghana.
23	Albright, T.P., T.G. Moorhouse, and T.J. McNabb. 2004. The rise and fall of water hyacinth in Lake Victoria and Kagera River Basin, 1989-2001. Journal of Aquatic Plant Management 42: 73-84.
24	Al-Eryan, M.A.S., M.M.M. Altahtawy, H.K. El-Sherief, and A.M.H. Abu-Shall. 2004. Efficacy of *Phytomyza orobanchia* Kalt. in reduction of *Orobanche crenata* Forsk. seed yield under semi-field conditions. Egyptian Journal of Biological Pest Control 14(1): 237-242.
25	Alex, J. 1992. Biological Control of Weeds in Ontario. *In* G. Boiteau, Ed. Proceedings of the 38th Annual Meeting of the Canadian Pest Management Society. 27-31 July 1991, Fredericton, New Brunswick, Canada; Agassiz Research Station, Agriculture Canada. pp. 111-117.
26	Ali, A.-s. and R. Labrada. 2006. Problems posed by *Prosopis* in Yemen. *In* FAO, Ed. Problems posed by the introduction of *Prosopis spp.* in selected countries. FAO, Rome. pp. 21-28.
27	Alonso-Zarazaga, M.A. and M. Sáchez-Ruiz. 2002. Revision of the *Trichosirocalus horridus* (Panzer) species complex, with description of two new species infesting thistles (Coleoptera: Curculionidae, Ceutorhynchinae). Australian Journal of Entomology 41: 199-208.
28	Aloyce, R.C., J. Ndunguru, P. Mjema, and F. Katagira. 2001. Water hyacinth (*Eichhornia crassipes*) management in Lake Victoria: update on infestation levels. *In* Proceedings of the 1st Lake Victoria Environmental Management Project Regional Scientific Conference. 3-7 December 2001, Kisumu, Kenya; KIDACE, KMFRI. pp. 206-210.
29	Alyokhin, A.V., R.H. Messing, and J.J. Duan. 2001. Utilization of the exotic weed *Pluchea odorata* (Asteraceae) and related plants by the introduced biological control agent *Acinia picturata* (Diptera: Tephritidae) in Hawaii. Biocontrol Science and Technology 11: 703-710.
30	Alyokhin, A.V., R.H. Messing, and J.J. Duan. 2002. Infestation of *Elephantopus mollis* (Asteraceae) flowerheads by *Tetraeuaresta obscuriventris* (Diptera: Tephritidae) on Kauai, Hawaiian Islands. Entomological News 113: 247-252.
31	Amrine Jr., J.W. 2002. Multiflora Rose. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 265-292.
32	Amrine Jr., J.W. and T.A.H. Stasny. 1994. Catalog of the Eriophyoidea (Acarina:Prostigmata) of the World. Indira Publishing House, West Bloomfield, MI. 531 pp.
33	Amsellem, Z., S. Barghouthi, B. Cohen, Y. Goldwasser, J. Gressel, L. Hornok, Z. Kerenyi, Y. Kleifeld, O. Klein, J. Kroschel, J. Sauerborn, D. Müller-Stover, H. Thomas, M. Vurro, and M.-C. Zonno. 2001. Recent advances in the biocontrol of *Orobanche* (broomrape) species. Biocontrol 46: 211-228.
34	Anderson, D.M. 1956. Notes on *Cleonus piger* (Scop.) in the United States (Coleoptera, Curculionidae). The Coleopterists Bulletin 10(6): 81-85.
35	Anderson, E.F. 2001. The Cactus Family. Timber Press, Inc., Portland, Oregon. 776 pp.
36	Anderson, G.L., E.S. Delfosse, N.R. Spencer, C.W. Prosser, and R.D. Richard. 2000. Biological control of leafy spurge: an emerging success story. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 15-25.
37	Anderson, R.S. 2003. *Pseudotychius watsoni* Blatchley (Curculionoidea; Nanophyidae) new to Canada. The Coleopterists Bulletin 57(1): 110-112.
38	Andreas, J.E. 2013. (personal communication) Washington State University Extension, Integrated Weed Control Project, Puyallup Research Center, 2606 W Pioneer, Puyallup, WA 98371 USA.
39	Andreas, J.E., E.M. Coombs, J. Milan, G.L. Piper, and M. Schwarzländer. 2012. Biological Control. *In* E. Peachey, D. Ball, H. A., J. Yenish, T. Miller, D. Morishita, and P. Hutchinson, Eds. Pacific Northwest Weed Management Handbook. Oregon State University, Corvallis, Oregon. pp. B1-B6.
40	Andreas, J.E., M. Schwarzländer, H. Ding, and S.D. Eigenbrode. 2008. Post-release non-target monitoring of *Mogulones cruciger*, a biological control agent released to control *Cynoglossum officinale* in Canada. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 75-82.
41	Andres, L.A. 1985. Interaction of *Chrysolina quadrigemina* and *Hypericum* spp. in California. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 235-239.

Code	Reference
42	Andres, L.A. and E. Coombs. 1995. Scotch broom. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 303-305.
43	Andres, L.A., E. Coombs, and J.P. McCaffrey. 1995. Mediterranean sage. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 296-298.
44	Andres, L.A. and C.J. Davis. 1973. The biological control of weeds with insects in the United States. *In* P.H. Dunn, Ed. Proceedings of the II International Symposium on Biological Control of Weeds. 4-7 October 1971, Rome, Italy; CAB. pp. 11-28.
45	Andres, L.A. and R.D. Goeden. 1995. Puncturevine. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 318-321.
46	Andres, L.A., R.B. Hawkes, and A. Rizza. 1967. *Apion* seed weevil introduced for biological control of Scotch Broom. California Agriculture 21(8): 13.
47	Andres, L.A. and N.E. Rees. 1995. Musk thistle. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 248-251.
48	Andriaens, T. 2013. (personal communication) Research Institute for Nature and Forest, Research Group Wildlife Management, Dept. Management and Sustainable Use, Kliniekstraat 25, B-1070 Brussels.
49	Ang, B.N., L.T. Kok, G.I. Holtzman, and D.D. Wolf. 1995. Canada thistle (*Cirsium arvense* (L.) Scop.) response to density of *Cassida rubiginosa* Muller (Coleoptera: Chrysomelidae) and plant competition. Biological Control 5: 31-38.
50	Annecke, D.P. and V.C. Moran. 1978. Critical reviews of biological pest control in South Africa. 2. The prickly pear, *Opuntia ficus-indica* (L.) Miller. Journal of the Entomological Society of South Africa 41: 161-188.
51	Annecke, D.P. and S. Neser. 1977. On the biological control of some Cape pest plants. *In* Proceedings of the 2nd National Weeds Conference of South Africa. 2-4 February 1977, Stellenbosch, South Africa; A.A. Balkema. pp. 303-319.

Code	Reference
52	Anon. 1994. Beneficial organisms shipped by the SPC-German Biological Control Project during 1991-1993. SPC Agricultural News 3: 17.
53	Anonymous. 1916. La lutte contre le “Lantana mexicana”. Journal Officiel des Establissements Français de l’Océanie 15 May: 263.
54	Anton, K.-W. 1994. The Bruchidae (Coleoptera) of Oman, with descriptions of a new genus and two new species. *In* W. Buttiker and F. Krupp, Eds. Fauna of Saudi Arabia. Vol. 14. pp. 105-112.
55	Anwar, A.I. 1996. Biological control efforts towards the management of some common weeds in Malaysia. *In* S. Tjitrosemito and I. Soerianegara, Eds. Proceedings of the Symposium on Biology and Management of Weeds and 4th Tropical Weed Science Conference. 22-24 November 1994, Bogor, Indonesia; SEAMEO BIOTOP. pp. 149-157.
56	Anwar, A.I. 1997. (personal communication) Centre for Strategic Research, Environment and Natural Resource Management, MARDI, Serdang, Malaysia.
57	Anwar, A.I., S.S. Sastroutomo, A. Sivapragasam, B.L. Tay, B. Razali, and A. Zubir. 1994. Introduction and impact of *Neochetina bruchi* as a biological control agent of water hyacinth in Malaysia. *In* A. Rajan and Y.B. Ibrahim, Eds. Proceedings of the 4th International Conference on Plant Protection in the Tropics. 28-31 March 1994, Kuala Lumpur, Malaysia; Kuala Lumpur; Malaysian Plant Protection Society. pp. 113-115.
58	Anwar, A.I., A. Sivapragasam, A.B. Mislamah, P.S.S. Ooi, P.S.S. Durai, and A. Ganapathi. 1994. Research advances on biocontrol of giant mimosa in Malaysia. *In* A. Rajan and Y. Ibrahim, Eds. Proceedings of the 4th International Conference on Plant Protection in the Tropics. 28-31 March 1994, Kuala Lumpur, Malaysia; Kuala Lumpur; Malaysian Plant Protection Society. pp. 109-110.
59	Anwar, A.I., A. Sivapragasam, A.B. Mislamah, B. Razali, and A.R. Fathin. 1997. Status of biological control using two exotic natural enemies against water hyacinth in peninsular Malaysia. *In* A. Rajan, Ed. Proceedings of the 16th Asian-Pacific Weed Science Society Conference. September 1997, Kuala Lumpur, Malaysia; Malaysian Plant Protection Society. pp. 348-351.
60	Applequist, W.L. 2002. A reassessment of the nomenclature of *Matricaria* L. and *Tripleurospermum* Sch. Bip. (*Asteraceae*). Taxon 51(November): 757-761.
61	Aterrado, E.D. and N.S.J. Bachiller. 2002. Biological control of *Chromolaena odorata*: preliminary studies on the use of the gall-forming fly *Cecidochares connexa* in the Phillippines. *In* C. Zachariades, R. Muniappan, and L. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 137-139.
62	Baars, J.-R. 2003. Geographic range, impact, and parasitism of lepidopteran species associated with the invasive weed *Lantana camara* in South Africa. Biological Control 28(3): 293-301.

Code	Reference
63	Baars, J.R. 2011. Classical biological control for the management of alien invasive species in Ireland. Biology and Environment-Proceedings of the Royal Irish Academy 111B(3): 1-10.
64	Baars, J.R. and J. Caffery. 2008. Invasive Species Ireland, case study 4, water fern, *Azolla filiculoides* - Under biological control in Ireland. http://invasivespeciesireland.com/wp-content/uploads/2010/11/Case_Study_4_Biological_control.pdf. 10 June 2012.
65	Baars, J.-R. and F. Heystek. 2003. Geographical range and impact of five biocontrol agents established on *Lantana camara* in South Africa. Biocontrol 48: 743-749.
66	Baars, J.-R. and S. Neser. 1999. Past and present initiatives on the biological control fo *Lantana camara* (Verbenaceae) in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 21-33
67	Baars, J.-R., A.J. Urban, and M.P. Hill. 2003. Biology, host range, and risk assessment supporting release in Africa of *Falconia intermedia* (Heteroptera: Miridae), a new biocontrol agent for *Lantana camara*. Biological Control 28(3): 282-292.
68	Bailey, K.L. and S. Falk. 2011. Bioherbicide finds new pathway. Biocontrol News and Information 32(3): 17N-24N.
69	Bailey, K.L. and S. Falk. 2012. *Phoma macrostoma*: an update on the new turfgrass bioherbicide. Western Canada Turfgrass Association, News Update, Saturday, 11 August 2012.
70	Bailey, K.L., W.M. Pitt, S. Falk, and J. Derby. 2011. The effects of *Phoma macrostoma* on nontarget plant and target weed species. Biological Control 58: 379-386.
71	Bakar, B.H. 2004. Invasive weed species in Malaysian agro-ecosystems: species, impacts and management. Malaysian Journal of Science 23: 1-42.
72	Baker, C.R.B., R.L. Blackman, and M.F. Claridge. 1972. Studies on *Haltica carduorum* Guerin (Coleoptera: Chrysomelidae) an alien beetle released in Britain as a contribution to the biological control of the creeping thistle, *Cirsium arvense* (L.) Scop. Journal of Applied Ecology 9: 819-830.
73	Baker, J.L. and N.A.P. Webber. 2008. Feeding impacts of a leafy spurge biological control agent on a native plant, *Euphorbia robusta*. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 503-506.
74	Baker, L. 1997. (personal communication) Fremont County Weed and Pest, Lander, Wyoming, United States of America.
75	Baker, S.D. 1955. Note on tutsan rust in New Zealand. New Zealand Journal of Science and Technology 36: 483-484.
76	Balciunas, J. and B. Villegas. 1999. Two new seed head flies attack yellow starthistle. California Agriculture 53(2): 8-11.
77	Balciunas, J.K., M.J. Grodowitz, A.F. Cofrancesco Jr., and J.F. Shearer. 2002. Hydrilla. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 91-114.
78	Balciunas, J.K. and B. Villegas. 2001. Unintentionally released *Chaetorellia succinea* (Diptera: Tephritidae): is this natural enemy of yellow starthistle a threat to safflower growers? Environmental Entomology 30(5): 953-963.
79	Balciunas, J.K. and B. Villegas. 2007. Laboratory and realized host ranges of *Chaetorellia succinea* (Diptera: Tephritidae), an unintentionally introduced natural enemy of yellow starthistle. Environmental Entomology 36(4): 849-857.
80	Balentine, K.M., P.D. Pratt, F.A. Dray Jr., M.B. Rayamajhi, and T.D. Center. 2009. Geographic distribution and regional impacts of *Oxyops vitiosa* (Coleoptera: Curculionidae) and *Boreioglycaspis melaleucae* (Hemiptera: Psyllidae), biological control agents of the invasive tree *Melaleuca quinquenervia*. Environmental Entomology 38(4): 1145-1154.
81	Balsbaugh Jr., E.U., R.D. Frye, C.G. Scholl, and A.W. Anderson. 1981. Insects for weed control: status in North Dakota. Farm Research 40(1): 3-7.
82	Bandara, W.M.P.T. 2013. (personal communication) Plant Protection Service, Department of Agriculture, P.O. Box 22 Gannoruwa, Peradeniya, Sri Lanka.
83	Barbosa, P., S.M. Braxton, and A.E. Segarra-Carmona. 1994. A history of biological control in Maryland. Biological Control 4: 185-243.
84	Barreto, R. 2008. Latin American weed biological control science at the crossroads. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 109-121.
85	Barton, J., S.V. Fowler, A.F. Gianotti, C.J. Winks, M. de Beurs, G.C. Arnold, and G. Forrester. 2007. Successful biological control of mist flower (*Ageratina riparia*) in New Zealand: agent establishment, impact and benefits to the native flora. Biological Control 40(3): 370-385.
86	Batra, S.W.T. 1983. Establishment of *Hyles euphorbiae* (L.) (Lepidoptera: Sphingidae) in the United States for control of the weedy spurges *Euphorbia esula* L. and *E. cyparissias* L. Journal of the New York Entomological Society 91: 304-311.
87	Baudoin, A.B.A.M., R.G. Abad, L.T. Kok, and W.L. Bruckart. 1993. Field evaluation of *Puccinia carduorum* for biological control of musk thistle. Biological Control 3: 53-60.

Code	Reference
88	Bean, D. 2006. Biocontrol of tamarisk using tamarisk leaf beetle, *Diorhabda elongata*. Report for the Tamarisk Coaltion. Colorado Department of Agriculture, Conservation Services. 5 pp.
89	Bean, D.W. 2013. (personal communication) Colorado Department of Agriculture, Conservation Services, 750 37.8 Rd., Palisade, CO 81526 USA.
90	Bean, D.W., T.L. Dudley, and K. Hultine. 2013. Bring on the beetles: the history and impact of tamarisk biological control. *In* A. Sher and M. Quigley, Eds. *Tamarix*: a case study of ecological change in the American West. Oxford University Press, New York. pp. 377-403.
91	Bean, D.W., D.J. Kazmer, K. Gardner, D.C. Thompson, B. Reynolds, J.C. Keller, and J.F. Gaskin. 2013. Molecular genetic and hybridization studies of *Diorhabda* spp. released for biological control of *Tamarix*. Invasive Plant Science and Management 6(1): 1-15.
92	Bean, D.W., T. Wang, R.J. Bartlet, and B.W. Zilkowski. 2007. Diapause in the leaf beetle *Diorhabda elongata* (Coleoptera: Chrysomelidae), a biological control agent for tamarisk (*Tamarix spp.*). Environmental Entomology 36(3): 531-540.
93	Beardsley. 1971. *Megastigmus* sp. Proceedings of the Hawaiian Entomological Society 21.
94	Becker, E., S.F. Shamoun, and W.E. Hintz. 2005. Efficacy and environmental fate of *Chondrostereum purpureum* used as a biological control for red alder (*Alnus rubra*). Biological Control 33: 269-277.
95	Beed, F. and T. Dubois. 2009. The role of International Institute of Tropical Agriculture in biological control of weeds. *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 453-464.
96	Bella, S. and G. Marchese. 2007. First record of *Lantanophaga pusillidactylus* (Walker, 1864) for the Italian fauna (Lepidoptera Pterophoridae). Bollettino di Zoologia Agraria e di Bachicoltura 39(1): 71-74.
97	Belton, T. 2008. Management strategy for Mexican thorn (*Prosopis juliflora*) on Ascension Island. Royal Society for the Protection of Birds, U.K. 23 pp.
98	Bennett, F.D. 1970. Recent investigations on the biological control of some tropical and sub-tropical weeds. *In* Proceedings of the 10th British Weed Control Conference. 16-19 November 1970, London, England; British Crop Protection Council. pp. 660-668.
99	Bennett, F.D. 1971. Some recent successes in the field of biological control in the West Indies. Review Peru Entomology 14: 369-373.
100	Bennett, F.D. 1974. Biological control of aquatic weeds. *In* F.G. Maxwell and F.A. Harris, Eds. Proceedings of the Summer Institute of Biological Control of Plant Insects and Diseases. 1974, Jackson, Mississippi; University Press of Mississippi. pp. 224-237.
101	Bennett, F.D. 1975. Insects and plant pathogens for the control of *Salvinia* and *Pistia*. *In* P.L. Brezonik and J.L. Fox, Eds. Proceedings of a Symposium on Water Quality Management Through Biological Control. 25-30 January 1975, Gainesville, Florida, USA; University of Florida. pp. 28-35.
102	Bennett, F.D. 1979. Records of natural enemies of water hyacinth *Eichhornia crassipes* and of puncture vine *Tribulus cistoides* from Mexico. *In* VII Reunion Nacional de Control Biologica, Veracruz. 1979, Veracruz, Mexico; Comite Organizador de la VII Reunion Nationale de Control Biologico. pp. 137-141.
103	Bennett, F.D. 1984. Biological control of aquatic weeds. *In* G. Thyagarajan, Ed. Proceedings of the International Conference on Water Hyacinth. 7-11 February 1983, Hyderabad, India; United Nations Environment Programme. pp. 14-40.
104	Bennett, F.D. 1989. *Microlarinus lypriformis* (Coleoptera: Curculionidae) in Curacao, Venezuela, and Puerto Rico: new distribution records. The Coleopterists Bulletin 43: 390-391.
105	Bennett, F.D. and R.M. Baranowski. 1981. Discovery of the puncturevine stem weevil, *Microlarinus lypriformis*, (Coleoptera: Curculionidae) in the Bahamas. Florida Entomologist 64(1): 197.
106	Bennett, F.D. and D.H. Habeck. 1995. *Cactoblastis cactorum*: A successful weed control agent in the Caribbean, now a pest in Florida. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 21-26.
107	Berenbaum, M. and S. Passoa. 1983. Notes on the biology of *Agonopterix alstroemeriana* (Clerck), with descriptions of the immature stages (Oecophoridae). Journal of the Lepidopterists' Society 37: 38-45.
108	Besaans, L. 2012. *Aceria lantanae*: lantana flower gall mite. Fact sheet on invasive alien plants and their control in South Africa. Agricultural Research Council-Plant Protection Research Institute. 1 pp.
109	Beshir, M.O. 1984. The establishment and distribution of natural enemies of water hyacinth released in Sudan. Tropical Pest Management. 30: 320-323.
110	Beshir, M.O. and F.D. Bennett. 1985. Biological control of water hyacinth on the White Nile, Sudan. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 491-496.
111	Bess, H.A. and F.H. Haramoto. 1958. Biological control of Pamakani, *Eupatorium adenophorum*, in Hawaii by a Tephritid gall fly, *Procecidochares utilis*. I. The life history of the fly and its effectiveness in the control of the weed. *In* E.C. Becker, Ed. Proceedings of the 10th International Congress of Entomology. 17-25 August 1956, Montreal, Quebec, Canada; Mortimer. pp. 543-548.

Code	Reference
112	Bess, H.A. and F.H. Haramoto. 1972. Biological control of Pamakani, *Eupatorium adenophorum*, in Hawaii by a Tephritid gall fly, *Procecidochares utilis*. 3. Status of the weed, fly and parasites of the fly in 1966-71 vs 1950-57. Proceedings of the Hawaiian Entomological Society 21: 165-178.
113	Bethune, S., M. Griffin, and D. Joubert. 2004. National review of invasive alien species in Namibia. Prepared for the Directorate of Environmental Affairs, Ministry of Environment and Tourism. Southern Africa Biodiversity Support Program, Windhoek, Namibia. 153 pp.
114	Bhumannavar, B.S. 2013. (personal communication) National Bureau of Agriculturally Important Insects, P.Bag No:2491, H.A. Farm Post, Bellary Road, Bangalore - 560 024. Karnataka, India.
115	Bhumannavar, B.S. and S. Ramani. 2007. Introduction and establishment of *Cecidochares connexa* (Macquart) (Diptera: Tephritidae) for the biological suppression of *Chromolaena odorata* in India. *In* P.-Y. Lai, G.V.P. Reddy, and R. Muniappan, Eds. Proceedings of the 7th International Workshop on Biological Control and Management of *Chromolaena odorata* and *Mikania micrantha*. 12-15 September 2006, Taiwan; National Pingtung University of Science and Technology. pp. 38-48.
116	Bieńkowski, A. 2001. A study on the genus Chrysolina MOTSCHULSKY, 1860, with a checklist of all the described subgenera, species, subspecies, and synonyms (Coleoptera: Chrysomelidae: Chrysomelinae). Genus 12(2): 105-235.
117	Biocontrol Agents and Host Plants in British Columbia. 2012. *In* Invasive Plants with Biocontrol. British Columbia Ministry of Forests, Lands, and Natural Resource Operations, http://www.for.gov.bc.ca/hra/plants/biocontrol/bcmatrix.htm. 1 September 2012.
118	Biosecurity Australia. 2010. Draft risk analysis report for the release of *Plectonycha correntina* for the biological control of *Anredera cordifolia* (Madeira vine). Biosecurity Australia, Canberra. 56 pp.
119	Biosecurity SA. 2010. Biological control of English broom. Factsheet 2010. Government of South Australia. 2 pp.
120	Biosecurity SA. 2010. Biological control of gorse. Factsheet 2010. Government of South Australia. 2 pp.
121	Biosecurity SA. 2010. Biological control of Salvation Jane. Factsheet 2010. Government of South Australia. 2 pp.
122	Biosecurity SA. 2011. History of weed biocontrol agent releases in SA through August 2011. Government of South Australia. 4 pp.
123	BIRC. 2010. Directory of least-toxic pest control products (Bio-Integral Resource Center). The IPM Practitioner 32(11/12): 1-52.
124	Birdsall, J.L. and G.P. Markin. 2010. Biological control of yellow starthistle (*Centaurea solstitialis*) in the Salmon River canyon of Idaho. Invasive Plant Science and Management 3: 462-469.

Code	Reference
125	Blossey, B. 1993. Herbivory below ground and biological weed control: life history of a root-boring weevil on purple loosestrife. Oecologia 94(3): 380-387.
126	Blossey, B. 1995. Coexistence of two leaf-beetles in the same fundamental niche. Distribution, adult phenology and oviposition. Oikos 74: 225-234.
127	Blossey, B. 1997. (personal communication) Cornell University, Department of Natural Resources, Fernow Hall, Ithaca, New York, United States of America.
128	Blossey, B. 2002. Purple Loosestrife. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 149-157.
129	Blossey, B. 2013. (personal communication) Department of Natural Resources, 211 Bruckner Hall, Cornell University Ithaca, NY 14853, USA.
130	Blossey, B., R. Casagrande, L. Tewksbury, D.A. Landis, R.N. Wiedenmann, and D.R. Ellis. 2001. Nontarget feeding of leaf-beetles introduced to control purple loosestrife (*Lythrum salicaria* L.). Natural Areas Journal 21(4): 368-377.
131	Blossey, B. and M. Schat. 1997. Performance of *Galerucella calmariensis* (Coleoptera: Chrysomelidae) on different North American populations of purple loosestrife. Environmental Entomology 26: 339-445.
132	Blossey, B. and D. Schroeder. 1995. Host specificity of three potential biological weed control agents attacking flowers and seeds of *Lythrum salicaria* (purple loosestrife). Biological Control 5: 47-53.
133	Boardman, R.M. 1977. Biological control: pitting insects against insects. California Agriculture 31(10): 8-11.
134	Bofeng, I., G. Donnelly, W. Orapa, and M. Day. 2004. Biological control of *Chromolaena odorata* in Papua New Guinea. *In* M. Day and R.E. McFadyen, Eds. Proceedings of the 6th International Workshop on Biological Control and Management of *Chromolaena*. 6-9 May 2003, Cairns, Queensland, Australia; Australian Centre for International Agricultural Research. pp. 14-16.
135	Böhm, H. 2008. “*Opuntia dillenii*” - an interesting and promising Cactaceae taxon. Journal of the Professional Association for Cactus Development 10: 148-170.
136	Boldt, P.E. 1991. (personal communication) United States Department of Agriculture, Agricultural Research Service, Grasslands Research Laboratory, 808 Blackland Road, Temple, Texas 76502, United States of America.

Code	Reference
137	Boldt, P.E. and C.J. DeLoach. 1985. Evaluating *Rhinocyllus conicus* (Coleoptera : Curculionidae) on *Silybum marianum* (Compositae) in Texas. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 417-422.
138	Boldt, P.E. and R. Sobhian. 1993. Release and establishment of *Aceria malherbae* (Acari: Eriophyidae) for control of field bindweed in Texas. Environmental Entomology 22: 235-237.
139	Bootsma, H.A. and S.E. Jorgensen. 2004. Lake Malawi/Nyasa. *In* M. Nakamura, Ed. Managing Lake Basins: Practical Approaches for Sustainable Use. Global Environmental Facility. pp. 259-276.
140	Bornemissza, G.F. 1966. An attempt to control ragwort in Australia with the cinnabar moth, *Callimorpha jacobaeae* L. (Arctiidae: Lepidoptera). Australian Journal of Zoology 14: 201-243.
141	Bottimer, L.J. 1968. On the two species of *Bruchidius* (Coleoptera: Bruchidae) established in North America. The Canadian Entomologist 100(2): 139-145.
142	Boughton, A., G.R. Buckingham, C.A. Bennett, R. Zonneveld, J.A. Goolsby, R.W. Pemberton, and T.D. Center. 2011. Laboratory host range of *Austromusotima camptozonale* (Lepidoptera: Crambidae), a potential biological control agent of Old World climbing fern, *Lygodium microphyllum* (Lygodiaceae). Biocontrol Science and Technology 21(6): 643-676.
143	Boughton, A.J. 2013. (personal communication) University of Florida, Tropical Research & Education Center 18905 S.W. 280 Street Homestead, FL 33031 USA.
144	Boughton, A.J., R.R. Kula, M. Gates, Y. Zhang, M. Nunez, J. O'Connor, J.B. Whitfield, and T.D. Center. 2012. Parasitoids attacking larvae of a recently introduced weed biological control agent, *Neomusotima conspurcatalis* (Lepidoptera: Crambidae): key to species, natural history and integrative taxonomy Annals of the Entomological Society of America 105: 753-767.
145	Boughton, A.J. and R.W. Pemberton. 2008. Efforts to establish a foliage-feeding moth, *Austromusotima camptozonale*, against *Lygodium microphyllum* in Florida, considered in the light of a retrospective review of establishment success of weed biocontrol agents belonging to different arthropod taxa. Biological Control 47: 28-36.
146	Boughton, A.J. and R.W. Pemberton. 2009. Establishment of an imported natural enemy, *Neomusotima conspurcatalis* (Lepidoptera: Crambidae) against an invasive weed, Old World climbing fern, *Lygoidum microphyllum*, in Florida. Biocontrol Science and Technology 19(7): 769-772.
147	Boughton, A.J. and R.W. Pemberton. 2011. Limited field establishment of a weed biocontrol agent, *Floracarus perrepae* (Acariformes: Eriophyidae), against Old World climbing fern in Florida - a possible role of mite resistant plant genotypes. Environmental Entomology 40(6): 1448-1457.
148	Boughton, A.J. and R.W. Pemberton. 2012. Biology and reproductive parameters of the brown Lygodium moth, *Neomusotima conspurcatalis* - A new biological control agent of old world climbing fern in Florida. Environmental Entomology 41(2): 308-316.
149	Bourchier, R., R. Hansen, R. Lym, A. Norton, D. Olson, C.B. Randall, M. Schwarzländer, and L. Skinner. 2006. Biology and Biological Control of Leafy Spurge. FHTET-2005-07. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. 138 pp.
150	Bourchier, R. and B.H. Van Hezewijk. 2013. *Centaurea diffusa* Lamarck, diffuse knapweed and *Centaurea stoebe* subsp. *micranthos* (S.G. Gmel. ex Gugler) Hayek, spotted knapweed (Asteraceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 44. CABI Publishing Wallingford, U.K. pp. 302-307.
151	Bourchier, R. and B.H. Van Hezewijk. 2013. *Euphorbia esula* (L.), leafy spurge (Euphorbiaceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 47. CABI Publishing Wallingford, U.K. pp. 316-320.
152	Bourchier, R.S. 2013. (personal communication) Agriculture and Agri-Food Canada, Weed Biocontrol, Lethbridge Research Centre, 5403 1 Ave S, Lethbridge, Alberta, Canada T1J 4B1.
153	Bourchier, R.S., S. Erb, A.S. McClay, and A. Gassmann. 2002. *Euphorbia esula* (L.), leafy spurge and *Euphorbia cyprarissias* (L.), cypress spurge (Euphorbiaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 346-358.
154	Bourchier, R.S., K. Mortensen, and M. Crowe. 2002. *Centaurea diffusa* Lamarck, diffuse knapweed, and *Centaurea maculosa* Lamarck, spotted knapweed (Asteraceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 302-313.
155	Bourke, T.V., T.L. Fenner, J.N.L. Stibick, G.L. Baker, E. Hassan, D.F. O'Sullivan, and C.S. Li. 1973. Insect pest survey for the year ending 30th June 1969. Annual Report. Department of Agriculture, Stock and Fisheries, Port Moresby, Papua New Guinea. 57 pp.
156	Boyetchko, S.M. 2013. (personal communication) Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, Saskatchewan S7N 0X2 Canada.
157	Boyetchko, S.M., K.L. Bailey, and R.A. De Clerck-Floate. 2009. Current biological weed control agents - their adoption and future prospects. Prairie Soils and Crops Journal 2: 38-45.
158	Braimah, H. and J.A. Timbilla. 2002. A decade of successful biological control of Siam weed, *Chromolaena odorata* in Ghana: lessons and future plans. *In* C. Zachariades, R. Muniappan, and L. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 58-65.

Code	Reference
159	Brain, C.K. 1915. The Coccidae of South Africa - I. Transactions of the Royal Society of South Africa 5: 65-194.
160	Breniere, J. 1965. La lutte biologique a Madagascar. Congres de la Protection des Cultures Tropicales. Compte Rendus des Travaux, Marseilles 845-850.
161	Briden, K. 2008. Current status and management of boneseed in New Zealand. Plant Protection Quarterly 23(1): 20-22.
162	Briese, D.T. 1985. A survey to evaluate the long-term relationship between *Chrysolina quadrigemina* and its host-weed, St. John's wort, in southeastern Australia. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 691-708.
163	Briese, D.T. 1986. Factors affecting the establishment and survival of *Anaitis efformata* (Lepidoptera: Geometridae) introduced into Australia for the biological control of St. John's wort, *Hypericum perforatum*. II. Field trials. Journal of Applied Ecology 23: 821-839.
164	Briese, D.T. 1988. Bionomics of *Aphis chloris* Koch (Hemiptera: Aphididae) for biological control of St John's wort in Australia. Ecological Entomology 13: 365-374.
165	Briese, D.T. 1989. Host-specificity and virus-vector potential of *Aphis chloris* (Hemiptera: Aphididae), a biological control agent for St John's wort in Australia. Entomophaga 34: 247-264.
166	Briese, D.T. 1991. Current status of *Agrilus hyperici* (Coleoptera: Buprestidae) released in Australia in 1940 for the control of St John's wort: lessons for insect introductions. Biocontrol Science and Technology 1: 207-215.
167	Briese, D.T. 1991. Demographic processes in the root-borer *Agrilus hyperici* (Coleoptera: Buprestidae): a biological control agent of St John's wort. Biocontrol Science and Technology 1: 195-206.
168	Briese, D.T. 1996. Potential impact of the stem-boring weevil *Lixus cardui* on the growth and reproductive capacity of *Onopordum* thistles. Biocontrol Science and Technology 6: 251-261.
169	Briese, D.T. 1997. Biological control of St. John's wort: past, present and future. Plant Protection Quarterly 12: 73-80.
170	Briese, D.T. 2012. *Heliotropium amplexicaule* Vahl - blue heliotrope. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 282-288.
171	Briese, D.T. 2012. *Onopordum acanthium* L. (Scot thistle), *Onopordum illyricum* L. - Illyrian thistle and their hybrids. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 416-424.

Code	Reference
172	Briese, D.T. 2013. (personal communication) (Retired) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia.
173	Briese, D.T. and J.M. Cullen. 2012. *Hypericum perforatum* L. - St John's wort. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 299-307.
174	Briese, D.T. and P.W. Jupp. 1995. Establishment, spread and initial impact of *Aphis chloris* Koch (Hemiptera: Aphididae), introduced into Australia for the biological control of St John's wort. Biocontrol Science and Technology 5: 271-285.
175	Briese, D.T., W.J. Pettit, A. Swirepik, and A. Walker. 2002. A strategy for the biological control of *Onopordum* spp. thistles in south-eastern Australia. Biocontrol Science and Technology 1: 121-136.
176	Briese, D.T., W.J. Pettit, and A.D. Walker. 1996. Multiplying cages: a strategy for the rapid redistribution of agents with slow rates of increase. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 243-247.
177	Briese, D.T. and A. Walker. 2002. A new perspective on the selection of test plants for evaluating the host-specificity of weed biological control agents: the case of *Deuterocampta quadrijuga,* a potential insect control agent of *Heliotropium amplexicaule*. Biological Control 25: 273-287.
178	Briese, D.T. and M. Zapater. 2002. A strategy for the biological control of blue heliotrope (*Heliotropium amplexicaule*). *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 394-397.
179	Brinon, L. 2008. Cactus (*Acanthocereus pentagonus*) control trials on the south-west coast of New Caledonia. *In* V. Blanfort and W. Orapa, Eds. Ecology, impact and management of invasive plant species in pastoral areas: Proceedings of the regional workshop on invasive plant species in pastoral areas. 24-28 November 2003, Koné, New Caledonia; Secretariat of the Pacific Community. pp. 65-66.
180	Broughton, S. 1999. Impact of the seed-fly, *Ophiomyia lantanae* (Froggatt) (Diptera: Agromyzidae), on the viability of Lantana fruit in South-East Queensland, Australia. Biological Control 15: 168-172.
181	Broughton, S. 2000. Review and evaluation of lantana biocontrol programs. Biological Control 17(3): 272-286.
182	Bruckart, W.L., J.R. Frank, and D.R. Johnson. 1986. The potential of *Puccinia canaliculata* for biological control of yellow nutsedge in Maryland. *In* Proceedings of the 40th Annual Meeting, Northeastern Weed Science Society. Northeastern Weed Science Society. pp. 84.

Code	Reference
183	Bruckart, W.L. and G.L. Peterson. 1991. Phenotypic comparison of *Puccinia carduorum* from *Carduus thoermeri*, *C. tenuiflorus*, and *C. pycnocephalus*. Phytopathology 81: 192-197.
184	Bruckart, W.L., D.J. Politis, G. Defago, S.S. Rosenthal, and D.M. Supkoff. 1996. Susceptibility of *Carduus, Cirsium, and Cynara* species artificially inoculated with *Puccinia carduorum* from musk thistle. Biological Control 6: 215-221.
185	Bruzzese, E. 1995. Present status of biological control of European blackberry (*Rubus fruticosus* aggregate) in Australia. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 297-299.
186	Bruzzese, E. 1996. Ecology of *Cirsium vulgare* and *Silybum marianum* in relation to biological control. Plant Protection Quarterly 11: 245-249.
187	Bruzzese, E. and J.M. Cullen. 1995. Biological control of weeds of importance to the wool industry in southern Australia. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 457-462.
188	Bruzzese, E. and R.P. Field. 1985. Occurrence and spread of *Phragmidium violaceum* on blackberry (*Rubus fruticosus*) in Victoria, Australia. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 609-612.
189	Bruzzese, E. and M. Lane. 1996. The Blackberry Management Handbook. Department of Conservation and Natural Resources, Melbourne. 57 pp.
190	Buccellato, E.T.F., E.T.F. Witkowski, and M.J. Byrne. 2008. An arthropod and a pathogen in combination as biocontrol agents: how do they shape up? *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 57.
191	Buchanan, G. 1986. (personal communication) Department of Agriculture, P.O. Box 460, Irymple, Victoria 3498, Australia.
192	Buchanan, L.L. 1937. Notes on Curculionidae (Coleoptera). Journal of the Washington Academy of Sciences 27: 312-316.
193	Buckingham, G.R. 1988. Reunion in Florida - *Hydrilla,* a weevil, and a fly. Aquatics 10: 19-25.
194	Buckingham, G.R. 1994. Biological control of aquatic weeds. *In* D. Rosen, F.D. Bennett, and J.L. Capinera, Eds. Pest Management in the Subtropics: Biological Control - the Florida Experience. Intercept Ltd, Andover, U.K. pp. 413-480.

Code	Reference
195	Buckingham, G.R. 1996. Biological control of alligatorweed, *Alternanthera philoxeroides*, the world's first aquatic weed success story. Castanea 61: 232-243.
196	Buckingham, G.R. 2002. Alligatorweed. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. USDA Forest Service Publication FHTET-2002-04, Morgantown, WV, USA. pp. 5-16.
197	Buckingham, G.R. 2004. Alligatorweed, *Alternanthera philoxeroides*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and J. Cofrancesco, A.F., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 139-148.
198	Buckingham, G.R. 2004. Eurasian watermilfoil, *Myriophyllum spicatum*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 169-173.
199	Buckingham, G.R., D. Boucias, and R.F. Theriot. 1983. Reintroduction of the alligatorweed flea beetle (*Agasicles hygrophila* Selman and Vogt) into the United States from Argentina. Journal of Aquatic Plant Management 21: 101-102.
200	Buckingham, G.R. and M.J. Grodowitz. 2004. Hydrilla, *Hydrilla verticillata*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 184-195.
201	Buckingham, G.R. and B.M. Ross. 1981. Notes on the biology and host specificity of *Acentria nivea* (=*Acentropus niveus*). Journal of Aquatic Plant Management 19: 336.
202	Buckley, Y.M., M. Rees, Q. Paynter, and M. Lonsdale. 2004. Modeling integrated weed management of an invasive shrub in tropical Australia. Journal of Applied Ecology 41: 547-560.
203	Bule, S. 2009. Invasive Weeds management in Vanuatu. Presentation. *In* Pacific Biocontrol Strategy Workshop. 16-18th November 2009, Auckland, New Zealand; Landcare Research.
204	Bule, S. 2013. (personal communication) Biosecurity Vanuatu, Private Mail Bag 9095, Port Vila, Vanuatu.
205	Burkhardt, B. and H. Zwölfer. 2002. Macro-evolutionary trade-offs in the tephritid genus *Urophora*: benefits and costs of an improved plant gall. Evolutionary Ecology Research 4: 61-77.
206	Butler, F.C. 1951. Anthracnose and seedling blight of bathurst burr caused by *Colletotrichum xanthii* Halst. Australian Journal of Agricultural Research 2: 401-411.
207	Butler, J.L., M.S. Parker, and J.T. Murphy. 2006. Efficacy of flea beetle control of leafy spurge in Montana and South Dakota. Rangeland Ecology & Management 59: 453-461.

Code	Reference
208	Byrne, M., M. Hill, M. Robertson, A. King, A. Jadhav, N. Katembo, J. Wilson, R. Brudvig, and J. Fisher. 2010. Integrated management of water hyacinth in South Africa: Development of an integrated management plan for water hyacinth control, combining biological control, herbicidal control and nutrient control, tailored to the climatic regions of South Africa. WRC Report No. TT 454/10. Water Research Commission, Gezina, Pretoria. 302 pp.
209	Byrne, M.J. 2013. (personal communication) University of the Witwatersrand, School of Animal, Plant and Environmental Sciences, Private Bag 3, Johannesburg, 2050 South Africa.
210	Byrne, M.J., S. Currin, and M.P. Hill. 2002. The influence of climate on the establishment and success of the biocontrol agent *Gratiana spadicea*, released on *Solanum sisymbriifolium* in South Africa. Biological Control 24(2): 128-134.
211	Byrne, M.J., E.T.F. Witkowski, and F.N. Kalibbala. 2011. A review of recent efforts at biological control of *Caesalpinia decapetala* (Roth) Alston (Fabaceae) in South Africa. African Entomology 19(2): 247-257.
212	Cabrera Walsh, G. 2013. (personal communication) Fundacion para el Estudio de Especies Invasivas. Bolivar 1559, Hurlingham, Buenos Aires, Argentina.
213	Caldara, R. 2008. On the taxonomy and nomenclature of some Mecinini (Coleoptera, Curculionidae). Fragmenta entomologica, Roma 40(1): 125-137.
214	Caldara, R. 2012. (personal communication) Via Lorenteggio 37, I-20146 Milano, MI, Italia.
215	Caldara, R. and F. V. 2013. Systematics of the weevil genus *Mecinus* Germar, 1821 (Coleoptera: Curculionidae). I. Taxonomic treatment of the species. Zootaxa 3654(1): 1-105.
216	Calder, A.A. and D.P.A. Sands. 1985. A new Brazilian *Cyrtobagous* Hustache (Coleoptera: Curculionidae) introduced into Australia to control salvinia. Journal of the Australian Entomological Society 24: 57-64.
217	Callan, B.E., R. Wall, and V. Joshi. 2011. *Phragmidium violaceum* on *Rubus armeniacus* and *R. laciniatus* in British Columbia. North American Fungi 6(14): 1-5.
218	Callan, E.M. 1978. Biological notes on the introduced sawfly *Priophorus morio* (Lepeletier) (Hymenoptera: Tenthredinidae) in Australia. Journal of the Australian Entomological Society 17: 23-24.
219	Cam, N.V. 1997. (personal communication) Vien Bao Ve Thuc Vat, Chem Tu Liem, Hanoi, Vietnam.
220	Cam, N.V., P.V. Lam, H.C. Dien, T.T. Huong, and N.T. Hien. 1996. Biological control of giant sensitive plant *Mimosa pigra* in Vietnam. *In* N.V. Cam and P.V. Lam, Eds. Selected Scientific Reports on Biological Control of Pests and Weeds (1990-1995). Agricultural Publishing House, Hanoi, Vietnam. pp. 85-94.
221	Campbell, C., G.P. Markin, and M.W. Johnson. 1993. Fate of C*yanotricha necyria* (Lepidoptera: Notodontidae) and *Pyrausta perelegans* (Lepidoptera: Pyralidae) released for biological control of banana poka (*Passiflora mollissima*) on the Island of Hawai'i. Proceedings of the Hawaiian Entomological Society 32: 123-130.
222	Campbell, C.L. and J.P. McCaffrey. 1991. Population trends, seasonal phenology and impact of *Chrysolina quadrigemina*, *C. hyperici* (Coleoptera: Chrysomelidae) and *Agrilus hyperici* (Coleoptera: Buprestidae) associated with *Hypericum perforatum* in northern Idaho. Environmental Entomology 20: 303-315.
223	Campbell, M.H., D.T. Briese, and E.S. Delfosse. 1995. *Hypericum perforatum* L. *In* R.H. Groves, R.C.H. Shepherd, and R.G. Richardson, Eds. The Biology of Australian Weeds. Vol. 1. R.G. and F.J. Richardson, Melbourne. pp. 149-168.
224	Campbell, M.H., R.H. Holtkamp, L.H. McCormick, P.J. Wykes, J.F. Donaldson, P.J. Gullan, and P.S. Gillespie. 1994. Biological control of the native shrubs *Cassinia* spp. using the native scale insects *Austrotachardia* sp. and *Paratachardina* sp. (Hemiptera: Kerriidae) in New South Wales. Plant Protection Quarterly 9(2): 64-68.
225	Carrapiço, F., R. Santons, and A. Serrano. 2011. First occurrence of *Stenopelmus rufinasus* Gyllenhal, 1835 (Coleoptera: Erirhinidae) in Portugal. The Coleopterists Bulletin 65(4): 436-437.
226	Cartwright, B. and L.T. Kok. 1985. Growth responses of musk and plumeless thistles (*Carduus nutans* and *C. acanthoides*) to damage by *Trichosirocalus horridus* (Coleoptera: Curculionidae). Weed Science 33: 57-62.
227	Cartwright, K. 2013. (personal communication) 700 Research Ctr. Blvd., Fayetteville, AR 72701 USA.
228	Casonato, S.G., A.C. Lawrie, and D.A. McLaren. 1999. Biological control of *Hypericum androsaemum* with *Melampsora hypericorum*. *In* A.C. Bishop, M. Boersma, and C.D. Barnes, Eds. Proceedings of the 12th Australian Weeds Conference. 12-16 September 1999, Hobart, Tasmania, Australia; Tasmanian Weeds Society. pp. 339-342.
229	Castells, E., M.A. Berhow, S.F. Vaughn, and M.R. Berenbaum. 2005. Geographic variation in alkaloid production in *Conium maculatum* populations experiencing differential herbivory by *Agonopterix alstroemeriana*. Journal of Chemical Ecology 31(8): 1693-1709.
230	CDFA. 2011. Beneficial bugs in the Delta: CDFA begins releasing insects that feed on invasive water hyacinth. Planting Seeds, Food and Farming News from CDFA July 2011: 2 pp.
231	CDFA Unpublished Records. 2013. California Department of Food and Agriculture, Biological Control Program, 3288 Meadowview Road, Sacramento, California 95832 USA.

Code	Reference
232	Center, T., M.B. Rayamajhi, M.F. Purcell, M. Markinson, and J. Ding. 2011. Pre-release colonization of *Lilioceris* sp nr. *impressa* (Coleoptera: Chrysomelidae: Criocerinae) for control of air potato. Invasive Plant Management Research and Outreach Newsletter 3(1): 9-10.
233	Center, T.D. 1984. Dispersal and variation in infestation intensities of waterhyacinth moth, *Sameodes albiguttalis* (Lepidoptera; Pyralidae), populations in peninsular Florida. Environmental Entomology 13: 482-491.
234	Center, T.D. 1992. Release and field colonization of new biological control agents of *Hydrilla verticillata*. *In* Proceedings of the 26th Annual Meeting, Aquatic Plant Control Research Program. 18-22 November 1991, Dallas, Texas, USA; U.S. Army Engineers Waterways Experiment Station. pp. 205-221.
235	Center, T.D. 1994. Biological control of weeds: waterhyacinth and waterlettuce. *In* D. Rosen, F.D. Bennett, and J.L. Capinera, Eds. Pest Management in the Subtropics: Biological Control - the Florida Experience. Intercept Ltd, Andover, U.K. pp. 481-521.
236	Center, T.D. 2004. Waterhyacinth, *Eichhornia crassipes*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 402-413.
237	Center, T.D. 2013. (personal communication) (Retired) United States Department of Agriculture, Agricultural Research Service, Invasive Plant Research Laboratory, 3225 College Ave. Fort Lauderdale, FL 33314 USA.
238	Center, T.D., A.F. Cofrancesco, and J.K. Balciunas. 1989. Biological control of wetland and aquatic weeds in the southeastern United States. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 239-262.
239	Center, T.D., F.A. Dray Jr., and W.C. Durden. 1991. Release and establishment of insect biocontrol agents for hydrilla control. *In* Proceedings of the 25th Annual Meeting, Aquatic Plant Control Research Program. 26-30 June 1990, Orlando, Florida, USA; U.S. Army Engineers Waterways Experiment Station. pp. 124-132.
240	Center, T.D., M.J. Grodowitz, A.F. Cofrancesco, G. Jubinsky, E. Snoddy, and J.E. Freedman. 1997. Establishment of *Hydrellia pakistanae* (Diptera: Ephydridae) for the biological control of the submersed aquatic plant *Hydrilla verticillata* (Hydrocharitaceae) in the southeastern United States. Biological Control 8: 65-73.
241	Center, T.D. and M.P. Hill. 2002. Filed efficacy and predicted host range of the pickerelweed borer, *Bellura densa*, a potential biological control agent of water hyacinth. Biocontrol 47: 231-243.
242	Center, T.D., M.P. Hill, H. Cordo, and M.H. Julien. 2002. Waterhyacinth. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 41-72.

Code	Reference
243	Center, T.D., P.D. Pratt, P. Tipping, M.B. Rayamajhi, T.K. Van, S.A. Wineriter, F.A. Dray Jr., and M. Purcell. 2006. Field colonization, population growth, and dispersal of *Boreioglycaspis melaleucae* Moore, a biological control agent of the invasive tree *Melaleuca quinquenervia* (Cav.) Blake. Biological Control 39: 363-374.
244	Center, T.D., P.D. Pratt, P.W. Tipping, M.B. Rayamajhi, T.K. Van, S.A. Wineriter, and F.A. Dray. 2007. Initial impacts and field validation of host range for *Boreioglycaspis melaleucae* Moore (Hemiptera: Psyllidae), a biological control agent of the invasive tree *Melaleuca quinquenervia* (Cav.) Blake (Myrtales: Myrtaceae: Leptospermoideae). Environmental Entomology 36(3): 569-576.
245	Center, T.D., P.D. Pratt, P.W. Tipping, M.B. Rayamajhi, S.A. Wineriter, and M.F. Purcell. 2008. Biological control of *Melaleuca quinquenervia*: goal-based assessment of success. *In* M. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 655-664.
246	Center, T.D., M.F. Purcell, P.D. Pratt, M.B. Rayamajhi, P.W. Tipping, S.A. Wright, and F.A. Dray Jr. 2012. Biological control of *Melaleuca quinquenervia*: an Everglades invader. Biocontrol 57: 151-165.
247	Center, T.D., T.K. Van, M. Rayachhetry, G.R. Buckingham, F.A. Dray Jr., S.A. Wineriter, M.F. Purcell, and P.D. Pratt. 2000. Field colonization of the melaleuca snout beetle (*Oxyops vitiosa*) in South Florida. Biological Control 19: 112-123.
248	Chaboudez, P., R.H. Groves, and J.J. Burdon. 1993. *Puccinia Cardui-Pycnocephali*, a potential agent for the biological control of slender thistles in Australia. *In* J.T. Swarbrick, Ed. Proceedings of the 10th Australian and 14th Asian-Pacific Weed Conference 6-10 September 1993, Brisbane, Queensland, Australia; The Weed Society of Queensland. pp. 84-88.
249	Chabwela, H.N. and G.K. Kalyocha. 2003. An evaluation of the impact of invasive weeds on important migratory waterbird sites and their rehabilitation: the case of the Kafue flats. Report for the International Union for the Conservation of Nature. Zambia. 158 pp.
250	Chacko, M.J. and A.U. Narasimham. 1988. Biocontrol attempts against *Chromolaena odorata* in India - a review. *In* R. Muniappan, Ed. Proceedings of the 1st International Workshop on Biological Control of *Chromolaena odorata*. Feb 29 - March 4 1988, Bangkok, Thailand; Agricultural Experiment Station. pp. 65-79.
251	Charudattan, R. 1991. Chapter 2. The mycoherbicide approach with plant pathogens. *In* D.O. TeBeest, Ed. Microbial Control of Weeds. Chapman and Hall, Inc., New York. pp. 24-57.
252	Charudattan, R. 2005. Use of plant pathogens as bioherbicides to manage weeds in horticultural crops. Proceedings of the Florida State Horticultural Society 118: 208-214.

Code	Reference
253	Charudattan, R. 2013. (personal communication) President & CEO, BioProdex, Inc. Emeritus Professor, Univ. Florida-Plant Pathology Dept. 3131 NW 13th Street, Suite 54 Gainesville, FL 32609-2183 USA.
254	Chiarelli, R.N., P.D. Pratt, C.S. Silvers, J.S. Blackwood, and T.D. Center. 2011. Influence of temperature, humidity, and plant terpenoid profile on life history characteristics of *Boreioglycaspis melaleucae* (Hemiptera: Psyllidae), a biological control agent of the invasive tree *Melaleuca quinquenervia*. Annals of the Entomological Society of America 104(3): 488-497.
255	Chikwenhere, G.P. 1992. Floating aquatic weeds in Zimbabwe. *In* T. Matiza and S.A. Crafter, Eds. Proceedings of a Seminar on Wetlands of Zimbabwe (Wetlands, Ecology and Priorities for Conservation in Zimbabwe). 13-15 January 1992, pp. 137-148.
256	Chikwenhere, G.P. 1994. Biological control of water hyacinth (*Eichhornia crassipes*) in Zimbabwe - results of a pilot study. FAO Plant Protection Bulletin 42(4): 185-190.
257	Chikwenhere, G.P. 1994. Biological control of water lettuce in various impoundments of Zimbabwe. Journal of Aquatic Plant Management 32: 27-29.
258	Chikwenhere, G.P. 1998. Biological control in the management of water hyacinth and other macrophytes in Zimbabwe - a review. *In* Workshop on the Conservation and Management of Wetlands in Zimbabwe. 12-14 February 1997, Harare, Zimbabwe.
259	Chikwenhere, G.P. 1997. (personal communication) Plant Protection Research Institute, P.O. Box 8100, Causeway, Harare, Zimbabwe.
260	Chikwenhere, G.P. 2001. Current strategies for the management of water hyacinth on the Manyame River System in Zimbabwe. *In* M.H. Julien, M.P. Hill, T.D. Center, and J. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 105-108.
261	Chikwenhere, G.P. and I.W. Forno. 1991. Introduction of *Neohydronomus affinis* for biological control of *Pistia stratiotes* in Zimbabwe. Journal of Aquatic Plant Management 29: 53-55.
262	Chikwenhere, G.P. and C.L. Keswani. 1997. Economics of biological control of Kariba weed (*Salvinia molesta* Mitchell) at Tengwe in north-western Zimbabwe - a case study. International Journal of Pest Management 43: 109-112.
263	Chikwenhere, G.P. and S. Vestergaard. 2001. Potential effects of *Beauveria bassiana* (Balsmo) Vuillemin on *Neochetina bruchi* Hustache (Coleoptera: Curculionidae), a biological control agent of water hyacinth. Biological Control 21: 105-110.

Code	Reference
264	Choi, S. 2006. The efficacy of the weevil *Cyrtobagous salviniae* (Coleoptera: Curculionidae) as a biological control on giant salvinia (*Salvinia molesta*) in the lower Colorado River. Dissertation, Doctor of Philosophy. University of Arizona, Tucson, Arizona, USA. 80 pp.
265	Chu, J.-J., Y. Ding, and Q.-j. Zhuang. 2006. Invasion and control of water hyacinth (*Eichhornia crassipes*) in China. Journal of Zhejiang University SCIENCE B 7(8): 623-626.
266	Chun, M.E. 2002. Biological control of ivy gourd, *Coccinia grandis* (Cucurbitaceae), in Hawai'i. *In* C.W. Smith, J. Denslow, and S. Hight, Eds. Proceedings of workshop on biological control of native ecosystems in Hawaii, Technical Report 129. Pacific Cooperative Studies Unit, University of Hawaii at Manoa, Department of Botany, Honolulu, Hawaii, USA. pp. 8-12.
267	Cilliers, C.J. 1977. On the biological control of *Lantana camara* in South Africa. *In* Proceedings of the 2nd National Weeds Conference of South Africa. 2-4 February 1977, Stellenbosch, South Africa; A.A. Balkema. pp. 341-344.
268	Cilliers, C.J. 1983. The weed, *Lantana camara* L., and the insect natural enemies imported for its biological control into South Africa. Journal of the Entomological Society of South Africa 46: 131-138.
269	Cilliers, C.J. 1987. The evaluation of three insect natural enemies for the biological control of the weed *Lantana camara* L. Journal of the Entomological Society of South Africa 50: 15-34.
270	Cilliers, C.J. 1987. First attempt at and early results on the biological control of *Pistia stratiotes* L. in South Africa. Koedoe 30: 35-40.
271	Cilliers, C.J. 1987. Notes on the biology of the insect natural enemies of *Lantana camara* L. (Verbenaceae) and their seasonal history in South Africa. Journal of the Entomological Society of South Africa 50: 1-13.
272	Cilliers, C.J. 1991. Biological control of water fern, *Salvinia molesta* (Salviniaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 219-224.
273	Cilliers, C.J. 1991. Biological control of water hyacinth, *Eichhornia crassipes* (Pontederiaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 207-217.
274	Cilliers, C.J. 1995. Is one biological control agent sufficient to control *Pistia stratiotes*? *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 273.
275	Cilliers, C.J. 1997. (personal communication) Agricultural Research Council, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, Republic of South Africa.
276	Cilliers, C.J. 1999. Biological control of parrot's feather, *Myriophyllum aquaticum* (Vell.) Verdc. (Haloragaceae) in South Africa. *In* Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 113-118.

Code	Reference
277	Cilliers, C.J. 2013. (personal communication) (Retired) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
278	Cilliers, C.J., P.L. Campbell, D. Naude, and S. Neser. 1996. An integrated water hyacinth control program on the Vaal River, in a cool, high altitude area in South Africa. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 87-103.
279	Cilliers, C.J., M.P. Hill, J.A. Ogwang, and O. Ajuonu. 2003. Aquatic weeds in Africa and their control. *In* P. Neuenschwander, C. Borgemeister, and J. Langewald, Eds. Biological Control in IPM Systems in Africa. CAB International, Wallingford, U.K. pp. 161-178.
280	Cilliers, C.J. and S. Neser. 1991. Biological control of *Lantana camara* (Verbenaceae) in South Africa. Agriculture, Ecosystems & Environment 37: 57-75.
281	Cilliers, C.J., D. Zeller, and G. Strydom. 1996. Short- and long-term control of water lettuce (*Pistia stratiotes*) on seasonal water bodies and on a river system in the Kruger National Park, South Africa. Hydrobiologia 340: 173-179.
282	CIPC. 2010. Broom biocontrol? Look for galls in broom! Coastal Invasive Plant Committee E-Newsletter(October 2010): 7.
283	Claridge, M.F., R.L. Blackman, and C.R.B. Baker. 1970. *Haltica carduorum* Guerin introduced into Britain as a potential control agent for creeping thistle *Cirsium arvense* (L.) Scop. Entomologist 103: 210-212.
284	Clarke, C.R., J. Baker, M.A. Keller, and R.T. Roush. 2000. Biological control of horehound: lessons from South Australia. Plant Protection Quarterly 15(1): 29-32.
285	Cochard, R. and B.R. Jackes. 2005. Seed ecology of the invasive tropical tree *Parkinsonia aculeata*. Plant Ecology 180: 13-31.
286	Cochereau, P. and C. Mille. 2008. Weeds control in New Caledonia. *In* V. Blanfort and W. Orapa, Eds. Ecology, impact and management of invasives plant species in pastoral areas: Proceedings of the regional workshop on invasive plant species in pastoral areas. 24 to 28 November 2003, Koné, New Caledonia; Secretariat of the Pacific Community. pp. 104-107.
287	Cock, M.J.W. 1984. Possibilities for biological control of *Chromolaena odorata.* Tropical Pest Management. 30: 7-13.
288	Cock, M.J.W., Ed. 1985. A review of biological control of pests in the Commonwealth Caribbean and Bermuda up to 1982. Technical Communication No. 9, Commonwealth Institute of Biological Control. CAB, Farnham Royal. 218 pp.
289	Cock, M.J.W. 1986. (personal communication) Commonwealth Institute of Biological Control, Imperial College, Silwood Park, Ascot Berks SL5 7PY, United Kingdom.

Code	Reference
290	Cock, M.J.W., C.A. Ellison, H.C. Evans, and P.A.C. Ooi. 2000. Can failure be turned into success for biological control of mile-a-minute weed (*Mikania micrantha*)? *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 155-167.
291	Cock, M.J.W. and H.C.J. Godfray. 1985. Biological control of *Lantana camara* L. in the Philippines. Journal of Plant Protection in the Tropics 2: 61-63.
292	Cock, M.J.W. and J.D. Holloway. 1982. The history of, and prospects for, the biological control of *Chromolaena odorata* (Compositae) by *Pareuchaetes pseudoinsulata* Rego Barros and allies (Lepidoptera: Arctiidae). Bulletin of Entomological Research. 72: 193-205.
293	Cocquempot, C. 2013. (personal communication) INRA - UMR 1062 CBGP, International Campus of Baillarguet, CS 30016, 34988 Montférrier-sur-Lez cedex, France.
294	Coetzee, J.A., M.J. Byrne, and M.P. Hill. 2007. Impact of nutrients and herbivory by *Eccritotarsus catarinensis* on the biological control of water hyacinth, *Eichhornia crassipes*. Aquatic Botany 86: 179-186.
295	Coetzee, J.A., T.D. Center, M.J. Byrne, and M.P. Hill. 2005. Impact of the biocontrol agent *Eccritotarsus catarinensis*, a sap-feeding mirid, on the competitive performance of waterhyacinth, *Eichhornia crassipes*. Biological Control 32(1): 90-96.
296	Coetzee, J.A., M.P. Hill, and M.J. Byrne. 2008. Ten years after the release of the water hyacinth mirid *Eccritotarsus catarinensis* in South Africa: what have we learnt? *In* M. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 512-515.
297	Coetzee, J.A., M.P. Hill, M.J. Byrne, and A. Bownes. 2011. A review of the biological control programmes on *Eichhornia crassipes* (C. Mart.) Solms (Pontederiaceae), *Salvinia molesta* D. S Mitch. (Salviniaceae), *Pistia stratiotes* L. (Araceae), *Myriophyllum aquaticum* (Vell.) Verdc. (Haloragaceae) and *Azolla filiculoides* Lam. (Azollaceae) in South Africa. African Entomology 19(2): 451-468.
298	Coetzee, J.A., M.P. Hill, M.H. Julien, T.D. Center, and H.A. Cordo. 2009. *Eichhornia crassipes* (Mart.) Solms-Laub. (Pontederiaceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 183-210.
299	Coetzer, W. 2000. Oviposition preference of *Sulcobruchus subsuturalis* (Pic) (Coleoptera: Bruchidae), and introduced natural enemy of *Caesalpinia decapetala* (Roth) Alston (Caesalpiniaceae) in South Africa. African Entomology 8(2): 293-297.

Code	Reference
300	Coetzer, W. and J.H. Hoffmann. 1997. Establishment of *Neltumius arizonensis* (Coleoptera: Bruchidae) on mesquite (*Prosopis* Species: Mimosaceae) in South Africa. Biological Control 10: 187-192.
301	Coetzer, W. and S. Neser. 1999. Biological control initiatives against the invasive Oriental legume, *Caesalpinia decapetala* (Roth) Alston (Mauritius thorn), in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 145-152.
302	Cofrancesco, A.F. 2013. (personal communication) United States Army Corps of Engineers, Waterways Experiment Station, CEWES-ER-A, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199 USA.
303	Cofrancesco, A.F.J. 1988. Alligatorweed survey of ten southern states. Miscellaneous Paper A-88-3. U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, USA. 136 pp.
304	Cofrancesco Jr., A.F. 1982. Impact of augmented field populations of *Arzama densa* larvae on waterhyacinth. Miscellaneous Paper A-82-8. U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, USA. 25 pp.
305	Colless, D.H. 1982. Australian Anthomyiidae (Diptera). Australian Journal of Zoology 30: 81-91.
306	Collier, T.R. 2013. (personal communication) University of Wyoming, Department of Renewable Resources, 1000 E. University Avenue, Laramie, WY 82071 USA.
307	Colonnelli, E. 1983. Alcune Note Di Sistematica Generale Dei Ceitorhynchinae, Con Descrizione Di Un Nuovo Genere E Di Tre Nuove Specie (Coleoptera, Curculionidae). Fragm. Entomol., Roma 17(1): 159-179.
308	Commonwealth Institute of Biological Control. 1967. Annual Report for 1967. 99 pp.
309	Commonwealth Institute of Biological Control. 1968. Annual Report for 1968. 105 pp.
310	Commonwealth Institute of Biological Control. 1969. Annual Report for 1969. 107 pp.
311	Commonwealth Institute of Biological Control. 1970. Annual Report for 1970. 115 pp.
312	Commonwealth Institute of Biological Control. 1971. Annual Report for 1971. 135 pp.
313	Commonwealth Institute of Biological Control. 1972. Annual Report for 1972. 102 pp.
314	Commonwealth Institute of Biological Control. 1973. Annual Report for 1973. 52 pp.
315	Commonwealth Institute of Biological Control. 1974. Annual Report for 1974. 108 pp.

Code	Reference
316	Commonwealth Institute of Biological Control. 1975. Annual Report for 1975. 106 pp.
317	Commonwealth Institute of Biological Control. 1976. Annual Report for 1976. 113 pp.
318	Commonwealth Institute of Biological Control. 1978. Annual Report for 1977-1978. 90 pp.
319	Commonwealth Institute of Biological Control. 1979. Annual Report for 1978-1979. 92 pp.
320	Commonwealth Institute of Biological Control. 1981. Annual Report for 1980-1981. 88 pp.
321	Commonwealth Institute of Biological Control. 1982. Annual Report for 1981-1982. 85 pp.
328	Commonwealth Institute of Biological Control. 1983. Annual Report for 1982-1983. 63 pp.
322	Conant, P. 1998. A New Host Record for *Oidaematophorus beneficus* Yano & Heppner (Lepidoptera: Pterophoridae). Proceedings of the Hawaiian Entomological Society 33: 151-152.
323	Conant, P. 2002. Classical biological control of *Clidemia hirta* (Melastomataceae) in Hawai'i using multiple strategies. *In* C.W. Smith, J. Denslow, and S. Hight, Eds. Proceedings of workshop on biological control of native ecosystems in Hawaii, Technical Report 129. Pacific Cooperative Studies Unit, University of Hawaii at Manoa, Department of Botany, Honolulu, Hawaii, USA. pp. 13-20.
324	Conant, P. 2009. *Clidemia hirta* (L.) D. Don (Melastomataceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 163-182.
325	Conant, P. 2013. (personal communication) Hawaii Department of Agriculture, Plant Pest Control Branch, Hilo, Hawaii 96720 USA.
326	Conant, P., J.N. Garcia, M.T. Johnson, W.T. Nagamine, C.K. Hirayama, G.P. Markin, and R.L. Hill. 2013. Releases of natural enemies made in Hawaii since 1980 for classical biological control of weeds. *In* Y. Wu, T. Johnson, S. Sing, S. Raghu, G. Wheeler, P. Pratt, K. Warner, T. Center, J. Goolsby, and R. Reardon, Eds. Proceedings of the XIII International Symposium on Biological Control of Weeds. 11-16 September 2011, Kohala Coast, Hawaii, USA; Forest Health Technology Enterprise Team, Morgantown, WV, USA. pp. 230-242.
327	Connett, J.F., L.M. Wilson, J.P. McCaffrey, and B.L. Harmon. 2001. Phenological synchrony of *Eustenopus villosus* (Coleoptera: Curculionidae) with *Centaurea solstitialis* in Idaho. Environmental Entomology 30(2): 439-442.

Code	Reference
329	Conway, K.E., T.E. Freeman, and R. Charudattan. 1978. Development of *Cercospora rodmanii* as a biological control for *Eichhornia crassipes*. *In* Proceedings of the 5th International Symposium on Aquatic Weeds. 1978, Amsterdam, The Netherlands; European Weed Research Society. pp. 225-230.
330	Cook, J.C., R. Charudattan, T.W. Zimmerman, E.N. Rosskopf, W.M. Stall, and G.E. MacDonald. 2009. Effects of *Alternaria destruens*, glyphosate, and ammonium sulfate individually and integrated for control of dodder (*Cuscuta pentagona*). Weed Technology 23(4): 550-555.
331	Cook, R.P. 2001. Specificity of *Liothrips urichi* (Thysanoptera: Phlaeothripidae) for *Clidemia hirta* in American Samoa. Proceedings of the Hawaiian Entomological Society 35: 143-144.
332	Coombs, E.M. 1997. Biological control of weeds in Oregon. Annual Report. Project summaries 1996. Oregon Department of Agriculture, Noxious Weed Control Program, Salem, Oregon, USA. 33 pp.
333	Coombs, E.M. 1997. (personal communication) Oregon Department of Agriculture, Salem, Oregon 97310, United States of America.
334	Coombs, E.M. 2012. Biological control of weeds in Oregon. Annual Report 2012. Oregon Department of Agriculture, Noxious Weed Control Program, Salem, Oregon, USA. 35 pp.
335	Coombs, E.M. 2013. (personal communication) Oregon Department of Agriculture, Noxious Weed Control Program, 635 Capitol St NE Salem, OR 97301 USA.
336	Coombs, E.M., G.P. Markin, and J. Andreas. 2008. Release and establishment of the Scotch broom seed beetle, *Bruchidius villosus*, in Oregon and Washington, USA. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April, 2007, La Grande Motte, France; CAB International. pp. 516-520.
337	Coombs, E.M., G.P. Markin, P.D. Pratt, and B. Rice. 2004. Gorse, *Ulex europaeus*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 178-183.
338	Coombs, E.M., P.B. McEvoy, and G.P. Markin. 2004. Tansy ragwort, *Senecio jacobaea*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 335-344.
339	Coombs, E.M., J.C. Miller, L.A. Andres, and C.E. Turner. 2008. Biological control of Mediterranean sage (*Salvia aethiopis*) in Oregon. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April, 2007, La Grande Motte, France; CAB International. pp. 521-527.

Code	Reference
340	Coombs, E.M. and M.J. Pitcairn. 2004. Brooms. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 158-160.
341	Coombs, E.M. and L.M. Wilson. 2004. Mediterranean sage, *Salvia aethiopis*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 263-264.
342	Coppens d'Eeckenbrugge, G., V.E. Barney, P.M. Jorgenson, and J.M. MacDougal. 2001. *Passiflora tarminiana*, a new cultivated species of Passiflora subgenus Tacsonia (Passifloraceae). Novon 11(1): 8-15.
343	Cordo, H.A. 1996. Biological control of weeds in Argentina: progress and actual situation, two decades after its initiation. *In* M.C. Zapater, Ed. Proceedings of the 3rd Round Table of Biological Control in the Neotropics. 12-16 August 1991, Rio de Janeiro, Brazil; International Organization for Biological Control. pp. 9-15.
344	Cordo, H.A. 1997. (personal communication) Biological Control of Weeds Laboratory, United States Department of Agriculture, Agricultural Research Service, Bolivar 1559, 1686 Hurlingham, Province of Buenos Aires, Argentina.
345	Cordo, H.A. and C.J. DeLoach. 1976. Biology of the waterhyacinth mite in Argentina. Weed Science 24(3): 245-249.
346	Cordo, H.A., C.J. DeLoach, and D.H. Habeck. 1999. Biology of *Heilipodus ventralis* (Coleoptera: Curculionidae), an Argentine weevil for biological control of snakeweeds (*Gutierrezia* spp.) in the United States. Biological Control 15: 210-227.
347	Corrigan, J., D.R. Gillespie, R.A. De Clerck-Floate, and P.G. Mason. 2013. *Lythrum salicaria* L., purple loosestrife (Lythraceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 54. CABI Publishing Wallingford, U.K. pp. 363-366.
348	Costea, M., I. Spence, and S. Stefanovic. 2011. Systematics of *Cuscuta chinensis* species complex (subgenus *Grammica*, Convolvulaceae): evidence for long-distance dispersal and one new species. Organisms Diversity & Evolution 11: 373-386.
349	Costea, M. and F.J. Tardif. 2006. *Cuscuta campestris* Yuncker, *C. gronovii* Willd. ex Schult., *C. umbrosa* Beyr. ex Hook., *C. epithymum* (L.) L. and *C. epilinum* Weihe. Canadian Journal of Plant Science 86: 293-316.
350	Coulson, J.R. 1977. Biological control of alligatorweed, 1959-1972. A review and evaluation. Technical Bulletin No. 1547. United States Department of Agriculture, Washington D.C. 98 pp.
351	Coulson, J.R. 1981. The Soviet-American environmental agreement and exchange of beneficial organisms, 1972-1979. *In* J.R. Coulson, Ed. Proceedings of the Joint American-Soviet Conference on Use of Beneficial Organisms in the Control of Crop Pests. 13-14 August 1979, Washington, USA; Entomological Society of America. pp. 1-11.

Code	Reference
352	Coutinot, D., U. Starfinger, R. McFadyen, M.G. Volkovitsh, L. Kiss, M. Cristofaro, and P. Ehret. 2008. Feasibility of biological control of common ragweed (*Ambrosia artemisiifolia*) a noxious and highly allergenic weed in Europe. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 717-719.
353	Cowley, J.M. 1983. Life cycle of *Apion ulicis* (Coleoptera: Apionidae), and gorse seed attack around Auckland, New Zealand. New Zealand Journal of Zoology 10: 83-86.
354	Craemer, C. 1995. Host specificity, and release in South Africa, of *Aceria malherbae* Nuzzaci (Acari: Eriophyoidea), a natural enemy of *Convolvulus arvensis* L. (Convolvulaceae). African Entomology 3(2): 213-215.
355	Craemer, C. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Biosystematics Roodeplaat, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
356	Creed Jr., R.P. 1998. A biogeographic perspective on Eurasian watermilfoil declines: additional evidence for the role of herbivorous weevils in promoting declines? Journal of Aquatic Plant Management 36: 16-22.
357	Creed, R.P. and S.P. Sheldon. 1995. Weevils and watermilfoil: did a North American herbivore cause the decline of an exotic plant? Ecological Applications 5: 1113-1121.
358	Creed, R.P.J. 1997. (personal communication) Appalachian State University, Department of Biology, Boone, North Carolina 28608, United States of America.
359	Creed, R.P.J. and S.P. Sheldon. 1994. The effect of two herbivorous insect larvae on Eurasian watermilfoil. Journal of Aquatic Plant Management 32: 21-26.
360	Cripps, M.G., G.R. Edwards, G.W. Bourdôt, D.J. Saville, H.L. Hinz, and S.V. Fowler. 2010. Effects of pasture competition and specialist herbivory on the performance of *Cirsium arvense*. Biocontrol Science and Technology 20(5/6): 641-656.
361	Cripps, M.G., A. Gassmann, S.V. Fowler, G.W. Bourdôt, A.S. McClay, and G.R. Edwards. 2011. Classical biological control of *Cirsium arvense*: lessons from the past. Biological Control 57: 165-174.
362	Crous, P.W., C.L. Schoch, K.D. Hyde, A.R. Wood, C. Gueidan, G.S. de Hoog, and J.Z. Groenewald. 2009. Phylogenetic lineages in the *Capnodiales*. Studies In Mycology 64: 17-47.
363	Crouzel, I.S.d., H.A. Cordo, and E.D. Saini. 1983. Sobre el control biologico del "Yuyo Esqueleto" *Chondrilla juncea* L. en la Republica Argentina. Malezas: Revista de la Asociacion Argentina para el Control de Malezas 11: 216-232.

Code	Reference
364	Cruz, Z.T., R. Muniappan, and G.V.P. Reddy. 2006. Establishment of *Cecidochares connexa* (Diptera: Tephritidae) in Guam and its effect on the growth of *Chromolaena odorata* (Asteraceae). Annals of the Entomological Society of America 99: 845-850.
365	CSIRO. 2011. Scotch broom biocontrol agent: psyllid. http://www.csiro.au/en/Outcomes/Food-and-Agriculture/Scotch-broom-biocontrol-agent-psyllid.aspx. 10 April 2013.
366	CSIRO Entomology, WA Department of Agriculture, VIC Department Primary Industry, NSW Department of Primary Industries, and S.R.D. Institute. 2006. The biological control of Paterson's curse and Scotch thistles, a long-term investment by grazing industries, state and federal governments. Final report of Project ECO10-D for Meat & Livestock Australia. 45 pp.
367	Cuda, J.P. 2009. Insects for biocontrol of aquatic weeds. *In* L.A. Gettys, W.T. Haller, and M. Bellaud, Eds. Biology and Control of Aquatic Plants: A Best Management Practices Handbook. Aquatic Ecosystem Restoration Foundation, Marietta, Georgia, USA. pp. 55-60.
368	Cuda, J.P. 2012. (personal communication) University of Florida, Entomology and Nematology Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, Gainesville, FL 32611 USA.
369	Cuda, J.P., N.C. Coile, D. Gandolfo, J.C. Medal, and J.J. Mullahey. 2004. Tropical soda apple, *Solanum viarum*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 396-401.
370	Cuda, J.P., B.R. Coon, Y.M. Dao, and T.D. Center. 2002. Biology and laboratory rearing of *Cricotopus lebetis* (Diptera: Chironomidae), a natural enemy of the aquatic weed *Hydrilla* (Hydrocharitaceae). Annals of the Entomological Society of America 95(5): 587-596.
371	Cuda, J.P., B.R. Coon, Y.M. Dao, and T.D. Center. 2011. Effect of an herbivorous stem mining midge on the growth of hydrilla. Journal of Aquatic Plant Management 49: 83-89.
372	Cuda, J.P., A.P. Ferriter, V. Manrique, and J.C. Medal, Eds. 2006. Florida's Brazilian Peppertree Management Plan, Second edition. 81 pp.
373	Cuda, J.P., J.C. Medal, D.H. Habeck, J.H. Pedrosa-Macedo, and M. Vitorino. 2010. Classical biological control of Brazilian peppertree (*Schinus terebinthifolius*) in Florida. ENY-820. University of Florida IFAS Extension. 8 pp.
374	Cuda, J.P., G.S. Wheeler, and D.H. Habeck. 2011. Brazilian peppertree seed Chalcid, *Megastigmus tranvaalensis* (Hymenoptera: Torymidae). EENY 270. University of Florida IFAS Extension. 5 pp.

Code	Reference
375	Cullen, J.M. 1974. Seasonal and regional variation in the success of organisms imported to combat skeleton weed *Chondrilla juncea* L. in Australia. *In* A.J. Wapshere, Ed. Proceedings of the III International Symposium on Biological Control of Weeds. September 1973, Montpellier, France; CAB. pp. 111-117.
376	Cullen, J.M. 1978. Evaluating the success of the programme for the biological control of *Chondrilla juncea* L. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 117-121.
377	Cullen, J.M. 1981. Considerations in rearing *Bradyrrhoa gilveolella* for control of *Chondrilla juncea* in Australia. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; Commonwealth Scientific and Industrial Research Organization. pp. 233-239.
378	Cullen, J.M. 1997. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P.O. Box 1700, Canberra, Australian Capital Territory 2601, Australia.
379	Cullen, J.M. 2012. *Chondrilla juncea* L. - skeleton weed. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 150-161.
380	Cullen, J.M. 2013. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia.
381	Cullen, J.M., R.H. Groves, and J.F. Alex. 1982. The influence of *Aceria chondrillae* on the growth and reproduction capacity of *Chondrilla juncea*. Journal of Applied Ecology 19: 529-537.
382	Cullen, J.M., P.F. Kable, and M. Catt. 1973. Epidemic spread of a rust imported for biological control. Nature 224: 462-464.
383	Cullen, J.M. and A.D. Moore. 1981. Preliminary observations on *Longitarsus jacobaeae* introduced for the control of ragwort in Australia. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; Commonwealth Scientific and Industrial Research Organization. pp. 499-505.
384	Cullen, J.M. and A. Sheppard. 2012. *Carduus nutans* L. - nodding thistle. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 118-130.
385	Culliney, T.W. and W.T. Nagamine. 2000. Introductions for biological control in Hawaii,1987-1996. Proceedings of the Hawaiian Entomological Society 34: 101-113.
386	Culliney, T.W., W.T. Nagamine, and K.K. Teramoto. 2003. Introductions for biological control in Hawaii 1997-2001. Proceedings of the Hawaiian Entomological Society 36: 145-153.

Code	Reference
387	Currie, G.A. and R.V. Fyfe. 1938. The fate of certain European insects introduced into Australia for the control of weeds. Journal of the Council for Scientific and Industrial Research 11: 289-301.
388	Daddy, F., G.O. Adesina, and E. Aina. 2002. Establishment, release and impact of mixed host of specific weevils: *Neochetina eichhorniae* (Warner) and *N. bruchi* Hustache for the biological control of water hyacinth on Lake Kainji. *In* Proceedings of the International Conference on Water Hyacinth. 27 Nov - 1 Dec 2000, New Bussa, Nigeria. pp. 44-51.
389	Dagno, K., R. Lahlali, M. Diourté, and M.H. Jijakli. 2012. Present status of the development of mycoherbicides against water hyacinth: successes and challenges. A review. Biotechnology, Agronomy, Society and Environment 16(3): 360-368.
390	Dalin, P., D.W. Bean, T. Dudley, V. Carney, D. Eberts, K.T. Gardner, E. Hebertson, E.N. Jones, D.J. Kazmer, G.J. Michels, S.A. O'Meara, and D.C. Thompson. 2010. Seasonal adaptions to day length in ecotypes of *Diorhabda* spp. (Coleoptera: Chrysomelidae) inform selection of agents against saltcedars (*Tamarix* spp.). Environmental Entomology 39: 1666-1675.
391	Dana, E.D. and S. Viva. 2006. *Stenopelmus rufinasus* Gyllenhal 1836 (Coleoptera: Erirhinidae) naturalized in Spain. The Coleopterists Bulletin 60(1): 41-42.
392	Daniel, J.T., G.E. Templeton, R.J.J. Smith, and W.T. Fox. 1973. Biological control of northern jointvetch in rice with an endemic fungal disease. Weed Science. 21: 303-307.
393	Darwent, A.L., W. Lobay, W. Yarish, and P. Harris. 1975. Distribution and importance in northwestern Alberta of toadflax and its insect enemies. Canadian Journal of Plant Science 55: 157-162.
394	Davies, J.C. and D.J. Greathead. 1967. Occurrence of *Teleonemia scrupulosa* on *Sesamum indicum* Linn. in Uganda. Nature 213: 102-103.
395	Davies, J.T., J.E. Ireson, and G.R. Allen. 2007. The impact of the gorse spider mite, *Tetranychus lintearius*, on the growth and development of gorse, *Ulex europaeus*. Biological Control 41: 86-93.
396	Davies, J.T., J.E. Ireson, and G.R. Allen. 2008. The phenology and impact of the gorse seed weevil, *Exapion ulicis*, on gorse, *Ulex europaeus*, in Tasmania. Biological Control 45: 85-92.
397	Davis, C.J. 1958. Recent introductions for biological control in Hawaii III. Proceedings of the Hawaiian Entomological Society 16(3): 356-358.
398	Davis, C.J. 1959. Recent introductions for biological control in Hawaii IV. Proceedings of the Hawaiian Entomological Society 17(1): 62-66.
399	Davis, C.J. 1960. Recent introductions for biological control in Hawaii V. Proceedings of the Hawaiian Entomological Society 17: 244-248.
400	Davis, C.J. 1961. Recent introductions for biological control in Hawaii VI. Proceedings of the Hawaiian Entomological Society 17: 389-393.

Code	Reference
401	Davis, C.J. 1970. Recent introductions for biological control in Hawaii XV. Proceedings of the Hawaiian Entomological Society 20: 521-525.
402	Davis, C.J. 1971. Recent introductions for biological control in Hawaii XVI. Proceedings of the Hawaiian Entomological Society 21: 59-62.
403	Davis, C.J. 1974. Recent introductions for biological control XVIII. Proceedings of the Hawaiian Entomological Society 21(3): 355-358.
404	Davis, C.J. 1976. Notes and exhibitions. Proceedings of the Hawaiian Entomological Society 22: 177.
405	Davis, C.J. and M. Chong. 1969. Recent introductions for biological control in Hawaii XIV. Proceedings of the Hawaiian Entomological Society 20: 317-322.
406	Davis, C.J. and N.L.H. Krauss. 1962. Recent developments in the biological control of weed pests in Hawaii. Proceedings of the Hawaiian Entomological Society 18: 65-67.
407	Davis, C.J. and N.L.H. Krauss. 1962. Recent introductions for biological control in Hawaii VII. Proceedings of the Hawaiian Entomological Society 18: 125-129.
408	Davis, C.J. and N.L.H. Krauss. 1963. Recent introductions for biological control in Hawaii VIII. Proceedings of the Hawaiian Entomological Society 18: 245-249.
409	Davis, C.J. and N.L.H. Krauss. 1964. Recent introductions for biological control in Hawaii IX. Proceedings of the Hawaiian Entomological Society 18: 391-397.
410	Davis, C.J. and N.L.H. Krauss. 1965. Recent introductions for biological control in Hawaii X. Proceedings of the Hawaiian Entomological Society 19: 87-90.
411	Davis, C.J. and N.L.H. Krauss. 1966. Recent introductions for biological control in Hawaii XI. Proceedings of the Hawaiian Entomological Society 19: 201-207.
412	Davis, C.J. and N.L.H. Krauss. 1967. Recent introductions for biological control in Hawaii XII. Proceedings of the Hawaiian Entomological Society 19: 375-380.
413	Davis, C.J., E. Yoshioka, and D. Kageler. 1992. Biocontrol of *Lantana camara*, *Opuntia* spp., and *Ageratina riparia* in Hawai'i: a review and update. *In* C.P. Stone, C.W. Smith, and J.T. Tunison, Eds. Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. University of Hawaii Press, Honolulu, Hawaii. pp. 2-32.
414	Day, M.D. 2012. *Lantana camara* L. - lantana. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 334-346.
415	Day, M.D. 2012. *Lantana montevidensis* (Spreng.) Briq. - creeping lantana. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 347-350.
416	Day, M.D. 2012. *Mikania micrantha* Kunth - mile-a-minute. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 368-372.
417	Day, M.D. 2012. *Pistia stratiotes* L. - water lettuce. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 472-476.
418	Day, M.D. 2013. (personal communication) Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia.
419	Day, M.D. and I. Bofeng. 2007. Biocontrol of *Chromolaena odorata* in Papua New. *In* P.-Y. Lai, G.V.P. Reddy, and R. Muniappan, Eds. Proceedings of the 7th International Workshop on Biological Control and Management of *Chromolaena odorata* and *Mikania micrantha*. 12-15 September 2006, Taiwan; National Pingtung University of Science and Technology. pp. 53-67.
420	Day, M.D., I. Bofeng, and I. Nabo. 2013. Successful biological control of *Chromolaena odorata* (Asteraceae) by the gall fly *Cecidochares connexa* (Diptera: Tephritidae) in Papua New Guinea. *In* Y. Wu, T. Johnson, S. Sing, S. Raghu, G. Wheeler, P. Pratt, K. Warner, T. Center, J. Goolsby, and R. Reardon, Eds. Proceedings of the XIII International Symposium on Biological Control of Weeds. 11-16 September 2011, Kohala Coast, Hawaii, USA; Forest Health Technology Enterprise Team, Morgantown, WV, USA. pp. 400-408.
421	Day, M.D., A.A. Brito, A. De Costa Guterres, A.P. Da Costa Alves, T. Paul, and C.G. Wilson. 2013. Biocontrol of *Chromolaena odorata* (L.) King and Robinson (Asteraceae) in Timor Leste. *In* C. Zachariades, L.W. Strathie, M.D. Day, and R. Muniappan, Eds. Proceedings of the 8th International Workshop on Biological Control and Management of *Chromolaena odorata*. 1-2 November 2010, Nairobi, Kenya; ARC-PPRI, Pretoria. pp. 134-140.
422	Day, M.D., S. Broughton, and M.A. Hannan-Jones. 2003. Current distribution and status of *Lantana camara* and its biological control agents in Australia, with recommendations for further biocontrol introduction into other countries. Biocontrol News and Information 24(3): 63N-76N.
423	Day, M.D., I.W. Forno, R. Segura, and M. Martinez. 1995. Life cycle and host specificity of *Eutinobothrus* sp. (Col.: Curculionidae) an agent for biological control of *Sida acuta* (Malvaceae) in the Northern Territory, Australia. Entomophaga 40: 345-355.
424	Day, M.D., A.P. Kawi, J. Fidelis, A. Tunabuna, W. Orapa, B. Swamy, J. Ratutini, J. Saul-Maora, and C.F. Dewhurst. 2013. Biology, field release and monitoring of the rust *Puccinia spegazzinii* de Toni (Pucciniales: Pucciniaceae), a biocontrol agent of *Mikania micrantha* Kunth (Asteraceae) in Papua New Guinea and Fiji. *In* Y. Wu, T. Johnson, S. Sing, S. Raghu, G. Wheeler, P. Pratt, K. Warner, T. Center, J. Goolsby, and R. Reardon, Eds. Proceedings of the XIII International Symposium on Biological Control of Weeds. 11-16 September 2011, Kohala Coast, Hawaii, USA; Forest Health Technology Enterprise Team, Morgantown, WV, USA. pp. 211-217.

Code	Reference
425	Day, M.D. and T.D. McAndrew. 2002. Status of *Charidotis pygmaea* (Coleoptera: Chrysomelidae) as a biological control agent of *Lantana montevidensis* (Verbenaceae) in Australia. Biological Control 23: 27-34.
426	Day, M.D. and R.E.C. McFadyen. 2012. *Chromolaena odorata* (L.) Kind and Robinson - chromolaena. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 162-169.
427	Day, M.D., W. Orapa, and R. Muniappan. 2005. Two decades of weed biocontrol in the Pacific region. *In* Proceedings of the 20th Asian-Pacific Weed Sciences Society Conference. 7-11 November 2005, Ho Chi Min City, Vietnam. pp. 451-456.
428	Day, M.D., N. Riding, and A. Chamberlain. 2009. Biology and host range of *Ophiomyia camarae* Spencer (Diptera: Agromyzidae), a potential biocontrol agent for *Lantana* spp. (Verbenaceae) in Australia. Biocontrol Science and Technology 19(6): 627-637.
429	Day, M.D., C.J. Wiley, J. Playford, and M.P. Zalucki. 2003. Lantana: Current Management Status and Future Prospects. Australain Centre for International Agriculture Research, Canberra. 128 pp.
430	Day, M.D., B.W. Willson, and K.J. Latimer. 1998. The life history and host range of *Ectaga garcia*, a biological control agent for *Lantana camara* and *L. montevidensis* in Australia. Biocontrol 43(3): 325-338.
431	Day, M.D. and M.P. Zalucki. 2009. *Lantana camara* Linn. (Verbenaceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 211-246.
432	De Clerck-Floate, R. and H. Cárcamo. 2011. Biocontrol Arthropods: New Denizens of Canada's Grassland Agroecosystems. *In* K.D. Floate, Ed. Arthropods of Canadian Grasslands: Inhabitants of a Changing Landscape. Vol. 2. Biological Survey of Canada, Ottawa. pp. 291-321.
433	De Clerck-Floate, R. and V. Miller. 2002. Overwintering mortality of and host attack by the stem-boring weevil, *Mecinus janthinus* Germar, on Dalmatian toadflax (*Linaria dalmatica* (L.) Mill.) in western Canada. Biological Control 24: 65-74.
434	De Clerck-Floate, R., U. Schaffer, and S. Turner. 2010. Request for renewal of permit to field release the Swiss biotype of *Longitarsus jacobaeae* (Coleoptera: Chrysomelidae) as a biological control agent for tansy ragwort, *Jacobaea vulgaris* (Compositae: Asteraceae) in Canada. Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada. 36 pp.
435	De Clerck-Floate, R. and B. Wikeem. 2009. Influence of release size on establishment and impact of a root weevil for the biocontrol of houndstongue (*Cynoglossum officinale*). Biocontrol Science and Technology 19(2): 169-183.

Code	Reference
436	De Clerck-Floate, R.A. 2013. *Cynoglossum officinale* (L.), houndstongue (Boraginaceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 46. CABI Publishing, Wallingford, U.K. pp. 309-315.
437	De Clerck-Floate, R.A. 2013. (personal communication) Agriculture and Agri-Food Canada, Weed Biocontrol, Lethbridge Research Centre, 5403 1 Ave S, Lethbridge, Alberta, Canada T1J 4B1.
438	De Clerck-Floate, R.A. and P. Harris. 2002. *Linaria dalmatica* (L.) Miller, Dalmatian toadflax (Scrophulariaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 368-374.
439	De Clerck-Floate, R.A. and A. McClay. 2013. *Linaria vulgaris* Mill., yellow toadflax (Plantaginaceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 53. CABI Publishing Wallingford, U.K. pp. 354-362.
440	De Clerck-Floate, R.A. and M. Schwarzländer. 2002. *Cynoglossum officinale* (L.), houndstongue (Boraginaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CABI Publishing, Wallingford, U.K. pp. 338-343.
441	De Clerck-Floate, R.A. and S. Turner. 2013. *Linaria dalmatica* (L.) Mill., Dalmatian toadflax (Plantaginaceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 52. CABI Publishing Wallingford, U.K. pp. 342-353.
442	De Clerck-Floate, R.A., B. Wikeem, and R.S. Bourchier. 2005. Early establishment and dispersal of the weevil, *Mogulones cruciger* (Coleoptera: Curculionidae) for biological control of houndstongue (*Cynoglossum officinale*) in British Columbia, Canada. Biocontrol Science and Technology 15(2): 173-190.
443	De Groote, H., O. Ajuonu, S. Attignon, R. Djessou, and P. Neuenschwander. 2003. Economic impact of biological control of water hyacinth in southern Benin. Ecological Economics 45: 105-117.
444	de Jong, M.D. 2000. The BioChon story: deployment of *Chondrostereum purpureum* to suppress stump sprouting in hardwoods. Mycologist 14(2): 58-62.
445	de Klerk, J. 2004. Bush encroachment in Namibia. Report on Phase 1 of the Bush Encroachment, Research, Monitoring and Management Project. Ministry of Environment and Tourism, Government of the Republic of Namibia. 273 pp.
446	De Lotto, G. 1974. On the status and identity of the cochineal insects (Homoptera: Coccoidea: Dactylopiidae). Journal of the Entomological Society of South Africa 37: 167-193.
447	De Vol, J.E. and R.D. Goeden. 1973. Biology of *Chelinidea vittiger* with notes on its host-plant relationships and values in biological weed control. Environmental Entomology 2: 231-240.

Code	Reference
448	DeGraft-Johnson, K.A.A. 1996. Integrated control of aquatic weeds in Ghana. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 27-42.
449	DeGraft-Johnson, K.A.A. 1998. (personal communication) Hydrobotany and Watershed Management, Institute of Aquatic Biology, P.O. Box 38, Achimota, Ghana.
450	DeGraft-Johnson, K.A.A. and R. Hoevers. 1998. Effective control and preventing the spread of floating aquatic weeds in Ghana through public awareness and community-based biological control. *In* A. Monteiro, T. Vasconcelos, and L. Catarino, Eds. Proceedings of the 10th International Symposium on Aquatic Weeds. 21-25 September 1998, Lisbon, Portugal; European Weed Research Society. pp. 341-344.
451	Del Rosario, A.G. 2013. (personal communication) Palau Community College, Cooperative Research and Extension, P.O. Box 9 Koror, Palau 96940.
452	Delfosse, E.S. 1978. Effect on waterhyacinth of *Neochetina eichhorniae* (Col.: Curculionidae) combined with *Orthogalumna terebrantis* (Acari: Galumnidae). Entomophaga 23: 379-387.
453	Delfosse, E.S. and J.M. Cullen. 1981. New activities in biological control of weeds in Australia. I. Common heliotrope, *Heliotropium europaeum*. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 545-561.
454	Delfosse, E.S. and J.M. Cullen. 1981. New activities in biological control of weeds in Australia. II. *Echium plantagineum*: curse or salvation? *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 563-574.
455	Delfosse, E.S. and J.M. Cullen. 1981. New activities in biological control of weeds in Australia. III. St. John's wort: *Hypericum perforatum*. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 575-581.
456	Delfosse, E.S. and J.M. Cullen. 1982. Biological control of weeds of Mediterranean origin: a progress report. Australian Weeds March 1982: 25-30.
457	Delfosse, E.S., R.C. Lewis, and S. Hasan. 1995. Release of *Uromyces heliotropii* in Australia: A key agent in the integrated pest management system for common heliotrope. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 329-336.
458	Delfosse, E.S., R.C. Lewis, and C.S. Smith. 1987. Effect of drought and grasshoppers on establishment of *Dialectica scalariella* (Zeller) (Lepidoptera: Gracillariidae), a potential biological control agent for *Echium plantagineum* L. Journal of the Australian Entomological Society. 26: 279-280.
459	Delfosse, E.S., B.D. Perkins, and K.K. Steward. 1976. A new U.S. record for *Parapoynx diminutalis* (Lepidoptera: Pyralidae), a possible biological control agent for *Hydrilla verticillata*. Florida Entomologist 59: 19-20.
460	DeLoach, C.J. 1995. Progress and problems in introductory biological control of native weeds in the United States. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 111-122.
461	DeLoach, C.J. and R.I. Carruthers. 2004. Saltcedar, *Tamarix ramosissima, T. chinensis, T. parviflora, T. canariensis, T. gallica*, and hybrids. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 311-316.
462	DeLoach, C.J., R.I. Carruthers, T.L. Dudley, D. Eberts, D.J. Kazmer, A.E. Knutson, D.W. Bean, J. Knight, P.A. Lewis, L.R. Millbrath, and J.L. Tracy. 2004. First results for control of saltcedar (*Tamarix* spp.) in the open field in the western United States. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 505-513.
463	DeLoach, C.J. and H.A. Cordo. 1983. Control of waterhyacinth by *Neochetina bruchi* (Coleoptera: Curculionidae: Bagoini) in Argentina. Environmental Entomology 12: 19-23.
464	DeLoach, C.J. and J.P. Cuda. 1999. Host specificity of the Argentine root boring weevil, *Heilipodus ventralis* (Coleoptera: Curculionidae), a potential biocontrol agent for snakeweeds (*Gutierrezia*: Asteraceae) in Western North American rangelands - U.S. quarantine tests. Biological Control 15: 185-209.
465	DeLoach, C.J., P.J. Moran, A.E. Knutson, D.C. Thompson, R.I. Carruthers, J. Michels, J.C. Herr, M. Muegge, D. Eberts, C. Randal, J. Everitt, S. O'Meara, and J. Sanabria. 2008. Beginning success of biological control of saltcedars (*Tamarix* spp.) in the southwestern USA. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 535-539.
466	Delobel, A. 2011. Order Coleoptera, family Chrysomelidae. Subfamily Bruchinae. Arthropod Fauna of the UAE 4: 274-285.

Code	Reference
467	Delobel, A. and G. Fédière. 2002. First report in Egypt of two seed-beetles (Coleoptera: Bruchidae) noxious to *Prosopis* spp. Bulletin of Faculty of Agriculture, Cairo University 53(1): 129-139.
468	Delobel, A. and C.D. Johnson. 1998. First record of a seed-beetle on *Leucaena leucocephala* in West Africa. Leucnet News 5: 25-26.
469	d'Emmerez de Charmoy, D. 1899. Mongraphie des cochenilles de maurice. Societé Amicale Scientifique. Annex au Procès Verbal de la Réunion 24 mars 1899.
470	Den Breeÿen, A. 2004. Release strategies for the establishment of the leaf spot pathogen, *Mycovellosiella lantanae* var. *lantanae*, on *Lantana camara* in South Africa. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 386-388.
471	Den Breeÿen, A. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7599 South Africa.
472	Den Breeÿen, A. and M.J. Morris. 2003. Pathogenicity and host specificity of *Mycovellosiella lantanae* var. *lantanae*, a potential biocontrol agent for *Lantana camara* in South Africa. Biocontrol Science and Technology 13(3): 313-322.
473	Denke, P., K.P. Puliafico, and I. Foley. 2009. Montana Department of Agriculture Cooperative Pest Survey Report 2009. 63 pp.
474	Denmark, H.A. and H.H. Keifer. 1991. *Aceria lantanae* (Cook) in Florida (Acari: Eriphyidae). Entomology Circular No. 349 (Revised Ent. Circ. No. 166). Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 2 pp.
475	Dennill, G.B. 1985. The effect of the gall wasp *Trichilogaster acaciaelongifolia* (Hymenoptera: Pteromalidae) on reproductive potential and vegetative growth of the weed *Acacia longifolia*. Agriculture, Ecosystems & Environment 14: 53-61.
476	Dennill, G.B. and D. Donnelly. 1991. Biological control of *Acacia longifolia* and related weed species (Fabaceae) in South Africa. Agriculture, Ecosystems & Environment 37: 115-136.
477	Dennill, G.B., D. Donnelly, K. Stewart, and F.A.C. Impson. 1999. Insect agents used for the biological control of Australian *Acacia* species and *Paraserianthes lophantha* (Willd.) Nielsen (Fabaceae) in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 45-54
478	Dennill, G.B. and A.J. Gordon. 1990. Climate-related difference in the efficacy of the Australian gall wasp (Hymenoptera: Pteromalidae) released for the control of *Acacia longifolia* in South Africa. Environmental Entomology 19: 130-136.

Code	Reference
479	Dennill, G.B. and A.J. Gordon. 1991. *Trichilogaster* sp. (Hymenoptera: Pteromalidae), a potential biocontrol agent for the weed *Acacia pycnantha* (Fabaceae). Entomophaga 36: 295-301.
480	Denoth, M. and J.H. Myers. 2005. Variable success of biological control of *Lythrum salicaria* in British Columbia. Biological Control 32: 269-279.
481	Denton, G.R.W., R. Muniappan, and M. Marutani. 1991. The distribution and biological control of *Lantana camara* in Micronesia. Micronesica Supplement 3: 71-81.
482	Denton, G.R.W., R. Muniappan, and M. Marutani. 1991. Status and natural enemies of the weed, *Lantana camara*, in Micronesia. Tropical Pest Management 37: 338-344.
483	Dernovici, S.A., M.P. Teshler, and A.K. Watson. 2006. Is sunflower (*Helianthus annuus*) at risk to damage from *Ophraella communa*, a natural enemy of common ragweed (*Ambrosia artemisiifolia*)? Biocontrol Science and Technology 16(7): 669-686.
484	Desmier de Chenon, R. 2012. (personal communication) Current address unknown.
485	Desmier de Chenon, R. and A. Sipayung. 1998. A new biological control agent, *Procecidochares connexa* Macquart (Diptera: Tephritidae), for the biological control of the weed *Chromolaena odorata* in Indonesia. *In* P. Ferrar, R. Muniappan, and K.P. Jayanth, Eds. Proceedings of the 4th International Workshop on Biological Control and Management of *Chromolaena odorata*. Ocotober 1996, Bangalore, India; University of Guam. pp. 1.
486	Desmier de Chenon, R., A. Sipayung, and P. Sudharto. 2002. Impact of *Cecidochares connexa* on *Chromolaena odorata* in different habitats in Indonesia. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 152.
487	Desmier de Chenon, R., A. Sipayung, and P. Sudharto. 2002. Impact of *Cecidochares connexa* on *Chromolaena odorata* in different habitats in Indonesia. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 152.
488	Desmier de Chenon, R., A. Sipayung, and P. Sudharto. 2002. A new biological agent, *Actinote anteas*, introduced into Indonesia from South America for the control of *Chromolaena odorata*. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 170-176.

Code	Reference
489	DeWalt, S.J., J.S. Denslow, and K. Ickes. 2004. Natural-enemy release facilitates habitat expansion of the invasive tropical shrub *Clidemia hirta*. Ecology 85(2): 471-483.
490	Dewey, S.A., S.F. Enloe, F.D. Menalled, S.D. Miller, R.E. Whitesides, and L. Johnson, Eds. 2007. Weed Management Handbook 2006-2007. Montana, Utah, Wyoming: Cooperative Extension. 288 pp.
491	Dharmadhikari, P.R., P.A.C.R. Perera, and T.M.F. Hassen. 1977. The introduction of *Ammalo insulata* for the control of *Eupatorium odoratum* in Sri Lanka. *In* Technical Bulletin No. 18. Commonwealth Institute of Biological Control, Sri Lanka. pp. 129-135.
492	Dhileepan, K. 2012. *Macfadyena unguis-cati* (L.) A.H. Gentry - cat's claw creeper. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 351-359.
493	Dhileepan, K. 2012. Widespread establishment and the spreading of the *Carmenta* moth; a biological control agent for parthenium weed in Queensland, Australia. International Parthenium News 6: 9.
494	Dhileepan, K. 2013. (personal communication) Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia.
495	Dhileepan, K., S.K. Florentine, and C.J. Lockett. 2006. Establishment, initial impact and persistence of parthenium summer rust *Puccinia melampodii* in north Queensland. *In* C. Preston, J.H. Watts, and N.D. Crossman, Eds. Proceedings of the 15th Australian Weeds Conference. 24-28 September 2006, Adelaide, South Australia; Weed Management Society of South Australia. pp. 577-580.
496	Dhileepan, K., B. Madigan, M. Vitelli, R. McFadyen, K. Webster, and M. Trevino. 1996. A new initiative in the biological control of parthenium. *In* R.C.H. Shepherd, Ed. Proceedings of the 11th Australian Weeds Conference. 30 September -3 October 1996, Melbourne, Victoria, Australia; Weed Science of Victoria Inc. pp. 309-312.
497	Dhileepan, K. and R.C. McFadyen. 2012. *Parthenium hysterophorus* L. - parthenium. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 448-462.
498	Dhileepan, K., E.L. Snow, M.A. Rafter, M. Treviño, J. McCarthy, and K.A.S. Wilmot Senaratine. 2007. The leaf-tying moth *Hypocosmia pyrochroma* (Lep., Pyralidae), a host-specific biological control agent for cat's claw creeper *Macfadyena unguis-cati* (Bigoniaceae) in Australia. Journal of Applied Entomology 131: 564-568.
499	Dhileepan, K. and L. Strathie. 2009. *Parthenium hysterophorus* L. (Asteraceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, U.K. pp. 274-318.

Code	Reference
500	Dhileepan, K., D.B.J. Taylor, C. Lockett, and M. Treviño. 2013. Cat's claw creeper leaf-mining jewel beetle *Hylaeogena jureceki* Obenberger (Coleoptera: Buprestidae), a host-specific biological control agent for *Dolichandra unguis-cati* (Bignoniaceae) in Australia. Australian Journal of Entomology 52(2): 175-181.
501	Dhileepan, K., M. Treviño, D. Bayliss, M. Saunders, M. Shortus, J. McCarthy, E.L. Snow, and G.H. Walter. 2010. Introduction and establishment of *Carvalhotingis visenda* (Hemiptera: Tingidae) as a biological control agent for cat's claw creeper *Macfadyena unguis-cati* (Bignoniaceae) in Australia. Biological Control 55: 58-62.
502	Diatloff, G. and W.A. Palmer. 1988. The host specificity and biology of *Aristotelia ivae* Busck (Gelechiidae) and *Lorita baccharivora* (Tortricidae), two microlepidoptera selected as biological control agents for *Baccharis halimifolia* (Asteraceae) in Australia. Proceedings of the Entomological Society of Washington 90(4): 458-461.
503	Dickel, T.S. 1991. *Cactoblastis cactorum* in Florida (Lepidoptera: Pyralidae: Phycitinae). Tropical Lepidoptera 2: 117-118.
504	Ding, J.Q., R. Wang, W.D. Fu, and G.L. Zhang. 2001. Water hyacinth in China: Its distribution, problems and control status. *In* M.H. Julien, M.P. Hill, T.D. Center, and J.Q. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Centre for International Agricultural Research. pp. 29-32.
505	Diop, O. 2006. Management of invasive aquatic weeds with emphasis on biological control in Senegal. Thesis, Doctor of Philosophy. Rhodes University, Grahamstown, South Africa. 187 pp.
506	Diop, O. and M.P. Hill. 2009. Quantitative post-release evaluation of biological control of floating fern, *Salvinia molesta* D.S. Mitchell (Salviniaceae), with *Cyrtobagous salviniae* Calder and Sands (Coleoptera: Curculionidae) on the Senegal River and Senegal River Delta. African Entomology 17(1): 64-70.
507	Distant, W.L. 1907. Description of a new species of Tingididae from Honolulu. Entomologist 404: 60-61.
508	DiTomaso, A., S.F. Enloe, and M.J. Pitcairn. 2007. Exotic plant management in California annual grasslands. *In* M.R. Stromberg, J.D. Corbin, and C.M. D'Antonio, Eds. California Grasslands: Ecology and Management. University of California Press, Berkeley, California. pp. 281-296.
509	Dodd, A.P. 1929. The Progress of Biological Control of Prickly pear in Australia. Commonwealth Prickly Pear Board, Brisbane. 44 pp.
510	Dodd, A.P. 1933. The present position and future prospects in relation to the biological control of prickly pear. Journal of the Council for Scientific and Industrial Research 6: 8-13.

Code	Reference
511	Dodd, A.P. 1936. The control and eradication of prickly pear in Australia. Bulletin of Entomological Research 27: 503-517.
512	Dodd, A.P. 1953. Observations on the stem gall fly of Pamakani, *Eupatorium glandulosum*. Proceedings of the Hawaiian Entomological Society 15(1): 41-43.
513	Dodd, A.P. 1961. Biological control of *Eupatorium adenophorum* in Queensland. Australian Journal of Science 23: 356-365.
514	Donnelly, D. 1995. Host searching behaviour of the seed weevil, *Melanterius ventralis*: Implications for the biological control of *Acacia longifolia* in South Africa. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 577.
515	Donnelly, G. 1997. (personal communication) Department of Natural Resources, Alan Fletcher Research Station, Sherwood, Queensland 4075, Australia.
516	Donnelly, G.P. 2000. Biology and host specificity of *Rhinocloa callicrates* Herring (Hemiptera: Miridae) and its introduction and establishment as a biological control agent of *Parkinsonia aculeata* L. (Caesalpiniaceae) in Australia. Australian Journal of Entomology 39: 89-94.
517	Dorchin, N. and R.J. Adair. 2011. Two new *Dasineura* species (Diptera: Cecidomyiidae) from coastal tea tree, *Leptospermum laevigatum* (Myrtaceae) in Australia. Australian Journal of Entomology 50: 65-71.
518	Doudrick, R.L., W.R. Enns, M.F. Brown, and D.F. Millikan. 1986. Characteristics and role of the mite, *Phyllocoptes fructiphilus* (Acari, Eriophyidae) in the etiology of Rose Rosette. Entomological News 97(4): 163-172.
519	Downey, P.O., R.H. Holtkamp, J.E. Ireson, R.M. Kwong, and A.E. Swirepik. 2007. A review of the *Chrysanthemoides monilifera* biological control program in Australia: 1987-2005. Plant Protection Quarterly 22(1).
520	Drake, C.J. 1956. Hemiptera: Tingidae. Insects of Micronesia 7: 101-116.
521	Dray, F.A.J. and D.A. Center. 1994. Release and establishment of insect biocontrol agents of *Pistia*. *In* Proceedings of the 28th Annual Meeting, Aquatic Plant Control Research Program. 15-18 November 1993, Baltimore, Maryland, USA; U.S. Army Engineers Waterways Experiment Station. pp. 202-210.
522	Dray, F.A.J., T.D. Center, D.H. Habeck, C.R. Thompson, A.F. Cofrancesco, and J.K. Balciunas. 1990. Release and establishment in the southeastern United States of *Neohydronomus affinis* (Coleoptera: Curculionidae), an herbivore of waterlettuce. Environmental Entomology 19: 799-802.
523	Dray Jr., F.A. 2004. Waterlettuce, *Pistia stratiotes*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 402-413.

Code	Reference
524	Duangsuwan, W. 2002. Biological investigation on the waterhyacinth moth, *Niphograpta albiguttalis* (Warren) (Lepidoptera: Pyralidae), for biological control of waterhyacinth in Thailand. Thesis, Master of Science. Kasetsart University. 63 pp.
525	Dudley, T.L., A.M. Lamber, A. Kirk, and Y. Tamagawa. 2008. Post-release non-target monitoring of *Mogulones cruciger*, a biological control agent released to control *Cynoglossum officinale* in Canada. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 138-144.
526	Dugdale, J.S. 1988. Lepidoptera - Annotated Catalogue, and Keys to Family-Group Taxa. Fauna of New Zealand Vol. 14. Science Information Publishing Centre, Wellington
527	Dymock, J.J. 1987. Population changes of the seedfly, *Pegohylemyia jacobaeae* (Diptera: Anthomyiidae) introduced for biological control of ragwort. New Zealand Journal of Zoology 14: 337-342.
528	Edwards, D. and P.L. Thomas. 1977. The *Salvinia molesta* problem in the northern Botswana and eastern Caprivi area. *In* Proceedings of the 2nd National Weeds Conference of South Africa. 2-4 February 1977, Stellenbosch, South Africa; A.A. Balkema. pp. 221-237.
529	Edwards, P.B., R.J. Adair, R.H. Holtkamp, W.J. Wanjura, A.S. Bruzzese, and R.I. Forrester. 2009. Impact of the biological control agent *Mesoclanis polana* (Tephritidae) on bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) in eastern Australia. Bulletin of Entomological Research 99: 51-63.
530	Edwards, P.B., R.H. Holtkamp, and R.J. Adair. 1999. Establishment and rapid spread of the bitou seed fly, *Mesoclanis polana* Munro (Diptera: Tephritidae), in eastern Australia. Australian Journal of Entomology 38: 148-150.
531	Edwards, P.B., M. Hoskins, and T. Schatz. 2000. Potential benefits of using native insects for biological control - the case of *Platyomopsis humeralis* (Cerambycidae) on *Mimosa pigra* in northern Australia. Abstract. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 243.
532	Effowe, T.Q., K.B. Amevoin, Y. Nuto, D. Mondedji, and I.O. Glitho. 2010. Reproductive capacities and development of a seed bruchid beetle, *Acanthoscelides macrophthalmus*, a potential host for the mass rearing of the parasitoid, *Dinarmus basalis*. Journal of Insect Science 10(Article 129): 1-14.
533	Ehler, L.E. 1987. Ecology of *Rhopalomyia californica* Felt at Jasper Ridge (Diptera: Cecidomyiidae). Pan-Pacific Entomologist 63(3): 237-241.

Code	Reference
534	Ehlers, R.-U. 2008. Regulation of biological weed control agents in Europe: results of the EU Policy Support Action REBECA. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 369-375.
535	Eichlin, T.D. 1997. (personal communication) California Department of Food and Agriculture, Plant Pest Diagnostics Branch, California, United States of America (from collection records housed in the California State Collection of Arthropods).
536	El Tayeb, N.M. 2012. Successful biological control of water hyacinth (*Eichhornia crassipes*) by *Neochetina* weevils in Sudan. Speaking notes. *In* International Trade and Invasive Alien Species Conference. 12-13 July 2012, Geneva, Switzerland; Standards and Trade Development Facility.
537	Ellison, C. and M. Day. 2011. Current status of releases of *Puccinia spegazzinii* for *Mikania micrantha* control. Biocontrol News and Information 32(1): 1N-8N.
538	Ellison, C.A. 2013. (personal communication) CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, United Kingdom.
539	Ellison, C.A., H.C. Evans, D.H. Djeddour, and S.E. Thomas. 2008. Biology and host range of the rust fungus *Puccinia spegazzinii*: A new classical biological control agent for the invasive, alien weed *Mikania micrantha* in Asia. Biological Control 45: 133-145.
540	Enrique, A.E., H.A. Cordo, I.S.d. Crouzel, and M.R. Gimenez Tanzi. 1983. Importacion de *Rhinocyllus conicus* Froelich y *Trichosirocalus horridus* Panzer para el control biologico de los “Cardos” en la Argentina. Malezas: Revista de la Asociacion Argentina para el Control de Malezas 11: 232-241.
541	Enrique de Briano, A.E. 2010. Establecimiento, dispersión y prevalencia de *Rhinocyllus conicus* (Coleoptera; Curculionidae) sobre *Carduus* spp. (Asteraceae) y su incidencia sobre la producción de semillas en *C. acanthoides*. Thesis, Master of Science. Universidad Nacional de La Plata, La Plata, Argentina. 76 pp.
542	Environmental Risk Management Authority. 2006. Decision: To conditionally release from containment a mite, *Aceria genistae* (Eriophyidae), and two insects, *Agonopterix assimilella* (Lepidoptera, Oecophoridae) and *Gonioctena olivacea* (Coleoptera, Chrysomelidae), for biological control of the weed broom. Application code NOR05003. Environmental Risk Management Authority, New Zealand. 25 pp.
543	Epler, J.H., J.P. Cuda, and T.D. Center. 2000. Redescription of *Cricotopus lebetis* (Diptera: Chironomidae), a potential biocontrol agent of the aquatic weed hydrilla (Hydrocharitaceae). Florida Entomologist 83(2): 171-180.
544	EPPO. 2007. *Solanum elaeagnifolium*. Data sheets on quarantine pests. Bulletin OEPP/EPPO 37(2): 236-245.

Code	Reference
545	EPPO Reporting Service. 2008. *Stenopelmus rufinasus* (Coleoptera: Curculionidae): a biological control agent of *Azolla filiculoides* recorded in Spain. EPPO Reporting Service, No. 7 Paris, 2008-07-01. 2008/152. European and Mediterranean Plant Protection Organization. 18 pp.
546	Epstein, A.H. and J.H. Hill. 1995. The biology of Rose Rosette Disease: a mite-associated disease of uncertain aetiology. Journal of Phytopathology 143: 353-360.
547	Epstein, A.H. and J.H. Hill. 1999. Status of Rose Rosette Disease as a biological control for multiflora rose. Plant Disease 83(2): 92-101.
548	Erreguerena, I.A., G. Clemente, and A. Escande. 2008. Presencia de *Phragmidium violaceum* en zarzamoras (*Rubus ulmifolius*) de Laguna de los Padres (Gral. Pueyrredón, Buenos Aires, Argentina). Poster presentation. *In* VI Congreso Latinoamericano de Micologia. 10-13 November 2008, Mar del Plata, Argentina; Asociacion Latinoamericana de Micologia.
549	Esguerra, N.M. 2002. Introduction and establishment of the tephritid gall fly *Cecidochares connexa* on Siam weed, *Chromolaena odorata*, in the Republic of Palau. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 148-151.
550	Esguerra, N.M., A.G. Del Rosario, and T. Taro. 2010. Biological Control Introductions in the Freely Associated States of Micronesia. College of Micronesia Land Grant Program. 136 pp.
551	Esguerra, N.M., W.S. William, and J.R. Smith. 1996. Establishment of *Pareuchaetes pseudoinsulata* Rego Barros in the Eastern Carolina Islands: an effort to control the Siam weed, *Chromolaena odorata* (L.) R.M. King and H. Robinson. *In* U.K. Prasad, R. Muniappan, P. Ferrar, and J.P. Aeschlimann, Eds. Proceedings of the 3rd International Workshop on the Biological Control and Management of *Chromolaena odorata*. November 1993, Abijan, Côte d'Ivoire; University of Guam.
552	Esguerra, N.M., J.D. Williams, R.P. Samuel, and K.J. Diopulos. 1997. Biological control of the weed, *Mimosa invisa* Von Martius on Pohnpei and Yap. Micronesica 30: 421-427.
553	Evans, E.W. 1996. (personal communication) Utah State University, Department of Biology, Logan, Utah 84322-5305, United States of America.
554	Evans, H.C., G. Carrión, and F. Ruiz-Belin. 1995. Mycobiota of the giant sensitive plant, *Mimosa pigra* sensu lato in the Neotropics. Mycological Research 99(4): 420-428.
555	Evans, H.C., M. Swier, J. Harvey, D. Djeddour, K.R. Aneja, S. Doraiswamy, L.P. Kauraw, S.P. Singh, and P.S. Kumar. 2000. Developing strategies for the control of parthenium weed in India using fungal pathogens. RNRRS Project Final Technical Report. NRIL Contract code: ZA0007/87, NRRD Project code: R6695. Natural Resources International, Crop Protection Programme. 191 pp.

Code	Reference
556	Evans, H.C. and A.J. Tomley. 1996. Greenhouse and field evaluations of the rubber vine rust, *Maravalia cryptostegiae*, on Madagascan and Australian Asclepiadaceae. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 165-169.
557	Evans, J.W. 1942. The gorse weevil. Tasmanian Journal of Agriculture 13: 15-18.
558	Evans, K.J., M.K. Jones, F.A. Mahr, and R.T. Roush. 2000. DNA phenotypes of the blackberry biological control agent, *Phragmidium violaceum*, in Australia. Australasian Plant Pathology 29: 249-254.
559	Everts, J.G. 1921. *Stenopelmus rufinasus* Gyll. thans ook in ons land aangetroffen. Aawinsten voor de Nederlandsche Coleopteren-fauna. Vangmethoden. — Verslag 54. Wintervergadering, Leiden, 27 Febr 1921. Tijdschr. v. Ent. 64: 2-5.
560	Faubert, H. and R.A. Casagrande. 2002. Cypress Spurge. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 195-207.
561	Fauzi, M.T., A.J. Tomley, P.J. Dart, H.J. Ogle, and S.W. Adkins. 1999. The rust *Puccinia abrupta* var. *partheniicola*, a potential biological agent of Parthenium weed: environmental requirements for disease progress. Biological Control 14: 141-145.
562	Fayad, Y.H., A.A. Ibrahim, A.A. El-Zoghby, and F.F. Shalaby. 2001. Ongoing activities in the biological control of water hyacinth in Egypt. *In* M.H. Julien, M.P. Hill, T.D. Center, and J. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 43-46.
563	Feldman, S.R. 1997. Biological Control of plumeless thistle (*Carduus acanthoides* L.) in Argentina. Weed Science 45(4): 534-537.
564	Field, R.P. 1989. Progress towards biological control of ragwort in Australia. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 315-322.
565	Fisher, A.J., B.J. Aegerter, T.R. Gordon, L. Smith, and D.M. Woods. 2009. *Puccinia jaceae* var. *solstitialis* teliospore priming on yellow starthistle. Phytopathology 99(1): 67-72.
566	Fisher, A.J., D.M. Woods, L. Smith, and W.L. Bruckart III. 2007. Developing an optimal release strategy for the rust fungus *Puccinia jaceae* var. *solstitialis* for biological control of *Centaurea solstitialis* (yellow starthistle). Biological Control 42: 161-171.

Code	Reference
567	Fisher, A.J., D.M. Woods, L. Smith, and W.L. Bruckart. 2008. Monitoring the rust fungus, *Puccinia jaceae* var. *solstitialis*, for biological control of yellow starthistle (*Centaurea solstitialis*). *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 540-544.
568	Fisher, K., R. Fogliani, and D. Gehradte. 1990. Biological control of doublegee (*Emex australis*). *In* S. Broughton, Ed. Biennial Research Summaries 1988-1990, Entomology Branch. Western Australia Department of Agriculture, Perth, Western Australia. pp. 37-38.
569	Flanagan, G.J., L.A. Hills, and C.G. Wilson. 2000. The successful biological control of spinyhead sida, *Sida acuta* [Malvaceae], by *Calligrapha pantherina* (Col: Chrysomelidae) in Australia's Northern Territory. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 35-41.
570	Flanagan, G.J., D.S. Van Rangelrooy, and S. Kerin. 1996. Integrated management of *Parkinsonia aculeata* on the Roper River, Northern Territory, Australia. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 441-443.
571	Flanagan, G.J., C.G. Wilson, and J.D. Gillett. 1990. The abundance of native insects on the introduced weed *Mimosa pigra* in northern Australia. Journal of Tropical Ecology 6(2): 219-230.
572	Fogliani, R.G. and G.R. Strickland. 2000. Final report to meat and livestock Australia project DAW.057, 1994-2000. Biological control of dock: enhanced distribution of the dock moth. Western Australia Department of Agriculture, Perth, Western Australia. 88 pp.
573	Fornasari, L., C.E. Turner, and L.A. Andres. 1991. *Eustenopus villosus* (Coleoptera: Curculionidae) for biological control of yellow starthistle (Asteraceae: Cardueae) in North America. Environmental Entomology 20(4): 1187-1194.
574	Forno, I.W. 1985. How quickly can insects control *Salvinia* in the tropics. *In* K. Noda and B.L. Mercado, Eds. Proceedings of the 10th Asian-Pacific Weed Science Society Conference. 24-30 November 1985, Chiang Mai, Thailand; Asian-Pacific Weed Science Society. pp. 271-276.
575	Forno, I.W. 1987. Biological control of the floating fern *Salvinia molesta* in north-eastern Australia: plant herbivore interactions. Bulletin of Entomological Research 77: 9-17.
576	Forno, I.W. 1997. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, Long Pocket Laboratories, Private Bag No. 3, Indooroopilly, Queensland 4068, Australia.

Code	Reference
577	Forno, I.W., R.C. Kassulke, and K.L.S. Harley. 1992. Host specificity and aspects of the biology of *Calligrapha pantherina* (Col.: Chrysomelidae), a biological control agent of *Sida acuta* (Malvaceae) and *S. rhombifolia* in Australia. Entomophaga 37: 409-417.
578	Forno, I.W. and P. Smith. 1995. Biological control of floating aquatic weeds in Botswana. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 289.
579	Forno, W., T.A. Heard, and M.D. Day. 1994. Host specificity and aspects of the biology of *Coelocephalapion aculeatum* (Coleoptera: Apionidae), a potential biological control agent of *Mimosa pigra* (Mimosaceae). Biological Control 23: 147-153.
580	Forsyth, S.F. and A.K. Watson. 1985. Stress inflicted by organisms on Canada thistle. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 425-431.
581	Fortuner, R. and A.R. Maggenti. 1987. A reappraisal of Tylenchina (Nemata). 4. The family Anguinidae Nicoll, 1935 (1926). Revue Nématol 10(2): 163-176.
582	Fowler, S.V. 1997. (personal communication) CAB International Institute of Biological Control, Silwood Park, Ascot, Berks SL5 7TA, United Kingdom.
583	Fowler, S.V. 2004. Biological control of an exotic scale, *Orthezia insignis* Browne (Homoptera: Ortheziidae), saves the endemic gumwood tree, *Commidendrum robustum* (Roxb.) DC. (Asteraceae) on the island of St. Helena. Biological Control 29: 367-374.
584	Fowler, S.V. 2011. Weed bio control on Ascension Island. Ascension Conservation Quarterly 36: 16-21.
585	Fowler, S.V. 2013. (personal communication) Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand.
586	Fowler, S.V., S. Ganeshan, J. Mauremootoo, and Y. Mungroo. 2000. Biological control of weeds in Mauritius: past successes revisited and present challenges. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 43-50.
587	Fowler, S.V., Q. Paynter, L. Hayes, S. Dodd, and R. Groenteman. 2010. Biocontrol of weeds in New Zealand: an overview of nearly 85 years. *In* S.M. Zydenbos, Ed. Proceedings of the 17th Australasian Weeds Conference. 26-30 September 2010, Christchurch, New Zealand; New Zealand Plant Protection Society. pp. 211-214.
588	Franck, A.R. 2012. Systematics of Harrisia (Cactaceae). Disseration, Doctor of Philosophy. University of South Florida, Tampa, Florida, USA.
589	Fraser, B. and R. Emberson. 1987. Rediscovery of *Chrysolina quadrigemina* (Suffrian) (Coleoptera: Chrysomelidae) in New Zealand. New Zealand Entomologist 9: 57-59.

Code	Reference
590	Freedman, J.E., M.J. Grodowitz, R. Swindle, and J.G. Nachtrieb. 2007. Potential use of native and naturalized insect herbivores and fungal pathogens of aquatic and wetland plants. Final Report. ERDC/EL TR-07-11. Aquatic Plant Control Research Program, Washington D.C. 68 pp.
591	Freeman, T.E. and R. Charudattan. 1984. *Cercospora rodmanii* Conway a biological agent for waterhyacinth. Technical Bulletin No. 842. University of Florida IFAS Extension, Gainesville, Florida. 18 pp.
592	Freeman, T.E., R. Charudattan, and K.E. Conway. 1978. Status of the use of plant pathogens in the biological control of weeds. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 201-206.
593	Frick, K.E. 1964. *Leucoptera spartifoliella*, an introduced enemy of Scotch broom in the Western United States. Journal of Economic Entomology 57: 589-591.
594	Frick, K.E. 1969. Tansy ragwort control, aided by the establishment of seedfly from Paris. California Agriculture 23(12): 10-11.
595	Frick, K.E. and J.M. Chandler. 1978. Augmenting the moth (*Bactra verutana*) in field plots for early-season suppression of purple nutsedge (*Cyperus rotundus*). Weed Science 26: 703-710.
596	Friesen, R.D., C.E. Causton, and G.P. Markin. 2008. Status of the biological control of banana poka, *Passiflora mollissima* (aka *P. tarminiana*) in Hawaii. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 669-675.
597	Froggatt, W.W. 1904. The nut grass coccid (*Antonia australis*, Green). Agricultural Gazette of New South Wales 15: 407-410.
598	Fröhlich, J., S.V. Fowler, A. Gianotti, R.L. Hill, E. Killgore, L. Morin, L. Sugiyama, and C. Winks. 2000. Biological control of mist flower (*Ageratina riparia*, Asteraceae): Transferring a successful program from Hawai'i to New Zealand. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 51-57.
599	Frye, M.J., E.C. Lake, and J. Hough-Goldstein. 2010. Field host-specificity of the mile-a-minute weevil, *Rhinoncomimus latipes* Korotyaev (Coleoptera: Curculionidae). Biological Control 55: 234-240.
600	Fujimori, T. 1997. Biological agents for controlling insect pests and weeds in golf courses. Abstract. Phytoparasitica 25(4): 355.
601	Fullaway, D.T. 1954. Biological control of cactus in Hawaii. Journal of Economic Entomology 47: 696-700.
602	Fullaway, D.T. 1958. Importations of natural enemies of the weed, *Emex spinosa* Campd. Proceedings of the Hawaiian Entomological Society 16(3): 359-360.

Code	Reference
603	Furness, G. 1986. (personal communication) Department of Agriculture, Loxton, South Australia 5333, Australia.
604	FWC. 2010. New biocontrol insect targets water hyacinth (Florida Fish and Wildlife Conservation Commission). Invasive Plant Management Research and Outreach Newsletter 2(1): 1.
605	Fyfe, R.V. 1935. The lantana bug in Fiji. Agricultural Journal of Fiji. 8: 35-36.
606	Fyfe, R.V. 1936. The biological control of *Clidemia hirta* in Fiji. Journal of the Australian Institute of Agricultural Science 2: 8-9.
607	Gagné, R.J., S.A. Wright, M.F. Purcell, B.T. Brown, P.D. Pratt, and T.D. Center. 2009. Description of the larva of *Lophodiplosis trifida*, an Australian gall midge (Diptera: Cecidomyiidae) and biocontrol agent of paperbark in Florida, USA. Florida Entomologist 92(4): 593-597.
608	Ganeshan, S. 2013. (personal communication) Mauritius Sugarcane Industry Research Institute, Crop Protection Programme, Reduit, Mauritius.
609	Garcia-Rossi, D., N. Rank, and D.R. Strong. 2003. Potential for self-defeating biological control? Variation in herbivore vulnerability among invasive *Spartina* genotypes. Ecological Applications 13(6): 1640-1649.
610	Garcia-Tuduri, J.C., L.F. Martorell, and S.M. Gaud. 1979. Geographical distribution and host plants of the cactus moth, *Cactoblastis cactorum* Berg) in Puerto Rico and the United States Virgin Islands. Journal of Agriculture of the University of Puerto Rico 55: 130-137.
611	Gardner, D.E. 1992. Plant pathogens as biocontrol agents in native Hawaiian ecosystems. *In* C.P. Stone, C.W. Smith, and J.T. Tunison, Eds. Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. University of Hawaii Press, Honolulu, Hawaii. pp. 432-451.
612	Gardner, D.E. and C.J. Davis. 1982. The prospects for biological control of nonnative plants in Hawaiian National Parks. Technical Report 45. Cooperative Agreement No. CX 8000 2 000. University of Hawaii at Manoa, Honolulu, Hawaii. 55 pp.
613	Gardner, D.E. and C.S. Hodges. 1983. Leaf rust caused by *Kuehneola uredinis* on native and nonnative *Rubus* species in Hawaii. Plant Disease 67(9): 962-963.
614	Gardner, D.E., C.W. Smith, and G.P. Markin. 1995. Biological control of alien plants in natural areas of Hawaii. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 35-40.
615	Gardner, J.C.M. 1944. A note on the imported lantana bug (*Teleonemia scrupulosa* Stal.). Indian Forester 70: 139-140.
616	Garren, J.M. and S.Y. Strauss. 2009. Population-level compensation by an invasive thistle thwarts biological control from seed predators. Ecological Applications 19(3): 709-721.

Code	Reference
617	Gashamura, F.R. 2009. Effects of manure from water hyacinth on soil fertility and maize performance under controlled conditions in Rwanda. Thesis, Master of Science. Uppsala University, Uppsala, Sweden. 51 pp.
618	Gassmann, A. 2013. (personal communication) CABI, Rue des Grillons 1, CH-2800 Delémont, Switzerland.
619	Gassmann, A., M.J.W. Cock, R. Shaw, and H.C. Evans. 2006. The potential for biological control of invasive alien aquatic weeds in Europe: a review. Hydrobiologia 570: 217-222.
620	Gassmann, A. and L.-T. Kok. 2002. Musk Thistle (Nodding Thistle). *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 229-245.
621	Gassmann, A. and L.-T. Kok. 2002. Slenderflower Thistle. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 251-254.
622	Gassmann, A. and D. Schroeder. 1995. The search for effective biological control agents in Europe: history and lessons from leafy spurge (*Euphorbia esula* L.) and cypress spurge (*Euphorbia cyparissias* L.). Biological Control 5: 466-477.
623	Gatimel, B. 2013. (personal communication) Southern Province, Department of Rural Development, BP. 2386 - 98 846 Nouméa cedex, Nouvelle-Calédonie.
624	Gerber, E., U. Schaffner, A. Gassmann, H.L. Hinz, M.K. Seier, and H. Müller-Schärer. 2011. Prospects for biological control of *Ambrosia artemisiifolia* in Europe: learning from the past. Weed Research 51(6): 559-573.
625	Gherardi, F., J.R. Britton, K.M. Mavuti, N. Pacini, J. Grey, E. Tricarico, and D.M. Harper. 2011. A review of allodiversity in Lake Naivasha, Kenya: Developing conservation actions to protect East African lakes from negative impacts of alien species. Biological Control 144: 2585-2596.
626	Giblin-Davis, R.M., W. Ye, K.A. Davies, S.J. Scheffer, G.S. Taylor, M.F. Purcell, G. Wheeler, T.D. Center, and W.K. Thomas. 2005. *Fergusobia quinquenerviae/Fergusonina turneri* complex genotypes are not correlated with *Melaleuca quinquenervia* chemotypes. Journal of Nematology 37(3): 354-405.
627	Giliomee, J. 1986. The biological control of Kariba weed in the East Caprivi. African Wildlife 40: 189-195.
628	Gilstrap, F.E. and R.D. Goeden. 1974. Biology of *Tarachidia candefacta*, a Nearctic Noctuid introduced into the USSR for ragweed control. Annals of the Entomological Society of America 67: 265-270.

Code	Reference
629	Girling, D.J., D.J. Greathead, A.I. Mohyuddin, and T. Sankaran. 1979. The potential for biological control in the suppression of parasitic weeds. Biocontrol News and Information (Sample issue). 7-16.
630	Gitonga, W. 2013. (personal communication) Kenya Agricultural Research Institute- Mwea, P.O. Box 298-10300, Kerugoya, Kenya.
631	Given, B.B. and G.F. Woods. 1964. Gall midge to assist in controlling St. John's Wort. New Zealand Journal of Agriculture 108: 61-63.
632	Godfrey, K.E. 1997. (personal communication) California Department of Food and Agriculture, Biological Control Program, 1220 N Street, Sacramento, California 95814, United States of America.
633	Godfrey, K.E., L.W.J. Anderson, S.D. Perry, and N. Dechoretz. 1994. Overwintering and establishment potential of *Bagous affinis* (Coleoptera: Curculionidae) on *Hydrilla verticillata* (Hydrocharitaceae) in northern California. Florida Entomologist 77: 221-230.
634	Godfrey, K.E., L.W.J. Anderson, C.E. Turner, K. Chan, D. Quimayousie, and J. Barajas. 1996. *Hydrellia pakistanae* as a biological control agent of *Hydrilla verticillata*. *In* L.G. Bezark, Ed. Biological Control Program 1995 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry., Sacramento, California. pp. 29.
635	Goeden, R.D. 1978. Biological control of weeds. *In* C.P. Clausen, Ed. Introduced parasites and predators of arthropod pests and weeds. Agriculture Handbook 480. United States Department of Agriculture, Washington D.C. pp. 357-545.
636	Goeden, R.D. 1988. A capsule of biological control of weeds. Biocontrol News and Information 9: 55-61.
637	Goeden, R.D. 1995. Milk thistle. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 245-247.
638	Goeden, R.D., C.A. Fleschner, and D.W. Ricker. 1967. Biological control of prickly pear cacti on Santa Cruz Island, California. Hilgardia 38: 579-606.
639	Goeden, R.D., C.A. Fleschner, and D.W. Ricker. 1968. Insects control prickly pear cactus. California Agriculture 22(10): 8-10.
640	Goeden, R.D., O.V. Kovalev, and D.W. Ricker. 1974. Arthropods exported from California to the USSR for ragweed control. Weed Science 22: 156-158.
641	Goeden, R.D. and R.W. Pemberton. 1995. Russian thistle. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 276-280.

Code	Reference
642	Goeden, R.D. and D.W. Ricker. 1978. Establishment of *Rhinocyllus conicus* (Col.: Curculionidae) on Italian thistle in southern California. Environmental Entomology 7: 787-789.
643	Goeden, R.D. and D.W. Ricker. 1981. Santa Cruz Island - revisited. Sequential photography records. The causation, rates of progress, and lasting benefits of successful biological weed control. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 355-365.
644	Goeden, R.D. and D.W. Ricker. 1985. Seasonal asynchrony of Italian thistle, *Carduus pycnocephalus*, and the weevil, *Rhinocyllus conicus* (Coleoptera: Curculionidae), introduced for biological control in southern California. Environmental Entomology 14: 433-436.
645	Goeden, R.D., D.W. Ricker, and B.A. Hawkins. 1985. Ethological and genetic differences among three biotypes of *Rhinocyllus conicus* (Coleoptera: Curculionidae) introduced into North America for the biological control of asteraceous thistles. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 181-189.
646	Goeden, R.D., D.W. Ricker, and H. Müller. 1987. Introduction, recovery, and limited establishment of *Coleophora klimeschiella* (Lepidoptera: Coleophoridae) on Russian thistles, *Salsola australis*, in southern California. Environmental Entomology 16: 1027-1029.
647	Gomez, D.R., K.J. Evans, J. Baker, P.R. Harvey, and E.S. Scott. 2008. Dynamics of introduced populations of *Phragmidium violaceum* and implications for biological control of European blackberry in Australia. Applied and Environmental Microbiology 74(17): 5504.
648	Gomez, D.R., K.J. Evans, P.R. Harvey, J. Baker, J. Barton, M. Jourdan, L. Morin, S.R. Pennycook, and E.S. Scott. 2006. Genetic diversity in the blackberry rust pathogen, *Phragmidium violaceum*, in Europe and Australasia as revealed by analysis of SAMPL. Mycological Research 110: 423-430.
649	Gonzalez, R.H. and S. Rojas. 1966. Estudio anlitico del control biologico de plagas agricolas en Chile. Agricultura Tecnica (Chile) 26: 133-147.
650	Goolsby, J., P. Moran, J. Adamczyk, A. Kirk, W. Jones, M. Garcia, and E. Mendoza. 2009. Host range of the European, rhizome-stem feeding scale *Rhizaspidiotus donacis* (Leonardi) (Hemiptera: Diaspididae), a candidate biological control agent for giant reed, *Arundo donax* L. (Poales: Poaceae) in North America. Biocontrol Science and Technology 19: 899-918.
651	Goolsby, J.A. 2012. (personal communication) United States Department of Agriculture, Agricultural Research Service, Knipling-Bushland U.S. Livestock Insects Research Laboratory, Cattle Fever Tick Research Laboratory, 22675 N. Moorefield Rd., Moore Airbase, Building 6419, Edinburg, Texas 78541 USA.

Code	Reference
652	Goolsby, J.A., A.A. Kirk, P.J. Moran, E. Racelis, J.J. Adamczyk, E. Cortés, M.Á.M. García, M. Martinez Jimenez, K.R. Summy, M.A. Ciomperlik, and D.P.A. Sands. 2011. Establishment of the armored scale, *Rhizaspidiotus donacis*, a biological control agent of *Arundo donax*. Southwestern Entomologist 36(3): 373-374.
653	Goolsby, J.A. and P. Moran. 2009. Host range of *Tetramesa romana* Walker (Hymenoptera: Eurytomidae), a potential biological control of giant reed, *Arundo donax* L. in North America. Biological Control 49(2): 160-168.
654	Gordon, A.J. 1999. Biological control of Australian myrtle, *Leptospermum laevigatum* (J. Gaertn.) F. Muell. (Myrtaceae), in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 139-143.
655	Gordon, A.J. 1999. A review of established and new insect agent for the biological control of *Hakea sericea* Schrader (Proteaceae) in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 35-43.
656	Gordon, A.J. 2003. Biology and host range of the stem-boring beetle *Aphanasium australe*, a promising agent for the biological control of *Hakea sericea* in South Africa. Biocontrol 48: 113-122.
657	Gordon, A.J. 2011. Biological control endeavours against Australian myrtle, *Leptospermum laevigatum* (Gaertn.) F. Muell. (Myrtaceae), in South Africa. African Entomology 19(2): 349-335.
658	Gordon, A.J. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7600 South Africa.
659	Gordon, A.J. and A. Fourie. 2011. Biological control of *Hakea sericea* Schrad. & J. C. Wendl. and *Hakea gibbosa* (Sm.) Cav. (Proteaceae) in South Africa. African Entomology 19(2): 303-314.
660	Gordon, A.J. and R.L. Kluge. 1991. Biological control of St John's wort, *Hypericum perforatum* (Clusiaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 77-90.
661	Gordon, A.J., R.L. Kluge, and S. Neser. 1985. The effect of the gall midge, *Zeuxidiplosis giardi* (Diptera: Cecidomyiidae) on seedlings of St. John's wort, *Hypericum perforatum* (Clusiaceae). *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 743-748.
662	Gordon, A.J. and S. Neser. 1986. The seasonal history of the gall midge *Zeuxidiplosis giardi* Kieffer (Diptera: Cecidomyiidae), an introduced natural enemy of St John's wort, *Hypericum perforatum* L. Journal of the Entomological Society of South Africa 49: 115-120.
663	Goulet, E.J., J. Thaler, A. Ditommaso, M. Schwarzländer, and E.J. Shields. 2013. Impact of *Mecinus janthinus* (Coleoptera: Curculionidae) on the growth and reproduction of *Linaria dalmatica* (Scrophulariaceae). Great Lakes Entomologist 46(1-2): 90-98.

Code	Reference
664	Gourlay, A.H. 2013. (personal communication) Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand.
665	Gourlay, A.H., R. Wittenberg, R.L. Hill, A.G. Spiers, and S.V. Fowler. 2000. The biological control programme against *Clematis vitalba* in New Zealand. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 709-718.
666	Grandgirard, J. 2013. (personal communication) Service du Développement Rural, Département de la Protection des Végétaux, BP 100, 98713 Papeete, French Polynesia.
667	Greathead, D.J. 1968. Biological control of Lantana. A review and discussion of recent developments in East Africa. Pest Articles and News Summaries (PANS) 14C: 167-175.
668	Greathead, D.J. 1971. A review of biological control in the Ethiopian region. Technical Communication No. 5. Commonwealth Institute of Biological Control, Farnham Royal, England. 162 pp.
669	Greathead, D.J. 1984. The natural enemies of *Striga* spp. and the prospects for their utilisation as biological control agents. *In* E.S. Ayensu, H. Doggett, R.D. Keynes, J. Marton-Lefevre, L.J. Musselman, C. Parker, and A. Pickering, Eds. *Striga*. Biology and Control. ICSU Press and IDRC, France. pp. 133-160.
670	Greathead, D.J. 1993. (personal communication) Centre for Population Biology, Imperial College, Silwood Park, Ascot, Berks SL5 7PY, United Kingdom.
671	Greve, J.E.v.S. and J.W. Ismay. 1983. Crop insect survey of Papua New Guinea from July 1st 1969 to December 31st 1978. Papua New Guinea Agricultural Journal 32: 1-120.
672	Grevstad, F.S. 2004. Smooth cordgrass, *Spartina alterniflora*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 317-321.
673	Grevstad, F.S. 2006. Ten-year impacts of the biological control agents *Galerucella pusilla* and *G. calmariensis* (Coleoptera: Chrysomelidae) on purple loosestrife (*Lythrum salicaria*) in central New York State. Biological Control 39: 1-8.
674	Grevstad, F.S., C. O'Casey, and M.L. Katz. 2012. A comparison of four geographic sources of the biocontrol agent *Prokelisia marginata* (Homoptera: Delphacidae) following introduction into a common environment. Environmental Entomology 41(3): 448-454.
675	Grevstad, F.S., D.R. Strong, D. Garcia-Rossi, R.W. Switzer, and M.S. Wecker. 2003. Biological control of *Spartina alterniflora* in Willapa Bay, Washington using the planthopper *Prokelisia marginata*: agent specificity and early results. Biological Control 27(1): 32-42.

Code	Reference
676	Grevstad, F.S., R.W. Switzer, and M.S. Wecker. 2004. Habitat trade-offs in the summer and winter performance of the planthopper *Prokelisia marginata* introduced against the intertidal grass *Spartina alterniflora* in Willapa Bay, Washington. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 457-463.
677	Grevstad, F.S., M.S. Wecker, and D.R. Strong. 2010. Biological control of *Spartina*. Update to report written in 2004. *In* D.R. Ayres, D.W. Kerr, S.D. Ericson, and P.R. Olofson, Eds. Proceedings of the 3rd International Conference on Invasive *Spartina*. 8-10 November 2004, San Francisco, California, USA; San Francisco Estuary, Invasive *Spartina* Project of the California State Coastal Conservancy. pp. 267-272.
678	Griffin, J.J. and F.A. Blazich. 2008. *Myrica* L. and *Morella* Lour. *In* F.T. Bonner and R.P. Karrfalt, Eds. Woody Plant Seed Manual. USDA Forest Service, Washington D.C. pp. 733-737.
679	Griffiths, M. and R.E. McFadyen. 1993. Biology and host-specificity of *Platphalonidia mystica* (Lep.: Cochylidae) introduced into Queensland to biologically control *Parthenium hysterophorus* (Asteraceae). Entomophaga 38: 131-137.
680	Grodowitz, M.J. 1997. (personal communication) United States Army Corps of Engineers, Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, Mississippi 39180, United States of America.
681	Grodowitz, M.J., T.D. Center, A.F. Cofrancesco, and J.E. Freedman. 1997. Release and establishment of *Hydrellia balciunasi* (Diptera: Ephydridae) for the biological control of the submersed aquatic plant *Hydrilla verticillata* (Hydrocharitaceae) in the United States. Biological Control 9: 15-23.
682	Grodowitz, M.J., T.D. Center, and E. Snoddy. 1995. Current status on the use of insect biocontrol agents for the management of hydrilla. *In* Proceedings of the 29th Annual Meeting, Aquatic Plant Control Research Program. 14-17 November 1994, Vicksburg, Mississippi, USA; U.S. Army Engineers Waterways Experiment Station. pp. 134-141.
683	Grodowitz, M.J., T.D. Center, E. Snoddy, and D.F.A. Jr. 1994. Release and establishment of insect biocontrol agents for the management of hydrilla. *In* Proceedings of the 28th Annual Meeting, Aquatic Plant Control Research Program. 15-18 November 1993, Baltimore, Maryland, USA; U.S. Army Engineers Waterways Experiment Station. pp. 181-201.
684	Grodowitz, M.J., W. Johnson, and L.D. Nelson. 1992. Status of biological control of waterlettuce in Louisiana and Texas using insects. Miscellaneous Paper A-92-3. U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, USA. 20 pp.
685	Grodowitz, M.J., R.M. Stewart, and A.F. Cofrancesco. 1991. Population dynamics of waterhyacinth and the biological control agent *Neochetina eichhorniae* (Coleoptera: Curculionidae) at a southeast Texas location. Environmental Entomology 20: 652-660.

Code	Reference
686	Groenteman, R. 2013. (personal communication) Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand.
687	Groenteman, R., S.V. Fowler, and J.J. Sullivan. 2010. Response of two *Chrysolina* species to different *Hypericum* hosts. *In* S.M. Zydenbos, Ed. Proceedings of the 17th Australasian Weeds Conference. 26-30 September 2010, Christchurch, New Zealand; New Zealand Plant Protection Society. pp. 227-230.
688	Groenteman, R., D. Kelly, S.V. Fowler, and G.W. Bourdôt. 2007. Interactions between nodding thistle seed predators. New Zealand Plant Protection 60: 152-157.
689	Groenteman, R., D. Kelly, S.V. Fowler, and G.W. Bourdôt. 2008. Which species of thistle biocontrol agent *Trichosirocalus* are present in New Zealand? *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 145-149.
690	Grosskopf, G. 2005. Biology and life history of *Cheilosia urbana* (Meigen) and *Cheilosia psilophthalma* (Becker), two sympatric hoverflies approved for the biological control of hawkweeds (*Hieracium* spp.) in New Zealand. Biological Control 35: 142-154.
691	Grossrieder, M. and I.P. Keary. 2004. The potential for the biological control of *Rumex obtusifolius* and *Rumex crispus* using insects in organic farming, with particular reference to Switzerland. Biocontrol News and Information 25(3): 65N-79N.
692	Groves, R.H. 2013. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Plant Industry & CRC Australian Weed Management, GPO Box 1600, Canberra, Australian Capital Territory 2601 Australia.
693	Groves, R.H. and A.W. Sheppard. 2012. *Carduus pycnocephalus* and *C. tenuiflorus* - slender thistles. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 131-138.
694	Gültekin, L. 2006. On some Lixinae types of I.C. Fabricius (Coleoptera, Curculionidae). Fragmenta entomologica, Roma 38(1): 111-133.
695	Gulya, T.J. and W.D. Stegmeier. 2002. First report of *Puccinia canaliculata* on sunflower. Abstract. Plant Disease 86(5): 559.
696	Guo, J.-Y., F.-H. Wan, and Z.S. Zhou. 2010. Biological control of common ragweed in China. Powerpoint presentation. Institute of Plant Protection, Chinese Academy of Agricultural Sciences. 50 pp.
697	Guo, J.-Y., Z.S. Zhou, X.-W. Zheng, H.-S. Chen, F.-H. Wan, and Y.-H. Luo. 2011. Control efficiency of leaf beetle, *Ophraella communa*, on the invasive common ragweed, *Ambrosia artemisiifolia*, at different growing stages. Biocontrol Science and Technology 21(9): 1049-1063.

Code	Reference
698	Gutierrez, J. and I.W. Forno. 1989. Introduction into New Caledonia of two hispine phytophages of lantana: *Octotoma scabripennis* and *Uroplata girardi* (Coleoptera, Chrysomelidae). Acta Oecologica, Oecologia Applicata 10: 19-29.
699	Guttierrez López, E., R. Huerto Delgadillo, and M. Martinez Jiménez. 1996. Water hyacinth problems in Mexico and practised methods for control. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 125-135.
700	Haag, K.H. 1986. Effective control of waterhyacinth using *Neochetina* and limited herbicide application. Journal of Aquatic Plant Management 24: 70-75.
701	Habeck, D.H. 1974. *Arzama densa* as a pest of dasheen. Florida Entomologist 57: 409-410.
702	Habeck, D.H. and F.D. Bennett. 1989. First record of a phytophagous seed chalcid from Brazilian peppertree in Florida. Florida Entomologist 72(2): 378-379.
703	Habeck, D.H. and F.D. Bennett. 1990. *Cactoblastis cactorum* Berg (Lepidoptera: Pyralidae), a Phycitine new to Florida. Entomology Circular No. 33. Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 4 pp.
704	Haines, M.L., P. Syrett, R.M. Emberson, T.M. Withers, S.V. Fowler, and S.P. Worner. 2004. Ruling out a host-range expansion as the cause of the unpredicted non-target attack on tagasaste (*Chamaecytisus proliferus*) by *Bruchidius villosus*. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 271-276.
705	Haller, W.T. 1996. Operational aspects of chemical, mechanical and biological control of water hyacinth in the United States. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 137-151.
706	Hammes, C. and R. Putoa. 1986. Catalogue des Insectes et Acariens d'intérêt agricole en Polynésie française. Entomologie agricole. Notes et documents No. 02. Centre ORSTOM de Tahiti, Tahiti. 270 pp.
707	Hancox, N.G., P. Syrett, and R.R. Scott. 1986. Biological control of St. John's wort (*Hypericum perforatum*) in New Zealand: a review. Plant Protection Quarterly 1: 152-155.
708	Hansen, R. 1997. (personal communication) United States Department of Agriculture, Animal and Plant Health Inspection Service, Bozeman, Montana 59717, United States of America.
709	Hansen, R. and C. Southwick. 2010. Biological control of Canada thistle. *In* CPHST Biological Control Unit 2010 Annual Report. USDA APHIS PPQ. pp. 1-4.
710	Hansen, R.W. 2013. (personal communication) United States Department of Agriculture, Agricultural Research Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology, 2301 Research Bldg., Suite 108, Fort Collins, CO 80526-1825 USA.
711	Hansen, R.W., R.D. Richard, P.E. Parker, and L.E. Wendel. 1997. Distribution of biological control agents of leafy spurge (*Euphorbia esula* L.) in the United States: 1988-1996. Biological Control 10(2): 129-142.
712	Hansen, R.W., N.R. Spencer, L. Fornasari, P.C. Quimby Jr., R.W. Pemberton, and R.M. Nowierski. 2004. Leafy spurge, *Euphorbia esula* (complex). *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 233-262.
713	Harley, K.L.S. 1973. Biological control of Central and South American weeds in Australia. *In* P.H. Dunn, Ed. Proceedings of the II International Symposium on Biological Control of Weeds. 4-7 October 1971, Rome, Italy; CAB. pp. 4-8.
714	Harley, K.L.S. 1974. Biological control of Lantana in Australia. *In* A.J. Wapshere, Ed. Proceedings of the III International Symposium on Biological Control of Weeds. September 1973, Montpellier, France; CAB. pp. 23-29.
715	Harley, K.L.S. 1997. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, Long Pocket Laboratories, Private Bag No. 3, Indooroopilly, Queensland 4068, Australia.
716	Harley, K.L.S., I.W. Forno, R.C. Kassulke, and D.P.A. Sands. 1984. Biological control of water lettuce. Journal of Aquatic Plant Management 22: 101-102.
717	Harley, K.L.S. and R.C. Kassulke. 1971. Tingidae for biological control of *Lantana camara* (Verbenaceae). Entomophaga 16: 389-410.
718	Harley, K.L.S., R.C. Kassulke, D.P.A. Sands, and M.D. Day. 1990. Biological control of water lettuce, *Pistia stratiotes* (Araceae) by *Neohydronomus affinis* (Coleoptera: Curculionidae). Entomophaga 35: 363-374.
719	Harley, K.L.S. and R.K. Kunimoto. 1969. Assessment of the suitability of *Plagiohammus spinipennis* (Thoms.) (Col., Cerambycidae) as an agent for control of weeds of the genus *Lantana* (Verbenaceae).II. Host specificity. Bulletin of Entomological Research 58: 787-792.
720	Harman, H.M., P. Syrett, R.L. Hill, and C.T. Jessep. 1996. Arthropod introductions for biological control of weeds in New Zealand. New Zealand Entomologist 19: 71-79.

Code	Reference
721	Harman, H.M., N.W. Waipara, C.J. Winks, L.A. Smith, P.G. Peterson, A. Jones, and J. Stanley. 2007. Distribution of bridal creeper rust (*Puccinia myrsiphylli)* in New Zealand. New Zealand Plant Protection 60: 320.
722	Harman, H.M., N.W. Waipara, C.J. Winks, L.A. Smith, P.G. Peterson, and J.P. Wilkie. 2008. Natural enemies of bridal creeper, *Asparagus asparagoides*, in New Zealand. New Zealand Plant Protection 61: 362-367.
723	Harmon, B. 2013. (personal communication) University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339 Moscow, ID 83844-2339 USA.
724	Harris, P. 1961. Control of toadflax by *Brachypterolus pulicarius* (L.) (Coleoptera: Curculionidae) and *Gymnaetron antirrhini* (Payk.) (Coleoptera: Curculionidae) in Canada. The Canadian Entomologist 93: 977-981.
725	Harris, P. 1964. Host specificity of *Altica carduorum* Guer. (Coleoptera: Chrysomelidae). Canadian Journal of Zoology 42: 857-862.
726	Harris, P. 1967. Suitability of *Anaitis plagiata* (Geometridae) for biocontrol of *Hypericum perforatum* in dry grassland of British Columbia. The Canadian Entomologist 99: 1304-1310.
727	Harris, P. 1980. Effects of *Urophora affinis* Frfld. and *U. quadrifasciata* (Meig.) (Diptera: Tephritidae) on *Centaurea diffusa* Lam. and *C. maculosa* Lam. (Compositae). Zeitschrift für Angewandte Entomologie 90: 190-201.
728	Harris, P. 1980. Establishment of *Urophora affinis* Frfld. and *U. quadrifasciata* (Meig.) (Diptera: Tephritidae) in Canada for the biological control of diffuse and spotted knapweed. Zeitschrift für Angewandte Entomologie 89: 504-514.
729	Harris, P. 1984. *Carduus nutans* L., nodding thistle and *C. acanthoides* L., plumeless thistle (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 115-126.
730	Harris, P. 1984. *Euphorbia esula-virgata* complex, leafy spurge and *E. cyparissias* L., cypress spurge (Euphorbiaceae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 159-169.
731	Harris, P. 1984. *Linaria vulgaris* Miller, yellow toadflax and *L. dalmatica* (L.) Mill., broad-leaved toadflax (Scrophulariaceae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 179-182.
732	Harris, P. 1984. *Salsola pestifer* A.Nels., Russian thistle (Chenopodiaceae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 191-193.
733	Harris, P. 1988. Environmental impact of weed-control insects. BioScience 38(8): 542-548.
734	Harris, P. 1997. Monitoring and impact of weed biological control agents. *In* D.A. Andow, D.W. Ragsdale, and R.E. Nyvall, Eds. Ecological Interactions and Biological Control. Westview Press, Boulder, Colorado. pp. 215-223.
735	Harris, P. 1997. (personal communication) Research Centre, Agriculture and Agri-Food Canada, P.O. Box 3000, Lethbridge, Alberta, TIJ 4B1, Canada.
736	Harris, P. and J. Alex. 1971. *Euphorbia esula* L., leafy spurge and *E. cyparissias* L., cypress spurge (Euphorbiaceae). Technical Communication, Commonwealth Institute of Biological Control 4: 83-88.
737	Harris, P. and A.C. Carder. 1971. *Linaria vulgaris* Mill., yellow toadflax, and *L. dalmatica* (L.) Mill., broad-leaved toadflax (Scrophulariaceae). Technical Communication, Commonwealth Institute of Biological Control 4: 94-97.
738	Harris, P. and M. Maw. 1984. *Hypericum perforatum* L., St. John's wort (Hypericaceae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 171-177.
739	Harris, P. and J.H. Myers. 1984. *Centaurea diffusa* Lam. *C. maculosa* Lam. s. lat., diffuse and spotted knapweed (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 127-137.
740	Harris, P., D. Peschken, and J. Milroy. 1969. The status of biological control of the weed *Hypericum perforatum* in British Columbia. The Canadian Entomologist 101: 1-15.
741	Harris, P. and D.P. Peschken. 1971. *Hypericum perforatum* L., St. John's wort (Hypericaceae). Technical Communication, Commonwealth Institute of Biological Control 4: 89-94.
742	Harris, P. and J.D. Shorthouse. 1996. Effectiveness of gall inducers in weed biological control. The Canadian Entomologist 128: 1021-1055.
743	Harris, P., L.S. Thompson, A.T.S. Wilkinson, and M.E. Neary. 1978. Reproduction biology of tansy ragwort, climate and biological control by the cinnabar moth in Canada. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 163-173.
744	Harris, P. and A.T.S. Wilkinson. 1984. *Cirsium vulgare* (Savi) Ten., bull thistle (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 147-153.
745	Harris, P., A.T.S. Wilkinson, and J.H. Myers. 1984. *Senecio jacobaea* L., tansy ragwort (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 195-201.

Code	Reference
746	Harris, P., A.T.S. Wilkinson, M.E. Neary, and L.W. Thompson. 1971. *Senecio jacobaea* L., tansy ragwort (Compositae). Technical Communication, Commonwealth Institute of Biological Control 4: 97-104.
747	Harris, P., A.T.S. Wilkinson, L.S. Thompson, and M. Neary. 1978. Interaction between the cinnabar moth, *Tyria jacobaeae* L. (Lep.: Arctiidae) and ragwort *Senecio jacobaea* L. (Compositae) in Canada. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 174-180.
748	Harris, P. and H. Zwölfer. 1971. *Carduus acanthoides* L. welted thistle, and *C. nutans* L., nodding thistle (Compositae). Technical Communication, Commonwealth Institute of Biological Control 4: 76-79.
749	Harris, R. 1999. The biological control of Scotch thistles: the importation and release of Scotch thistle gall fly. Progress Report to July 1999. Agmardt Ref: 9803, FITT: Project 97FT 01. Landcare Research. 4 pp.
750	Hartmann, H. and A.K. Watson. 1980. Damage to common ragweed (*Ambrosia artemisiifolia*) caused by the white rust fungus (*Albugo tragopogonis*). Weed Science 28: 632-635.
751	Hasan, S. 1988. Chapter 9. Biocontrol of weeds with Microbes. *In* K.G. Mukerji and K.L. Garg, Eds. Biocontrol of Plant Diseases. Vol. 1. CRC Press, Boca Raton, Florida. pp. 129-151.
752	Hasan, S., E.S. Delfosse, E. Aracil, and R.C. Lewis. 1992. Host-specificity of *Uromyces heliotropii*, a fungal agent for the biological control of common heliotrope (*Heliotropium europaeum*) in Australia. Annals of Applied Biology 121: 697-705.
753	Haseler, W.H. 1966. The status of insects introduced for the biological control of weeds in Queensland. Journal of the Entomological Society of Queensland 5: 1-4.
754	Hassanein, E.-H.E., R.A.A. Elenin, H.M. Ibrahim, M.S. Tewfik, A.S. Kholosy, H.R. El-Wekil, Z.R. Yehia, and H.T. Al-Marsafy, Eds. 2005. IPM Egyptian experience in weed management in winter cereals and legumes. Weed Research Central Laboratory Agricultural Research Center. 324 pp.
755	Hawkes, R.B. 1973. Natural mortality of cinnabar moth in California. Annals of the Entomological Society of America 66: 137-146.
756	Hawkes, R.B. 1981. Biological control of tansy ragwort in the State of Oregon, U.S.A. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 623-626.
757	Hawkes, R.B., R.D. Goeden, A. Mayfield, and D.W. Ricker. 1975. Biological control of Russian thistle. California Agriculture 29(4): 3-4.
758	Hawkes, R.B. and G.R. Johnson. 1978. *Longitarsus jacobaeae* aids moth in biological control of tansy ragwort. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 193-196.

Code	Reference
759	Hawkes, R.B. and A. Mayfield. 1978. *Coleophora* spp. as biological control agents against Russian thistle. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 113-116.
760	Hayes, L. 2007. Status of weed biological control agents in Southland. Contract Report: LC0708/022. Landcare Research. 30 pp.
761	Hayes, L. 2013. (personal communication) Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand.
762	HDOA Unpublished Records. 2013. Hawaii Department of Agriculture, Plant Pest Control Branch, 1428 S. King Street, Honolulu, Hawaii 96814 USA.
763	He, D., L. Liu, G. Jing, and Y. Wei. 1987. The safety testing of the Tephritid gallfly, *Procecidochares utilis* Stone. Chinese Journal of Biological Control 3: 1-3.
764	He, M. 2012. (personal communication) Invasion Ecology and Biocontrol Lab, Wuhan Botanical Garden/Institute, Chinese Academy of Sciences Moshan, Wuhan, Hubei Province, 430074 China.
765	Heard, T.A. 2012. *Mimosa pigra* L. - mimosa. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 378-397.
766	Heard, T.A. 2013. (personal communicaiton) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, 41 Boggo Road, Dutton Park, QLD 4102, Australia.
767	Heard, T.A., J.A. Burcher, and I.W. Forno. 1999. *Chalcodermus serripes* (Coleoptera: Curculionidae) for biological control of *Mimosa pigra*: host relations and life cycle. Biological Control 15: 1-9.
768	Heard, T.A., R.R. Chan, K.A.D.W. Senaratne, W.A. Palmer, C. Lockett, and B. Lukitsch. 2009. *Agonosoma trilineatum* (Heteroptera: Scutelleridae) a biological control agent of the weed bellyache bush, *Jatropha gossypiifolia* (Euphorbiaceae). Biological Control 48: 196-203.
769	Heard, T.A. and M.D. Day. 2012. *Sida acuta* Burm. f - spinyhead sida, *Sida rhombifolia* L. - paddy's lucerne and *Sida cordifolia* L. - flannel weed. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 544-550.
770	Heard, T.A., K. Dhileepan, F. Bebawi, K.L. Bell, and R. Segura. 2012. *Jatropha gossypiifolia* L. - bellyache bush. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 324-333.
771	Heard, T.A., L.P. Elliott, B. Anderson, L. White, N. Burrows, A. Mira, R. Zonneveld, G. Fichera, R. Chan, and R. Segura. 2010. Biology, host specificity, release and establishment of *Macaria pallidata* and *Leuciris fimbriaria* (Lepidoptera: Geometridae), biological control agents of the weed *Mimosa pigra*. Biological Control 55: 248-255.

Code	Reference
772	Heard, T.A. and W. Forno. 1996. Host selection and host range of the flower-feeding weevil, *Coelocephalapion pigrae*, a potential biological control agent of *Mimosa pigra*. Biological Control 6: 83-95.
773	Heard, T.A. and M.G. Gardner. 1994. Comparative studies of development and host utilization by *Calligrapha pantherina* on *Sida acuta* and *S. rhombifolia*. Biological Control 4: 336-340.
774	Heard, T.A. and Q. Paynter. 2009. *Mimosa pigra* L. (Leguminosae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 256-273.
775	Heard, T.A., Q. Paynter, R. Chan, and A. Mira. 2005. *Malacorhinus irregularis* for biological control of *Mimosa pigra*: host-specificity, life cycle, and establishment in Australia. Biological Control 32: 252-262.
776	Heard, T.A. and R. Segura. 2004. Agents for biological control of *Mimosa pigra* in Australia: review and future prospects. *In* M. Julien, G. Flanagan, T. Heard, B. Hennecke, Q. Paynter, and C. Wilson, Eds. Research and Management of *Mimosa pigra*. CSIRO Entomology, Canberra. pp. 126-140.
777	Heard, T.A., R. Segura, M. Martinez, and I.W. Forno. 1997. Biology and host range of the green-seed weevil, *Sibinia fastigiata*, for biological control of *Mimosa pigra*. Biocontrol Science and Technology 7: 631-644.
778	Hemachandra, K.S. 2013. (personal communication) University of Peradeniya, Department of Agricultural Biology, Faculty of Agriculture, Peradeniya, Sri Lanka.
779	Hendricks, H.J. 1993. Revision of the tribe Serroleacaniini Shinji (Pseudococcidae) with discussion on other “legless” mealybugs. Dissertation, Doctor of Philosophy. Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA. 273 pp.
780	Hennecke, B.R. 2004. The prospect of biological control of *Mimosa pigra* with fungal pathogens in Australia. *In* M. Julien, G. Flanagan, T. Heard, B. Hennecke, Q. Paynter, and C. Wilson, Eds. Research and Management of *Mimosa pigra*. CSIRO Entomology, Canberra. pp. 117-121.
781	Hennecke, B.R. 2006. Failure of *Diabole cubensis*, a promising classical biological control agent, to establish in Australia. Biological Control 39: 121-127.
782	Henry, K., S. Ivory, A.L. Lush, and J. Kent. 2008. Importation, rearing and field release of the Cape broom psyllid, *Arytinnis hakani*. Final Report. SARDI1/SARD002240. Land & Water Australia. 14 pp.
783	Heppner, J.B., Ed. 1995. Atlas of Neotropical Lepidoptera. Vol. 3. Association for Tropical Lepidoptera, Inc., Gainesville, Florida. liv + 243 pp.
784	Hernández-Vera, G., M. Mitrović, J. Jović, I. Toševski, R. Caldara, A. Gassmann, and B.C. Emerson. 2010. Host-associated genetic differentiation in a seed parasitic weevil *Rhinusa antirrhini* (Coleoptera: Curculionidae) revealed by mitochondrial and nuclear sequence data. Molecular Ecology 19: 2289-2300.

Code	Reference
785	Herr, J.C. 2013. (personal communication) United States Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weeds Research Unit, 800 Buchanan Street, Albany, California 94710 USA.
786	Heystek, F. 2006. Laboratory and field host utilization by established biological control agents of *Lantana camara* L. in South Africa. Thesis, Master of Science. Rhodes University, Grahamstown, South Africa. 167 pp.
787	Heystek, F. 2007. Adding pressure on lantana. Plant Protection News 74: 12.
788	Heystek, F. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
789	Heystek, F. and Y. Kistensamy. 2009. Initial establishment of the lantana petiole gall weevil. Plant Protection News 80: 9-10.
790	Heystek, F. and T. Olckers. 2004. Establishment and impact of *Falconia intermedia* (Hemiptera: Miridae) on *Lantana camara* (Verbenaceae) in South Africa. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 606.
791	Heystek, F., A.R. Wood, S. Neser, and Y. Kistensamy. 2011. Biological control of two *Ageratina* species (Asteraceae: Eupatorieae) in South Africa. African Entomology 19(2): 208-216.
792	Hidalgo, O., N. Garcia-Jacas, T. Garnatje, and A. Susanna. 2006. Phylogeny of *Rhaponticum* (Asteraceae, Cardueae-Centaureinae) and related genera inferred from nuclear and chloroplast DNA sequence data: taxonomic and biogeographic implications. Annals of Botany 97: 705-714.
793	Hight, S. 2013. (personal communication) United States Department of Agriculture, Agricultural Research Service, Center for Medical, Agricultural, and Veterinary Entomology, 6383 Mahan Drive, Tallahassee, FL 32308 USA.
794	Hight, S.D., B. Blossey, J. Laing, and R. DeClercke-Floate. 1995. Establishment of insect biological control agents from Europe against *Lythrum salicaria* in North America. Environmental Entomology 24: 967-977.
795	Hight, S.D. and J.E. Carpenter. 2009. Flight phenology of male *Cactoblastis cactorum* (Lepidoptera: Pyralidae) at different latitudes in the southeastern United States. Florida Entomologist 92(2): 208-216.
796	Hight, S.D., J.P. Cuda, and J.C. Medal. 2002. Brazilian Peppertree. *In* R.V. Driesche, B. Blossey, M. Hoddle, S. Lyon, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 311-322.

Code	Reference
797	Hill, J.H. and A.J. McConnachie. 2009. *Azolla filiculoides* Lamarck (Azollaceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 74-87.
798	Hill, M.P. 1997. (personal communication) Rhodes University, Grahamstown, South Africa.
799	Hill, M.P. 1997. Water hyacinth in Zambia: restoring the balance on the Kafue River. Plant Protection News 47: 11-13.
800	Hill, M.P. 2013. (personal communication) Rhodes University, Zoology and Entomology, P.O. Box 94 Grahamstown 6140 South Africa.
801	Hill, M.P. and C.J. Cilliers. 1999. A review of the arthropod natural enemies, and factors that influence their efficacy, in the biological control of water hyacinth, *Eichhornia crassipes* (Mart.) Solms-Laub. (Pontederiaceae), in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990–1998). African Entomology Memoir 1: 103-112.
802	Hill, M.P., C.J. Cilliers, and S. Neser. 1999. Life history and laboratory host range of *Eccritotarsus catarinensis* (Carvalho) (Heteroptera: Miridae), a new natural enemy released on water hyacinth (*Eichhornia crassipes* (Mart.) Solms-Laub.) (Pontederiaceae) in South Africa. Biological Control 14: 127-133.
803	Hill, M.P. and P.E. Hulley. 1995. Biology and host range of *Gratiana spadicea* (Klug, 1829) (Coleoptera: Chrysomelidae: Cassidinae), a potential biological control agent for the weed *Solanum sisymbriifolium* Lamarck (Solanaceae) in South Africa. Biological Control 5: 345-352.
804	Hill, M.P. and M.H. Julien. 2004. The transfer of appropriate technology; key to the successful biological control of five aquatic weeds in Africa. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 370-374.
805	Hill, M.P., A.J. McConnachie, and M.J. Byrne. 2008. *Azolla filiculoides* Lamarck (Pteridophyta: Azollaceae) control in South Africa: a 10-year review. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 558-560.
806	Hill, M.P. and I.G. Oberholzer. 2004. The mirid *Eccritotarsus catarinensis* is an effective agent against water hyacinth in some areas of South Africa. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 545-547.

Code	Reference
807	Hill, R.L. 1989. *Ageratina adenophora* (Sprengel) R.King & H. Robinson, Mexican devil weed (Asteraceae). *In* P.J. Cameron, R.L. Hill, J. Bain, and W.P. Thomas, Eds. A review of biological control of invertebrate pests and weeds in New Zealand 1874 to 1987. CAB International, London. pp. 317-320.
808	Hill, R.L. and A.H. Gourlay. 2002. Host-range testing, introduction, and establishment of *Cydia succedana* (Lepidoptera: Tortricidae) for biolgoical control of gorse, *Ulex europaeus* L., in New Zealand. Biological Control 25: 173-186.
809	Hill, R.L., A.H. Gourlay, and S.V. Fowler. 2000. The Biological Control Program Against Gorse in New Zealand. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 909-917.
810	Hill, R.L., A.H. Gourlay, and L. Martin. 1991. Seasonal and geographic variation in the predation of gorse seed, *Ulex europaeus* L., by the seed weevil *Apion ulicis* Forst. New Zealand Journal of Zoology 18: 37-43.
811	Hill, R.L., A.H. Gourlay, and C.J. Winks. 1993. Choosing gorse spider mite strains to improve establishment in different climates. *In* Proceedings of the 6th Australasian Grassland Invertebrate Ecological Conference. February 1993, Hamilton, New Zealand; AgResearch, Ruakura Agricultural Centre. pp. 377-383.
812	Hill, R.L., J.M. Grindell, C.J. Winks, J.J. Sheat, and L.M. Hayes. 1991. Establishment of gorse spider mite as a control agent for gorse. *In* Proceedings of the 44th New Zealand Weed and Pest Control Conference. 13-15 August 1991, Tauranga, New Zealand; New Zealand Weed and Pest Control Society Inc. pp. 31-34.
813	Hill, R.L., J. Ireson, A.W. Sheppard, A.H. Gourlay, H. Norambuena, G.P. Markin, R. Kwong, and E.M. Coombs. 2008. A global view of the future for biological control of gorse, *Ulex europaeus* L. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 680-686.
814	Hill, R.L., G.P. Markin, A.H. Gourlay, S.V. Fowler, and E. Yoshioka. 2001. Host range, release, and establishment of *Sericothrips staphylinus* Haliday (Thysanoptera: Thripidae) as a biological control agent for gorse, *Ulex europaeus* L. (Fabaceae), in New Zealand and Hawaii. Biological Control 21: 63-74.
815	Hill, R.L., D.J. O'Donnell, A.H. Gourlay, and C.B. Speed. 1995. Suitability of *Agonopterix ulicetella* (Lepidoptera: Oecophoridae) as a control for *Ulex europaeus* (Fabaceae: Genisteae) in New Zealand. Biocontrol Science and Technology 5: 3-10.
816	Hill, R.L., R. Wittenberg, and A.H. Gourlay. 2001. Biology and host range of *Phytomyza vitalbae* and its establishment for the biological control of *Clematis vitalba* in New Zealand. Biocontrol Science and Technology 11: 459-473.

Code	Reference
817	Ho, W.Y., H. Ky, S.K. Yeap, R.A. Rahim, A.R. Omar, C.L. Ho, and N.B. Alitheen. 2009. Traditional practice, bioactivities and commercialization potential of *Elephantopus scaber* Linn. Journal of Medicinal Plants Research 3(13): 1212-1221.
818	Hoare, R.J.B. 2001. Adventive species of Lepidoptera recorded for the first time in New Zealand. New Zealand Entomologist 24: 23-47.
819	Hodges, A. and G. Hodges. 2009. *Hypogeococcus pungens* Granara de Willink (Insecta: Hemiptera: Pseudococcidae), a mealybug. EENY-459. University of Florida IFAS Extension. 5 pp.
820	Hodges, R.W. 1974. Gelechoidea: Oecophoridae. Fascile 6.2. E.W. Classey Ltd and R.B.D. Publications Inc., London. 142 pp.
821	Hodson, J.L., J.H. Hoffmann, and H.G. Zimmermann. 2003. Biological control of spear thistle, *Cirsium vulgare* (Asteraceae), in South Africa: a modest start for *Rhinocyllus conicus* (Coleoptera: Curculionidae). African Entomology 11(1): 15-20.
822	Hoebeke, E.R. and A.G. Wheeler. 2005. Establishment of three European flea beetles in Nova Scotia: *Longitarsus ganglbaueri* heikertinger, *L. jacobaeae* (Waterhouse), and *L. rubiginosa* (Foudras) (Coleoptera: Chrysomelidae: Alticinae). Proceedings of the Entomological Society of Washington 107: 319-322.
823	Hoffman, J.H. 2013. (personal communication) University of Cape Town, Department of Biological Sciences, Rondebosch 7701 South Africa.
824	Hoffmann, J.H. 1988. An early assessment of *Trichapion lativentr*e (Coleoptera: Apionidae) for biological control of the weed *Sesbania punicea* (Fabaceae) in South Africa. Journal of the Entomological Society of South Africa 51: 265-273.
825	Hoffmann, J.H., F.A.C. Impson, V.C. Moran, and D. Donnelly. 2002. Biological control of invasive golden wattle trees (*Acacia pycnantha*) by a gall wasp, *Trichilogaster* sp. (Hymenoptera: Pteromalidae), in South Africa. Biological Control 25: 64-73.
826	Hoffmann, J.H. and V.C. Moran. 1991. Biocontrol of a perennial legume, *Sesbania punicea*, using a florivorous weevil, *Trichapion lativentre*: weed population dynamics with a scarcity of seeds. Oecologia 88: 574-576.
827	Hoffmann, J.H. and V.C. Moran. 1991. Biological control of *Sesbania punicea* (Fabaceae) in South Africa. Agriculture, Ecosystems & Environment 37: 157-174.
828	Hoffmann, J.H. and V.C. Moran. 1995. Biological control of *Sesbania punicea* with *Neodiplogrammus quadrivittatus*: Predictions of limited success soon confounded. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 201.

Code	Reference
829	Hoffmann, J.H. and V.C. Moran. 1998. The population dynamics of an introduced tree, *Sesbania punicea*, in South Africa, in response to long-term damage caused by different combinations of three species of biological control agents. Oecologia 114(3): 343-348.
830	Hoffmann, J.H. and V.C. Moran. 1999. A review of the agents and factors that have contributed to the successful biological control of *Sesbania punicea* (Cav.) Benth. (Papilionaceae) in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 75-79.
831	Hoffmann, J.H., V.C. Moran, and F.A.C. Impson. 1998. Promising results from the first biological control programme against a solanaceous weed (*Solanum elaeagnifolium*). Agriculture, Ecosystems & Environment 70(2-3): 145-150.
832	Hoffmann, J.H., V.C. Moran, and D.A. Zeller. 1998. Evaluation of *Cactoblastis cactorum* (Lepidoptera: Phycitidae) as a biological control agent of *Opuntia stricta* (Cactaceae) in the Kruger National Park, South Africa. Biological Control 12: 20-24.
833	Hoffmann, J.H., V.C. Moran, and H.G. Zimmermann. 1999. Integrated management of *Opuntia stricta* (Haworth) Haworth (Cactaceae) in South Africa: an enhanced role for two, renowned, insect agents. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990–1998). African Entomology Memoir 1: 15-20.
834	Hoffmann, J.H. and H.G. Zimmermann. 1989. Ovipositional and feeding habits in Cactophagous Pyralids: predictions for biological control of cactus weeds in Southern Africa. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 395-399.
835	Holloway, B.A. 1983. Species of ragwort seedflies imported into New Zealand (Diptera: Anthomyiidae). New Zealand Journal of Agricultural Research 26: 245-249.
836	Holloway, J.D. and S.E. Miller. 1995. Status of *Rhynchopalpus brunellus* in the Hawaiian Islands, with comments on systematics of the *Nolinae* (Lepidoptera: Noctuidae). Bishop Museum Occasional Papers 42: 31-34.
837	Holloway, J.K. and C.B. Huffaker. 1949. Klamath Weed Beetles. California Agriculture 3(2): 9-10.
838	Holloway, J.K. and C.B. Huffaker. 1952. Insects to control a weed. *In* Yearbook of Agriculture, 1952. U.S. Government Printing Office, Washington. pp. 135-140.
839	Holtkamp, R.H. 2012. *Cassinia* spp. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 146-149.
840	Holtkamp, R.H. 2012. *Cylindropuntia imbricata* (Haw.) F.M. Knuth - rope pear, and *Cylindropuntia rosea* (DC.) Backeb. - Hudson pear. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 198-202.

Code	Reference
841	Holtkamp, R.H. 2013. (personal communication) Tamworth Agricultural Institute, NSW DPI, 4 Marsden Park Road, Calala, NSW 2340, Australia.
842	Holtkamp, R.H. and M.H. Campbell. 1995. Biological control of *Cassinia* spp. (Asteraceae). *In* E. Delfosse and R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 447-449.
843	Holtkamp, R.H. and A.J. Maguire. 1993. NSW biological control program. *In* R. Holtkamp, Ed. Proceedings of a National Workshop on *Chrysanthemoides monilifera*. 28-30 April 1993, Port Macquarie, Australia. pp. 24-25.
844	Hosking, J.R. 1985. The role of insects in the long term control of *Opuntia aurantiaca. In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 761-769.
845	Hosking, J.R. 2012. *Opuntia* spp. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 431-436.
846	Hosking, J.R. 2013. (personal communication) Tamworth Agricultural Institute, NSW DPI, 4 Marsden Park Road, Calala, NSW 2340, Australia.
847	Hosking, J.R., R.E. McFadyen, and N.D. Murray. 1988. Distribution and biological control of cactus species in eastern Australia. Plant Protection Quarterly 3: 115-123.
848	Hosking, J.R., A.W. Sheppard, and J.-L. Sagliocco. 2012. *Cytisus scoparius* (L.) Link - broom, Scotch broom or English broom. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. pp. 203-210.
849	Hosking, J.R., J.M.B. Smith, and A.W. Sheppard. 1996. *Cytisus scoparius* (L.) Link subsp. *scoparius*. Plant Protection Quarterly 11: 102-108.
850	Hosking, J.R., P.R. Sullivan, and S.M. Welsby. 1994. Biological control of *Opuntia stricta* (Haw.) Haw. var. *stricta* using *Dactylopius opuntiae* (Cockerell) in an area of New South Wales, Australia, where *Cactoblastis cactorum* (Berg) is not a successful biological control agent. Agriculture, Ecosystems & Environment 48: 241-255.
851	Hough-Goldstein, J. 2012. (personal communication) University of Delaware, Department of Entomology & Wildlife Ecology, Newark DE 19716 USA.
852	Hough-Goldstein, J., E. Lake, and R. Reardon. 2012. Status of an ongoing biological control program for the invasive vine, *Persicaria perfoliata* in eastern North America. Biocontrol 57: 181-189.
853	Hough-Goldstein, J., E.C. Lake, R. Reardon, and Y. Wu. 2008. Biology and biological control of mile-a-minute weed. FHTET-2008-10. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. 74 pp.
854	Hough-Goldstein, J., M. Mayer, W. Hudon, G. Robbins, P. Morrison, and R. Reardon. 2009. Monitored releases of *Rhinoncomimus latipes* (Coleoptera: Curculionidae), a biological control agent of mile-a-minute weed (*Persicaria perfoliata*), 2004-2008. Biological Control 51: 450-457.
855	Hough-Goldstein, J., M. Schiff, E. Lake, and B. Butterworth. 2008. Impact of the biological control agent *Rhinoncomimus latipes* (Coleoptera: Curculionidae) on mile-a-minute weed, *Persicaria perfoliata*, in field cages. Biological Control 46: 417-423.
856	Howard, G. 2013. (personal communication) International Union for Conservation of Nature, PO Box 68200-00200, Nairobi, Kenya.
857	Hoy, J.M. 1960. Establishment of *Procecidochares utilis* Stone (Diptera: Trypetidae) on *Eupatorium adenophorum* Spreng. in New Zealand. New Zealand Journal of Science 3: 200-208.
858	Hrusa, G.F. and J.F. Gaskin. 2008. The *Salsola tragus* complex in California (Chenopodiaceae): Characterization and status of *Salsola australis* and the autochthonous allopolyploid *Salsola ryanii sp. nov*. Madroño 55(2): 113-131.
859	HSPA. 1927. Report of Committee in Charge of the Experiment Station, for the year ending September 30, 1927. Hawaiian Sugar Planters' Association. pp. 21-22.
860	Hudson, W., J. DeSio, R. Strubel, C. Detweiler, G. Robbins, M. Mayer, A. Lovero, and J. Beetle. 2010. *Rhinoncomimus latipes* (Coleoptera: Curculionidae) as a biological control agent for mile-a minute, *Persicaria perfoliata* in New Jersey. Annual Report 2010. New Jersey Department of Agriculture, Trenton, New Jersey, USA. 12 pp.
861	Hufbauer, R.A. and D.K. MacKinnon. 2008. Population structure of an inadvertently introduced biological control agent of toadflaxes: *Brachypterolus pulicarius* in North America. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 418-421.
862	Huffaker, C.B., J. Hamai, and R.M. Nowierski. 1983. Biological control of puncturevine, *Tribulus terrestris* in California after twenty years of activity of introduced weevils. Entomophaga 28: 387-400.
863	Huffaker, C.B. and C.E. Kennett. 1959. A ten-year study of vegetational changes associated with biological control of Klamath weed. Journal of Range Management 12: 69-82.
864	Igrc, J. 1987. The investigations of the beetles *Zygogramma suturalis* F. - as a potential agent for the biological control of the common ragweed. Poljoprivredna znanstvena smotra 76-77: 31-56.
865	Igrc, J., C.J. Deloach, and V. Zlof. 1995. Release and Establishment of *Zygogramma suturalis* F. (Coleoptera: Chrysomelidae) in Croatia for Control of Common Ragweed (*Ambrosia artemisiifolia* L.). Biological Control 5(2): 203-208.

Code	Reference
866	Imaizumi, S., T. Nishino, K. Miyabe, T. Fujimori, and M. Yamada. 1997. Biological control of annual bluegrass (*Poa annua* L.) with a Japanese isolate of *Xanthomonas campestris* pv. *poae* (JT-P482). Biological Control 8: 7-14.
867	Impson, F.A.C. 2013. (personal communication) University of Cape Town, Department of Biological Sciences, Rondebosch 7701 South Africa; Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7600 South Africa.
868	Impson, F.A.C. and J.H. Hoffmann. 1998. Competitive interactions between larvae of three bruchid species (Coleoptera) in mesquite seeds (*Prosopis* spp.) under laboratory conditions. African Entomology 6(2): 376-378.
869	Impson, F.A.C., J.H. Hoffmann, and C. Kleinjan. 2009. Australian *Acacia* species (Mimosaceae) in South Africa. *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, U.K. pp. 38-62.
870	Impson, F.A.C., C.A. Kleinjan, J.H. Hoffmann, and J.A. Post. 2008. *Dasineura rubiformis* (Diptera: Cecidomyiidae), a new biological control agent for *Acacia mearnsii* in South Africa. South African Journal of Science 104: 247-249.
871	Impson, F.A.C., C.A. Kleinjan, J.H. Hoffmann, J.A. Post, and A.R. Wood. 2011. Biological control of Australian *Acacia* species and *Paraserianthes lophantha* (Willd.) Nielsen (Mimosaceae) in South Africa. African Entomology 19(2): 186-207.
872	Impson, F.A.C. and V.C. Moran. 2004. Thirty years of exploration for and selection of a succession of *Melanterius weevil* species for biological control of invasive Australian acacias in South Africa: should we have done anything differently? *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 127-134.
873	Impson, F.A.C., V.C. Moran, and J.H. Hoffman. 1999. A review of the effectiveness of seed-feeding bruchid beetles in the biological control of mesquite, *Prosopis* species (Fabaceae), in South Africa (1990-1998). *In* Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 81-88
874	Impson, F.A.C., V.C. Moran, C. Kleinjan, J.H. Hoffmann, and J.A. Moore. 2008. Multiple-species introductions of biological control agents against weeds: look before you leap. *In* M. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 26-31.
875	Impson, F.A.C., M.F. Purcell, and A.J. Gordon. 2012. Biological control of Australian plants: a South African and US perspective. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 1-17.

Code	Reference
876	Inside Ag. 2012. Biocontrol now an option for yellow toadflax. Inside Ag Newsletter: July 2012. Colorado Department of Agriculture. 1 pp.
877	International Institute of Biological Control. 1990. Annual Report for 1990. 84 pp.
878	International Institute of Biological Control. 1991. Annual Report for 1991. 84 pp.
879	International Institute of Biological Control. 1992. Annual Report for 1992. 96 pp.
880	International Institute of Biological Control. 1994. Annual Report for 1994. 101 pp.
881	International Institute of Biological Control. 1995. Annual Report for 1995. 111 pp.
882	International Institute of Biological Control. 1996. Annual Report for 1996. 136 pp.
883	Ireson, J.E. 2013. (personal communication) University of Tasmania, Tasmanian Institute of Agriculture, New Town Research Laboratories, 13 St John's Avenue, New Town 7008 Australia.
884	Ireson, J.E. and J.T. Davies. 2012. *Ulex europaeus* L. - gorse. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. pp. 581-590.
885	Ireson, J.E., J.T. Davies, W.S. Chatterton, and R.J. Holloway. 2002. Attempts to establish biological control agents for boneseed in Tasmania. *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 407-411.
886	Ireson, J.E., J.T. Davies, D.A. Friend, R.J. Holloway, W.S. Chatterton, E.I. Van Putten, and R.E.C. McFadyen. 2007. Weeds of pastures and field crops in Tasmania: economic impacts and biological control. Technical Series no. 13. CRC for Australian Weed Management, Adelaide, South Australia. 86 pp.
887	Ireson, J.E., D.A. Friend, R.J. Holloway, and S.C. Paterson. 1991. Biology of *Longitarsus flavicornis* (Stephens) (Coleoptera: Chrysomelidae) and its effectiveness in controlling ragwort (*Senecio jacobaea* L.) in Tasmania. Journal of the Australian Entomological Society 30: 129-141.
888	Ireson, J.E., A.H. Gourlay, R.J. Holloway, W.S. Chatterton, S.D. Foster, and R.M. Kwong. 2008. Host specificity, establishment and dispersal of the gorse thrips, *Sericothrips staphylinus* Haliday (Thysanoptera: Thripidae), a biological control agent for gorse, *Ulex europaeus* L. (Fabaceae), in Australia. Biological Control 45: 460-471.
889	Ireson, J.E., A.H. Gourlay, R.M. Kwong, R.J. Holloway, and W.S. Chatterton. 2003. Host specificity, release, and establishment of the gorse spider mite, *Tetranychus lintearius* Dufour (Acarina: Tetranychidae), for the biological control of gorse, *Ulex europaeus* L. (Fabaceae), in Australia. Biological Control 26: 117-127.

Code	Reference
890	Ireson, J.E., R.J. Holloway, W.S. Chatterton, and S.M. Leighton. 1999. An Overview of the Establishment, Distribution and Efficacy of Biological Control Agents for Ragwort, *Senecio Jacobaea* L., in Tasmania. *In* A.C. Bishop, M. Boersma, and C.D. Barnes, Eds. Proceedings of the 12th Australian Weeds Conference. 12-16 September 1999, Hobart, Tasmania, Australia; Tasmanian Weed Society. pp. 425-430.
891	Ireson, J.E. and D.A. McLaren. 2012. *Jacobaea vulgaris* Gaertn. - ragwort. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. pp. 314-323.
892	Irving, N.S. and M.O. Beshir. 1982. Introduction of some natural enemies of water hyacinth to the White Nile, Sudan. Tropical Pest Management 28: 20-26.
893	Isherwood, M.O. 1997. (personal communication) Department of Agriculture, 1428 So. King Street, Honolulu, Hawaii 96814-2512, United States of America.
894	IUCN. 2003. Management of invasives species in waterbird habitat in Lake Naivasha, Kenya. Report on the restoration of wetlands that are migratory bird habitats, and that have been damaged by invasive weeds. IUCN Eastern Africa Regional Programme, Nairobi, Kenya. 75 pp.
895	Ivanova, T.S. 1966. Experimenting with biological control for controlling Russian knapweed. Akad. Nauk.tadzhik. SSR (Otdel.biol.Nauk.) 2(23): 51-63.
896	IWC. 2012. Integrated Weed Control, Insect Price List. http://www.integratedweedcontrol.com/insects.htm. 12 September 2012.
897	Jacobs, J. and S. Sing. 2008. Ecology and management of diffuse knapweed (*Centaurea diffusa* Lam.). Invasive Species Technical Note No. MT-20. United States Department of Agriculture, Natural Resource Conservation Service. 12 pp.
898	Jacobs, J.S., S. Sing, and J.M. Martin. 2006. Influence of herbivory and competition on invasive weed fitness: observed effects of *Cyphocleonus achates* (Coleoptera: Curculionidae) and grass-seeding treatments on spotted knapweed performance. Environmental Entomology 35(6): 1590-1596.
899	Jacono, C.C., T.R. Davern, and T.D. Center. 2001. The adventive status of *Salvinia minima* and *S. molesta* in the southern United States and the related distribution of the weevil *Cyrtobagous salviniae*. Castanea 66(3): 214-226.
900	Jamieson, M.A., D. Knochel, A. Manrique, and T.R. Seasted. 2012. Top-down and bottom-up controls on Dalmatian toadflax (*Linaria dalmatica*) performance along the Colorado Front Range, USA. Plant Ecology 213: 185-195.
901	Janson, O.E. 1921. *Stenopelmus rufinasus* Gyll., an addition to the list of British Coleoptera. Entomologist's Monthly Magazine 57: 225-226.

Code	Reference
902	Jarvis, E. 1913. An insect enemy of nut grass. Queensland Agricultural Journal 31: 390-392.
903	Javaid, A., S. Shafique, and S. Shafique. 2007. Causes of rapid spread of *Parthenium hysterophorus* L. in Pakistan and possible control measures - a review. Pakistan Journal of Botany 39(7): 2611-2618.
904	Jayanth, K.P. 1987. Biological control of the water fern *Salvinia molesta* infesting a lily pond in Bangalore (India) by *Cyrtobagous salviniae*. Entomophaga 32: 163-165.
905	Jayanth, K.P. 1987. Introduction and establishment of *Zygogramma bicolorata* on *Parthenium hysterophorus* at Bangalore, India. Current Science 56: 310-311.
906	Jayanth, K.P. 1987. Suppression of water hyacinth by the exotic insect *Neochetina eichhorniae* in Bangalore, India. Current Science 56: 494-495.
907	Jayanth, K.P. 1988. Biological control of water hyacinth in India by release of the exotic weevil *Neochetina bruchi*. Current Science 17: 968-970.
908	Jayanth, K.P. 1988. Successful biological control of water hyacinth (*Eichhornia crassipes*) by *Neochetina eichhorniae* (Coleoptera: Curculionidae) in Bangalore, India. Tropical Pest Management 34: 263-266.
909	Jayanth, K.P. and P.N. Ganga Visalakshy. 1989. Establishment of the exotic mite *Orthogalumna terebrantis* Wallwork on water hyacinth in Bangalore, India. Journal of Biological Control 3: 75-76.
910	Jayanth, K.P. and P.N. Ganga Visalakshy. 1998. Current status of biological control trials against *Chromolaena odorata* in India. *In* P. Ferrar, R. Muniappan, and K.P. Jayanth, Eds. Proceedings of the 4th International Workshop on Biological Control and Management of *Chromolaena odorata*. October 1996, Bangalore, India; University of Guam. pp. 93-96.
911	Jayaweera, M.W., S.D.S. de Silva, N.P.D. Gamage, and A.P. Kasige. 2004. Potential for biological control of water hyacinth, (*Eichhornia crassipes* Mart.): the role of *Neochetina eichhorniae* and *N. bruchi*. *In* H.P.M. Gunasena and S.M.P.C. Padmini, Eds. Biological Pest Control. Proceedings of workshop on status and prospectus of biological pest control in Sri Lanka. 13 December 2004; SLCARP. pp. 72-93.
912	Jensen, K.I.N., P. Harris, and M.G. Sampson. 2002. *Hypericum perforatum* L., St John's wort (Clusiaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 361-368.
913	Jessep, C.T. 1970. St. John's Wort in New Zealand. Review, Tussock Grasslands and Mountain Lands Institute 20: 76-83.
914	Jessep, C.T. Introduction of a weevil for biological control of nodding thistle. *In* Proceedings of the 28th New Zealand Weed Pest Control Conference. 1975; New Zealand Weed and Pest Control Society Inc. pp. 205-206.

Code	Reference
915	Jessep, C.T. 1981. Progress report on biological control of nodding thistle (*Carduus nutans*) in New Zealand. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 635-637.
916	Jessep, C.T. 1989. *Carduus nutans* L., nodding thistle (Asteraceae). *In* P.J. Cameron, R.L. Hill, J. Bain, and W.P. Thomas, Eds. A review of biological control of invertebrate pests and weeds in New Zealand 1874 to 1987. CAB International, London. pp. 339-342.
917	Jessep, C.T. 1989. *Cirsium arvense* (L.) Scopoli, Californian thistle (Asteraceae). *In* P.J. Cameron, R.L. Hill, J. Bain, and W.P. Thomas, Eds. A review of biological control of invertebrate pests and weeds in New Zealand 1874 to 1987. CAB International, London. pp. 343-345.
918	Jessep, C.T. 1997. (personal communication) Department of Scientific and Industrial Research, Entomology Division, Lincoln Research Centre, Private Bag, Christchurch, New Zealand.
919	Jewsbury, N. 2001. Assessing the effectiveness of the biological control 'Mexican thorn', *Prosopis juliflora*, via the introductions of two seed feeding bruchids, on Ascension Island. Undergraduate Dissertation, Bachelor of Science. Kingston University, London, England.
920	Jianqing, D. 1997. (personal communication) Biological Control Institute, CAAS, 30 Baishiqiao Rd, Beijing, China.
921	Joder, A., J.H. Spafford, K. Batchelor, and T. Woodburn. 2002. Biology of *Stethynium* sp. nov. (Hymenoptera: Mymaridae), an egg parasitoid of *Zygina* sp. (Hemiptera: Cicadellidae). *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 412.
922	Joel, D.M. 2009. The new nomenclature of *Orobanche* and *Phelipanche*. Weed Research 49(Supplement 1): 6-7.
923	Johnson, R.L. and B. Blossey. 2002. Eurasian Watermilfoil. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 79-90.
924	Joley, D.B. 1997. (personal communication) California Department of Food and Agriculture, Biological Control Program, 1220 N Street, Sacramento, California 95814, United States of America.
925	Joley, D.B., B. Villegas, M.J. Pitcairn, H.D. Riley, and J.V. Albright. 1997. Biological control of purple loosestrife, *Lythrum salicaria*. *In* D.M. Woods, Ed. Biological Control Program 1996 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 33.

Code	Reference
926	Joley, D.B., B. Villegas, and C.E. Turner. 1995. Biological control of bull thistle, *Cirsium vulgare* (Savi) Tenore: release and colonization of *Urophora stylata* (Fabricius). *In* G. Bezark, Ed. Biological Control Program 1994 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 51.
927	Joley, D.B., B. Villegas, and C.E. Turner. 1996. Biological control of bull thistle, *Cirsium vulgare*: release and colonization of *Urophora stylata*. *In* L.G. Bezark, Ed. Biological Control Program 1995 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 27.
928	Joley, D.B. and D.M. Woods. 1997. Biological control of diffuse knapweed, *Centaurea diffusa*. *In* D.M. Woods, Ed. Biological Control Program 1996 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 35.
929	Joley, D.B., D.M. Woods, and C.E. Turner. 1996. Biological control of diffuse knapweed, *Centaurea diffusa*. *In* L.G. Bezark, Ed. Biological Control Program 1995 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 24.
930	Joseph, P.T. 1972. (personal communication) Department of Agriculture, Plant Protection, Government of the Cook Islands, Rarotonga, Cook Islands.
931	Joy, P., J. 1997. (personal communication) Kerala Agricultural University, College of Horticulture, Vellanikkara, Trichur-680 654, South India.
932	Joy, P.J., K.R. Lyla, and N.V. Satheesan. 1993. Biological control of *Chromolaena odorata* in Kerala (India). *Chromolaena odorata* Newsletter 7: 1-3.
933	Joy, P.J., N.V. Satheesan, K.R. Lyla, and D. Joseph. Successful biological control of the floating weed *Salvinia molesta* Mitchell using the weevil *Cyrtobagous salviniae* Calder and Sands in Kerala (India). *In* K. Noda and B.L. Mercado, Eds. Proceedings of the 10th Asian-Pacific Weed Science Society Conference. 24-30 November 1985, Chiang Mai, Thailand; Asian-Pacific Weed Science Society. pp. 622-626.
934	Julien, M.H. 1981. Control of aquatic *Alternanthera philoxeroides* in Australia; another success for *Agasicles hygrophila*. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 583-588.
935	Julien, M.H. 1981. A discussion of the limited establishment of *Perapion antiquum* and a review of the current status of biological control of *Emex* spp. in Australia. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 507-514.

Code	Reference
936	Julien, M.H. 2001. Biological control of water hyacinth with arthropods: a review to 2000. *In* M.H. Julien, M.P. Hill, T.D. Center, and J.Q. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Centre for International Agricultural Research. pp. 8-20.
937	Julien, M.H. 2012. *Eichhornia crassipes* (Martius) Solms-Laubach - water hyacinth. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 227-237.
938	Julien, M.H. 2012. *Salvinia molesta* D.S. Mitchell - salvinia. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 518-525.
939	Julien, M.H. 2013. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, 41 Boggo Road, Dutton Park, QLD 4102, Australia.
940	Julien, M.H., J.E. Broadbent, and N.C. Matthews. 1979. Effects of *Puccinia xanthii* on *Xanthium strumarium* (Compositae). Entomophaga 24: 29-34.
941	Julien, M.H., T.D. Center, and P.W. Tipping. 2002. Floating Fern (Salvinia). *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 17-32.
942	Julien, M.H., A.S.R. Chan, S. Schooler, and G. Traversa. 2012. *Alternanthera philoxeroides* (Martius) Grisebach - alligator weed. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 43-51.
943	Julien, M.H. and R.R. Chan. 1992. Biological control of alligator weed: unsuccessful attempts to control terrestrial growth using the flea beetle *Disonycha argentinensis* (Col.: Chrysomelidae). Entomophaga 37: 215-221.
944	Julien, M.H. and M.W. Griffiths, Eds. 1998. Biological control of weeds: a world catalogue of agents and their target weeds, Fourth edition. CABI Publishing, New York. 243 pp.
945	Julien, M.H., M.W. Griffiths, and J.N. Stanley. 2001. Biological control of water hyacinth. The moths *Niphograpta albiguttalis* and *Xubida infusellus*: biologies, host ranges, and rearing, releasing and monitoring techniques. ACIAR Monograph No. 79. Australian Centre for International Agriculture Research. 91 pp.
946	Julien, M.H., M.W. Griffiths, and A.D. Wright. 1999. Biological control of water hyacinth. The weevils *Neochetina bruchi* and *N. eichhomiae*: biologies, host ranges, and rearing, releasing and monitoring techniques for biological control of *Eichhomia crassipes*. ACIAR Monograph No. 60. Australian Centre for International Agricultural Research. 87 pp.
947	Julien, M.H. and K.L.S. Harley. 1978. The initiation of biological control of *Emex* spp. in Australia. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 141-144.
948	Julien, M.H., M.P. Hill, and P.W. Tipping. 2009. *Salvinia molesta* D.S. Mitchell Salviniaceae. *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 378-407.
949	Julien, M.H. and W. Orapa. 1999. Structure and management of a successful biological control project for water hyacinth. . *In* M. Hill, M.H. Julien, and T. Center, Eds. Proceedings of the 1st IOBC Global Working Group Meeting for the Biological and Integrated Control of Water Hyacinth 16-19 November 1998, Harare, Zimbabwe; Plant Protection Research Institute. pp. 123-134.
950	Julien, M.H. and W. Orapa. 2001. Insects used for the control of the aquatic weed, water hyacinth in Papua New Guinea. Papua New Guinea Journal of Agriculture, Forestry and Fisheries 44(1&2): 49-60.
951	Julien, M.H., J.K. Scott, W. Orapa, and Q. Paynter. 2007. History, opportunities and challenges for biological control in Australia, New Zealand and the Pacific islands. Crop Protection 26: 255-265.
952	Julien, M.H. and J. Stanley. 1999. Recent research on biological control for water hyacinth in Australia. *In* M. Hill, M.H. Julien, and T. Center, Eds. Proceedings of the 1st IOBC Global Working Group Meeting for the Biological and Integrated Control of Water Hyacinth. 16-19 November 1998, Harare, Zimbabwe; Plant Protection Research Institute. pp. 52-61.
953	Jupp, P.W. 1996. The establishment of a distribution network for the mite *Aculus hyperici* to control St John's wort (*Hypericum perforatum*) in Australia. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 451-453.
954	Jupp, P.W., D.T. Briese, and J.M. Cullen. 1997. Evidence for resistance in *Hypericum perforatum* to a biological control agent, the eriophyid mite *Aculus hyperici*. Plant Protection Quarterly 12: 67-70.
955	Jupp, P.W. and J.M. Cullen. 1996. Expected and observed effects of the mite *Aculus hyperici* on St John's wort, *Hypericum perforatum*, in Australia. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 365-370.
956	Juricek, C.J., T.L. Almquisst, and R.G. Lym. 2007. Biological control of yellow toadflax with *Mecinus janthinus* (Germar) in North Dakota. North Dakota Report. North Dakota State University. 3 pp.

Code	Reference
957	Kairo, M. 1998. (personal communication) CABI Bioscience, Caribbean and Latin American Centre, Gordon St, Curepe, Trinidad and Tobago, West Indies.
958	Kalibbala, F.N., E.T.F. Witkowski, and M.J. Byrne. 2008. Efficacy of the seed feeding bruchid beetle, *Sulcobruchus subsuturalis,* in the biological control of *Caesalpinia decapetala* in South Africa. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 636.
959	Kalischuk, A.R., R.S. Bourchier, and A.S. McClay. 2004. Post hoc assessment of an operational biocontrol program: efficacy of the flea beetle *Aphthona lacertosa* Rosenhauer (Chrysomelidae: Coleoptera), an introduced biocontrol agent for leafy spurge. Biological Control 29(3): 418-426.
960	Kamath, M.K. 1979. A review of biological control of insect pests and noxious weeds in Fiji 1969-1978. Agricultural Journal of Fiji 41: 55-72.
961	Kamath, M.K. 1982. Review of existing pest control methods using biological agents. Proceedings of Sub-regional Training Course. Ministry of Agriculture, Fisheries and Forest, Kingdom of Tonga. pp. 210-228.
962	Kami, P. 1997. (personal communication) Ministry of Agriculture, Forests and Fisheries, P.O. Box 14, Nuku'alofa, Tonga.
963	Kampeshi, C. and M. Shantima. 1999. Nutrient loading and water hyacinth infestation in the Lower Kafue River. *In* J.H. Hill, M. Julien, and T. Center, Eds. Proceedings of the 1st IOBC Global Working Group Meeting for the Biological and Integrated Control of Water Hyacinth. 16-19 November 1998, Harare, Zimbabwe; Plant Protection Research Institute. pp. 111-114.
964	Kangasniemi, B.J. 1982. Observations on herbivorous insects that feed on *Myriophyllum spicatum* in British Columbia. *In* Proceedings of the 2nd Annual Conference of the North American Lake Management Society. 26-29 October 1982, Vancouver, British Columbia, Canada. pp. 214-218.
965	Kapoor, V.C. and Y.K. Malla. 1978. The infestation of the gall fruit-fly, *Procecidochares utilis* (Stone) on crofton weed, *Eupatorium adenophorum* Sprengel in Kathmandu. Indian Journal of Entomology 40: 337-339.
966	Karam, J. and T. Paul. 2009. Biological control of two major weeds affecting crop and livestock production in East Timor. LPS/2003/028. Final Report. FR2009-23. Australian Centre for International Agricultural Research, Canberra. 39 pp.
967	Karren, J.B. 1989. *Chlamisus mimosae*, n. sp. (Coleoptera: Chrysomelidae: Chlamisinae) from Brazil and imported into Australia and Thailand. The Coleopterists Bulletin 43(4): 355-358.

Code	Reference
968	Kashefi, J., G.P. Markin, and J.L. Littlefield. 2008. Field studies of the biology of the moth *Bradyrrhoa gilveolella* (Treitschke) (Lepidoptera: Pyralidae) as a potential biocontrol agent for *Chondrilla juncea*. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 568-572.
969	Kasno, A.S.R. Putri, S. Widayanti, and Sunjaya. 2001. Establishment of *Neochetina spp*.: their pattern of local dispersal and age structure at the release site. Biotropia 17: 18-29.
970	Katjirua, J. and R. Killenga. 2000. Density dependent relationship between *Dactylopius opuntiae*, *Opuntia vulgaris* and *Cheilomenes lunata*. Abstract. Abstracts of student project reports: Kenya courses since 1995 in Plant Ecology. 9 pp.
971	Kawi, A. 2013. (personal communication) NARI-Aiyura, Highlands Regional Centre, PO Box 384, Kainantu, Eastern Highlands Province, Papua New Guinea.
972	Keeley, P.E., R.J. Thullen, and J.H. Miller. 1970. Biological control studies on yellow nutsedge with *Bactra verutana* Zeller. Weed Science 18(3): 393-395.
973	Keifer, H.H. and H.A. Denmark. 1976. *Eriophyes lantanae* Cook (Acarina: Eriophyidae) in Florida. Entomology Circular No. 166. Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 2 pp.
974	Keil, D. 2011. *C. jacea* nothosubsp. *pratensis* (W.D.J. Koch) Čelak. *In* Jepson Flora Project. Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=93858. 2 October 2012.
975	Kelly, D. and K. McCallum. 1995. Evaluating the impact of *Rhinocyllus conicus* on *Carduus nutans* in New Zealand. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 205-212.
976	Kergoat, G.J., N. Alvarez, M. Hossaert-McKey, N. Faure, and J.-F. Silvain. 2005. Parallels in the evolution of the two largest New and Old World seed-beetle genera (Coleoptera, Bruchidae). Molecular Ecology 14: 4003-4021.
977	Kermack, J. 1928. Action taken in regard to control of noxious weeds. Agricultural Journal of Fiji 1: 9-10.
978	Khan, R. and C.E. Jarvis. 1989. The correct name for the plant known as *Pluchea symphytifolia* (Miller) Gillis (Asteraceae). Taxon 38(4): 659-662.
979	Kiehr-Delhey, M. and R. Delhey. 1988. First record in Argentina of *Uromyces galegae*, a rust of *Galega officinalis*: possible biocontrol agent. Malezas 16(1): 79-80.
980	Kikodze, D. 2013. (personal communication) Institute of Botany, Ilia State University, Georgia 1 Kojori Road, 0105, Tbilisi, Georgia.

Code	Reference
981	Killgore, E. 2002. Biological control potential of *Miconia calvescens* using three fungal pathogens. *In* C.W. Smith, J. Denslow, and S. Hight, Eds. Proceedings of workshop on biological control of native ecosystems in Hawaii, Technical Report 129. Pacific Cooperative Studies Unit, University of Hawaii at Manoa, Department of Botany, Honolulu, Hawaii, USA. pp. 45-52.
982	King, A. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
983	King, A.M., R. Brudvig, and M.J. Byrne. 2011. Biological control of dense-thorned bitter apple, *Solanum sisymbriifolium* Lam. (Solanaceae), in South Africa. African Entomology 19(2): 427-433.
984	King, A.M., H.E. Williams, and L.G. Madire. 2011. Biological control of cat's claw creeper, *Macfadyena unguis-cati* (L.) A.H. Gentry (Bignoniaceae), in South Africa. African Entomology 19(2): 366-377.
985	King, G.E. 2000. Contribution to knowledge on the family *Pterophoridae* in Spain: *Lantanophaga pusillidactyla* (Walker, 1864) a new species for Spain and for Europe (*Lepidoptera: Pterophoridae*). SHILAP Revista de Lepidopterologia 28(111): 341-343.
986	King, S., T. Drlik, L. Simon, and W. Quarles. 1996. Integrated weed management of gorse. The IPM Practitioner 18: 1-9.
987	Kirk, P.M., P.F. Cannon, D.W. Minter, and J.A. Stalpers, Eds. 2008. Dictionary of the Fungi, 10th edition. CABI Publishing, U.K. 784 pp.
988	Kirschner, J. and J. Štěpánek. 2011. Typification of *Leontodon taraxacum* L. (≡ *Taraxacum officinale* F.H. Wigg.) and the generic name *Taraxacum*: a review and a new typification proposal. Taxon 60(1): 216-220.
989	Kissinger, D.G. 1966. *Cyrtobagous* Hustache, a genus of weevils new to the United States fauna (Coleoptera: Curculionidae: Bagoini). The Coleopterists Bulletin 20: 125-127.
990	Kistensamy, Y. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
991	Klein, H. 1999. Biological control of three cactaceous weeds, *Pereskia aculeata* Miller, *Harrisia martinii* (Labouret) Britton and *Cereus jamacaru* De Condolle in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 3-14.
992	Klein, H. 2011. A catalogue of the insects, mites and pathogens that have been used or rejected, or are under consideration, for the biological control of invasive alien plants in South Africa. African Entomology 19(2): 515-549.
993	Klein, H. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.

Code	Reference
994	Klein, O. and J. Kroschel. 2002. Biological control of *Orobanche* spp. with *Phytomyza orobanchia*, a review. Biocontrol 47: 245-277.
995	Kluge, R.L. 1991. Biological control of crofton weed, *Ageratina adenophora* (Asteraceae), in South Africa. Agriculture, Ecosystems & Environment 37: 187-191.
996	Kluge, R.L. 1991. Biological control of triffid weed, *Chromolaena odorata* (Asteraceae), in South Africa. Agriculture, Ecosystems & Environment 37: 193-197.
997	Kluge, R.L. 1994. Ant predation and the establishment of *Pareuchaetes pseudoinsulata* Rego Barros (Lepidoptera: Arctiidae) for biological control of triffid weed, *Chromolaena odorata* (L.) King & Robinson, in South Africa. African Entomology 2(1): 71-72.
998	Kluge, R.L. and P.M. Caldwell. 1993. Host specificity of *Pareuchaetes insulata* (Lep.: Arctiidae), a biological control agent for *Chromolaena odorata* (Compositae). Entomophaga 38(4): 451-457.
999	Kluge, R.L., M.J. Morris, and P.M. Caldwell. 1995. The biological control of *Chromolaena odorata* in South Africa: A progress report. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 473.
1000	Kluge, R.L. and S. Neser. 1991. Biological control of *Hakea sericea* (Proteaceae) in South Africa. Agriculture, Ecosystems & Environment 37: 91-113.
1001	Kluge, R.L. and M.W. Siebert. 1985. *Erytenna consputa* Pascoe (Coleoptera: Curculionidae) as the main mortality factor of developing fruits of the weed *Hakea sericea* Schrader, in South Africa. Journal of the Entomological Society of South Africa 48: 241-245.
1002	Kluge, R.L. and C. Zachariades. 2006. Assessing the damage potential of the stem-boring weevil *Lixus aemulus* for the biological control of *Chromolaena odorata*. Biocontrol 51: 547-552.
1003	Klyueva, M.P. and G.V. Pamukchi. 1978. Broomrape midge - the natural enemy of broomrape in Moldavia. Izvestiya Akademii Nauk Moldavskoi SSR, Seriya Biologicheskikh i Khimicheskikh Nauk 4: 21-25.
1004	Knochel, D.G., N.D. Monson, and T.R. Seastedt. 2010. Additive effects of aboveground and belowground herbivores on the dominance of spotted knapweed (*Centaurea stoebe*). Oecologia 164: 701-712.
1005	Knochel, D.G. and T.R. Seastedt. 2010. Reconciling contradictory findings of herbivore impacts on spotted knapweed (*Centaurea stoebe*) growth and reproduction. Ecological Applications 20(7): 1903-1912.
1006	Ko, M.P. 2012. (personal communication) Hawaii Department of Agriculture, 1428 S. King Street, Honolulu, Honolulu, Hawaii 96814 USA.
1007	Kok, L.T. 1986. Impact of *Trichosirocalus horridus* (Coleoptera: Curculionidae) on *Carduus* thistles in pastures. Crop Protection 5: 214-217.

Code	Reference
1008	Kok, L.T. 1989. Biological control of weeds in Virginia from 1969-1986. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 623-629.
1009	Kok, L.T., R.G. Abad, and A.B.A.M. Baudoin. 1996. Effects of *Puccinia carduorum* on musk thistle herbivores. Biological Control 6: 123-129.
1010	Kok, L.T. and A. Gassmann. 2002. Bull Thistle (Spear Thistle). *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 247-250.
1011	Kok, L.T. and A. Gassmann. 2002. Plumeless Thistle (Curled Thistle, Bristly Thistle). *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 255-261.
1012	Kok, L.T. and W.T. Mays. 1991. Successful biological control of plumeless thistle, *Carduus acanthoides* L. [Campanulatae: Asteraceae (=Compositae)], by *Trichosirocalus horridus* (Panzer) (Coleoptera: Curculionidae) in Virginia. Biological Control 1: 197-202.
1013	Kok, L.T. and W.W. Surles. 1975. Successful biocontrol of musk thistle by an introduced weevil, *Rhinocyllus conicus*. Environmental Entomology 4: 1025-1027.
1014	Kovalev, O.V. 1971. Phytophages of ragweeds *(Ambrosia* L.) in North America and their application in biological control in USSR. Zoologichesky Zhurnal 50: 199-209.
1015	Kovalev, O.V. 1973. Modern outlooks of biological control of weed plants in the U.S.S.R. and the international phytophagous exchange. *In* P.H. Dunn, Ed. Proceedings of the II International Symposium on Biological Control of Weeds. 4-7 October 1971, Rome, Italy; CAB. pp. 166-172.
1016	Kovalev, O.V. 1981. The introduction and acclimatization of phytophagous insect pests of ambrosia *(Ambrosia* L., Asteraceae) in the USSR. Trudy Vsesoyuznogo Entomologicheskogo Obshchestva 63: 9-11.
1017	Kovalev, O.V. 1997. (personal communication) Zoological Institute, Russian Academy of Sciences, St. Petersburg, 199034, Russia.
1018	Kovalev, O.V. and L.G. Danilov. 1973. The introduction of *Paranguina picridis* into the Crimea. Abstract. Zashcita-Rastenii 4: 43.
1019	Kovalev, O.V., S.Y. Reznik, and V.N. Cherkashin. 1983. Specific features of methods of using *Zygogramma* Chevr. (Coleoptera, Chrysomelidae) in the biological control of ragweeds (*Ambrosia artemisiifolia* L., *Ambrosia psilostachya* DC.). Entomologicheskoe Obozreniye 62: 402-408.
1020	Kovalev, O.V. and T.D. Runeva. 1970. *Tarachidia candefacta* Hubn. (Lepidoptera, Noctuidae) - an efficient phytophagous insect in the biological control of weeds of the genus *Ambrosia* L. Entomologocheskoe Obozreniye 49: 23-26.
1021	Kovalev, O.V., V.G. Shevchenko, and L.G. Danilov. 1974. The phytophagous mite *Aceria acroptiloni*, sp. n. (Acarina, Tetrapodili) - prospective agent for biological control of Russian knapweed, *Acroptilon repens* (L.) DC. Entomologicheskoe-Obozrenie 53(2): 280-290.
1022	Krauss, N.L.H. 1962. Biological control investigations on insect, snail and weed pests in tropical America 1961. Proceedings of the Hawaiian Entomological Society 18: 131-133.
1023	Krauss, N.L.H. 1962. Biological control investigations on lantana. Proceedings of the Hawaiian Entomological Society 18: 134-136.
1024	Krauss, N.L.H. 1963. Biological control investigations on christmas berry (*Schinus terebinthifolius*) and emex *(Emex* spp.). Proceedings of the Hawaiian Entomological Society 18: 281-287.
1025	Krauss, N.L.H. 1965. Investigations on biological control of *Melastoma* (*Melastoma malabathricum* L.). Proceedings of the Hawaiian Entomological Society 19: 97-101.
1026	Krauss, N.L.H. 1966. Biological control investigations on some Hawaiian weeds. Proceedings of the Hawaiian Entomological Society 19: 223-231.
1027	Kremer, R.J. 2000. Combinations of microbial and insect biocontrol agents for management of weed seeds. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 799-806.
1028	Kremer, R.J. and N.R. Spencer. 1989. Impact of a seed-feeding insect and microorganisms of velvetleaf (*Abutilon theophrasti*) seed viability. Weed Science 37(2): 211-216.
1029	Kropp, B.R., D.R. Hansen, and S.V. Thomson. 2002. Establishment and dispersal of *Puccinia thlaspeos* in field populations of dyer's woad. Plant Disease 86(3): 241-246.
1030	Kuijt, J. and E.A. Kellogg. 1996. Miscellaneous mistletoe notes, 20-36. Novon 6(1): 33-53.
1031	Kula, R.R., A.J. Boughton, and R.W. Pemberton. 2010. *Stantonia pallida* (Ashmead) (Hymenoptera: Braconidae) reared from *Neomusotima conspurcatalis* Warren (Lepidoptera: Crambidae), a classical biological control agent of *Lygodium microphyllum* (Cav.) R. Br. (Polypodiales: Lygodiaceae). Proceedings of the Entomological Society of Washington 112(1): 61-68.
1032	Kumar, P.S., R.J. Rabindra, and C.A. Ellison. 2008. Expanding classical biological control of weeds with pathogens in India: the way forward. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 165-172.
1033	Kumar, P.S., S. Ramani, and S.P. Singh. 2005. Natural suppression of the aquatic weed, *Salvinia molesta* D.S. Mitchell, by two previously unreported fungal pathogens. Journal of Aquatic Plant Management 43: 105-107.

Code	Reference
1034	Kumar, S. 1993. Biological control of problematic weeds of forests and wastelands in India. Annals of Entomology 11: 79-97.
1035	Kumashiro, B.R. 2010. (personal communication) Hawaii Department of Agriculture, 1428 S. King Street, Honolulu, Honolulu, Hawaii 96814 USA.
1036	Kuniata, L.S. 1994. Importation and establishment of *Heteropsylla spinulosa* (Homoptera: Psyllidae) for the biological control of *Mimosa invisa* in Papua New Guinea. International Journal of Pest Management 40: 64-65.
1037	Kuniata, L.S. 2009. *Mimosa diplotricha* C. Wright ex Sauvalle (Mimosaceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 247-255.
1038	Kuniata, L.S. and F. Dori. 1993. A potential biological control agent for *Mimosa invisa* in Papua New Guinea. Harvest 15: 54-55.
1039	Kuniata, L.S. and K.T. Korowi. 2004. Bugs offer sustainable control of *Mimosa invisa* and *Sida* spp. in the Markham Valley, Papua New Guinea. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 27 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 567-573.
1040	Kurugundla, C.N. 2006. Two alien invasive aquatic plants of Botswana - a short report to the Department of Water Affairs, Ministry of Minerals Energy and Water Resources. Botswana. 6 pp.
1041	Kurugundla, C.N. 2013. (personal communication) Principal Botanist, Private Bag 002, Maun, Botswana.
1042	Kurugundla, C.N., M.C. Bonyongo, and O. Serumola. 2010. Impact of deltamethrin aerial sprays on adult *Cyrtobagous salviniae* in Botswana. African Journal of Aquatic Science 35(3): 259-265.
1043	Kyalangalilwa, B., J.S. Boatwright, B.H. Daru, O. Maurin, and M. Van Der Bank. 2013. Phylogenetic position and revised classification of *Acacia* s.l. (Fabaceae: Mimosoideae) in Africa, including new combinations in *Vachellia* and *Senegalia*. Botanical Journal of the Linnean Society 172(4): 500-523.
1044	Labrada, R. 1996. Status of water hyacinth in developing countries. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 3-11.
1045	Lafontaine, J.D. and B.C. Schmidt. 2010. Annotated check list of the Noctuoidea (Insect, Lepidoptera) of North America north of Mexico. ZooKeys 40: 1-239.
1046	Lai, P.Y. and G.Y. Funasaki. 1985. Introductions for biological control in Hawaii 1981 and 1982. Proceedings of the Hawaiian Entomological Society 25: 83-86.

Code	Reference
1047	Lai, P.Y., G.Y. Funasaki, and S. Higa. 1982. Introductions for biological control in Hawaii: 1979 and 1980. Proceedings of the Hawaiian Entomological Society 24: 109-113.
1048	Lai, P.-Y., R. Muniappan, T.-H. Wang, and C.-J. Wu. 2006. Distribution of *Chromolaena odorata* and its Biological Control in Taiwan. Proceedings of the Hawaiian Entomological Society 38: 119-122.
1049	Lake, E.C., J. Hough-Goldstein, K.J. Shropshire, and V. D'Amico. 2011. Establishment and dispersal of the biological control weevil *Rhinoncomimus latipes* on mile-a-minute weed, *Persicaria perfoliata*. Biological Control 58: 294-301.
1050	Lal, S.N. 1997. (personal communication) Ministry of Agriculture, Fisheries, Forests and ALTA, Koronovia Research Station, P.O. Box 77, Nausori, Fiji.
1051	Landcare Research Ltd. 2001. Gall flies are go! What's New in Biological Control of Weeds? 18(May 2001): 1-2.
1052	Landcare Research Ltd. 2006. What's bugging the boneseed leafroller? What's New in Biological Control of Weeds? 38(November 2006): 1-8.
1053	Landcare Research Ltd. 2007. New broom agent unleashed. What's New in Biological Control of Weeds? 39(February 2007): 1.
1054	Landcare Research Ltd. 2008. Tussling with tutsan. What's New in Biological Control of Weeds? 45(August 2008): 3.
1055	Landcare Research Ltd. 2008. Two possible shots at lantana. What's New in Biological Control of Weeds? 45(August 2008): 9.
1056	Landcare Research Ltd. 2009. Can we hinder high country Hieracium? What's New in Biological Control of Weeds? 49(August 2009): 4-5.
1057	Landcare Research Ltd. 2009. Fascinating fungal findings. What's New in Biological Control of Weeds? 46(November 2009): 3-4.
1058	Landcare Research Ltd. 2009. Feasibility of tutsan biocontrol. What's New in Biological Control of Weeds? 49(August 2009): 2-3.
1059	Landcare Research Ltd. 2009. New agent update. What's New in Biological Control of Weeds? 47(February 2009): 2.
1060	Landcare Research Ltd. 2009. A new ally against broom. The Bugs' Informer, Southland Biocontrol News 2(March 2009): 1.
1061	Landcare Research Ltd. 2009. Still working after all these years. What's New in Biological Control of Weeds? 47(February 2009): 7-8.
1062	Landcare Research Ltd. 2009. Who's who in biological control of weeds? What's New in Biological Control of Weeds? 49(August 2009): 14-15.
1063	Landcare Research Ltd. 2010. More to seed-feeders than meets the eye. What's New in Biological Control of Weeds? 52(May 2010): 5-7.
1065	Landcare Research Ltd. 2011. Buddleia leaf weevil - dispersing and damaging. What's New in Biological Control of Weeds? 55(February 2011): 6-7.

Code	Reference
1066	Landcare Research Ltd. 2011. First woolly nightshade lace bug release. What's New in Biological Control of Weeds? 55(February 2011): 3.
1067	Landcare Research Ltd. 2011. Gall-formers on black wattle: uninvited but welcome. What's New in Biological Control of Weeds? 57(August 2011): 3.
1068	Landcare Research Ltd. 2011. Learning lessons for the future from the past. What's New in Biological Control of Weeds? 55(February 2011): 4-5.
1069	Landcare Research Ltd. 2011. A new pathogen to tackle blackberry. What's New in Biological Control of Weeds? 56(May 2011): 5-6.
1070	Landcare Research Ltd. 2011. What's bugging the boneseed leafroller? What's New in Biological Control of Weeds? 58(November 2011): 3.
1071	Landcare Research Ltd. 2012. Biocontrol beats herbicide for heather control. What's New in Biological Control of Weeds? 59(February 2012): 6-7.
1072	Landcare Research Ltd. 2012. Rusts to tackle one of the world's worst weeds. What's New in Biological Control of Weeds? 59(February 2012): 2-3.
1064	Landcare Research Ltd. 2013. *In* The Biological Control of Weeds Book. Landcare Research, Manaaki Whenua, http://www.landcareresearch.co.nz/research/biocons/weeds/book.asp. 21 August 2013.
1073	Landis, D.A., D.C. Sebolt, M.J. Haas, and M. Klepinger. 2003. Establishment and impact of *Galerucella calmariensis* L. (Coleoptera: Chrysomelidae) on *Lythrum salicaria* L. and associated plant communities in Michigan. Biological Control 28: 78-91.
1074	Lang, R.F., J.M. Story, and G.L. Piper. 1996. Establishment of *Larinus minutus* Gyllenhal (Coleoptera: Curculionidae) for biological control of diffuse and spotted knapweed in the western United States. Pan-Pacific Entomologist 72: 209-212.
1075	Larson, G.E., T.A. Wittig, K.F. Higgins, B. Turnipseed, and D. Gardner. 2005. Influence of biocontrol insects on Canada thistle: seed production germinability, and viability. The Prairie Naturalist 37(2): 85-100.
1076	Larsson, P. 2004. Introduced *Opuntia* spp. in southern Madagascar: problems and opportunities. Minor Field Studies No 285. Swedish University of Agricultural Sciences, SLU External Relations, Uppsala, Sweden. 25 pp.
1077	Laup, S. 1986. Biological control of water hyacinth: early observations. Harvest 12: 35-40.
1078	Laup, S. 1986. Biological control of water lettuce: early observations. Harvest 12: 41-43.
1079	Le Bourgeois, T. 2013. (personal communication) Cirad, UMR AMAP, TA A51/PS2, Boulevard de la Lironde, F34398 Montpellier Cedex 5, France.
1080	Le Bourgeois, T., S. Baret, and R. Desmier De Chenon. 2013. Biological control of *Rubus alceifolius* (Rosaceae) in La Réunion Island (Indian Ocean): from investigations on the plant to the release of the biocontrol agent *Cibdela janthina* (Argidae). *In* Y. Wu, T. Johnson, S. Sing, S. Raghu, G. Wheeler, P. Pratt, K. Warner, T. Center, J. Goolsby, and R. Reardon, Eds. Proceedings of the XIII International Symposium on Biological Control of Weeds. 11-16 September 2011, Kohala Coast, Hawaii, USA; Forest Health Technology Enterprise Team, Morgantown, WV, USA. pp. 153-160.
1081	Le Bourgeois, T., V. Blanfort, S. Baret, C. Lavergne, Y. Soubeyran, and J.Y. Meyer. 2008. Opportunities for classical biological control of weeds in European overseas territories. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 476-483.
1082	Lee, G.A. 1986. Integrated control of rush skeletonweed (*Chondrilla juncea*) in the Western U.S. Weed Science 34(Supplement 1): 2-6.
1605	Lee, S., R.W. Hodges, and R.L. Brown. 2009. Checklist of Gelechiidae (Lepidoptera) in America North of Mexico. Zootaxa 2231: 1-39.
1083	Leen, R. and G. Markin. 1996. Identity, release and establishment of *Caloptilia* nr. *schinella* (Walsingham) (Gracillariidae) on the island of Hawaii for control of *Myrica faya* Aiton (Myricaceae). Journal of the Lepidopterists' Society 50: 348-351.
1084	Leiss, K.A. 2011. Management practices for control of ragwort species. Phytochemistry Reviews 10: 153-163.
1085	Lekic, M. 1970. The role of the Dipteron *Phytomyza orobanchia* Kalt.(Agromyzidae) in reducing parasitic phanerogam populations of the *Orobanche* genus in Vojvodina. Savremena Poljoprivreda 18: 627-637.
1086	Lennox, C.L., M.J. Morris, and A.R. Wood. 2000. Stumpout - commercial production of a fungal inoculant to prevent regrowth of cut wattle stumps in South Africa. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 140.
1087	Leroux, A.M. and N.J. Holliday. 2010. Parasitism of the biological control agent *Hyles euphorbiae* (Lepidoptera: Sphingidae) by *Winthemia datanae* (Diptera: Tachinidae): a new host record. Proceedings of the Entomological Society of Manitoba 66: 17-21.
1088	LeSage, L. 1988. Notes on European *Longitarsus* species introduced in North America (Coleoptera: Chrysomelidae: Alticinae). The Canadian Entomologist 120: 1133-1145.
1089	LeSage, L. 1991. Family Chrysomelidae: leaf beetles. *In* Y. Bousquet, Ed. Checklist of beetles of Canada and Alaska. Argriculture Canada, Research Branch, Ottawa. pp. 301-323.

Code	Reference
1090	Lesica, P. and D. Hanna. 2009. Effect of biological control on leafy spurge (*Euphorbia esula*) and diversity of associated grasslands over 14 years. Invasive Plant Science and Management 2: 151-157.
1091	Leuenberger, B.E. 1993. Interpretation and typification of *Cactus opuntia* L., *Opuntia vulgaris* Mill., and *O. humifusa* (Rafin.) Rafin. (Cactaceae). Taxon 42(2): 419-429.
1092	Leuenberger, B.E. 2000. *Harrisia regelii* (Weingart) Borg and the discovery of its Argentinian origin. Haseltonia 7: 86-91.
1093	Lever, R.J.A.W. 1938. Economic insects in some western Pacific Islands. Agricultural Journal of Fiji 4: 11-12.
1094	Lewis, P.A., C.J. DeLoach, A.E. Knutson, J.L. Tracy, and T.O. Robbins. 2003. Biology of *Diorhabda elongata deserticola* (Coleoptera: Chrysomelidae), an Asian leaf beetle for biological control of saltcedars (*Tamarix* spp.) in the United States. Biological Control 27: 101-116.
1095	Li, H., Y. Li, and R. Wang. 1994. Biological control of alligatorweed, *Alternanthera philoxeroides*, in central China by inoculative releases of *Agasicles hygrophila* (Col.: Chrysomelidae) with artificial overwintering protection. Chinese Journal of Biological Control 10: 11-14.
1096	Liau, S.S., C.L. Tan, P.A.C. Ooi, G.F. Chung, S.A. Lee, and B.L. Tay. 1994. Field releases of *Liothrips mikaniae* (Priesner) for the control of *Mikania micrantha* HBK - Experience in Malaysia. *In* A. Rajan and Y.B. Ibrahim, Eds. Proceedings of the 4th International Conference on Plant Protection in the Tropics. 28-31 March 1994, Kuala Lumpur, Malaysia; Malaysian Plant Protection Society. pp. 116-119.
1097	Lindgren, C.J., J. Corrigan, and R.A. De Clerck-Floate. 2002. *Lythrum salicaria* L., purple loosestrife (Lythraceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 383-390.
1098	Linke, K.H., J. Sauerborn, and M.C. Saxena. 1995. Options for biological control of the parasitic weed *Orobanche*. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 633-640.
1099	Linsley, E.G. and J.A. Chemasak. 1984. The Cerambycidae of North America Part VII, No. 1: Taxonomy and Classification of the Subfamily Lamiinae, Tribes Parmenini through Acanthoderini. University of California Press, Berkeley and Los Angeles. 258 pp.
1100	Little Jr., E.L. and R.G. Skolmen. 1989. Common Forest Trees of Hawaii (Native and Introduced). Agriculture Handbook No. 679. USDA Forest Service, Washington, D.C. 321 pp.
1101	Littlefield, J. 2004. Russian knapweed, *Acroptilon repens*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 201-203.
1102	Littlefield, J. 2012. Biological control of Russian knapweed and other weeds invasive to lands managed by the BLM. BLM Assistance Agreement L10AC20127. Interim Report 2011. Montana State University. 5 pp.
1103	Littlefield, J. 2013. (personal communication) Montana State University, Department of Land Resources & Environmental Sciences, PO Box 173120 Bozeman, MT 59717-3120 USA.
1104	Littlefield, J. and P. Tipping. 2004. Bindweeds. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 150-157.
1105	Littlefield, J.L. 1997. (personal communication) Dept. Land Resources & Environmental Sciences Montana State University PO Box 173120 Bozeman, Montana 59717-3120, USA.
1106	Lloyd, C.J., R.A. Hufbauer, A. Jackson, S.J. Nissen, and A.P. Norton. 2005. Pre- and post-introduction patterns in neutral genetic diversity in the leafy spurge gall midge, *Spurgia capitigena* (Bremi) (Diptera: Cecidomyiidae). Biological Control 33(2): 153-164.
1107	Lloyd, S. 2005. Paterson's curse. Western Australia Department of Agriculture. Farmnot 33: 1-2.
1108	Löbl, I. and A. Smetana, Eds. 2010. Catalogue of Palearctic Coleoptera. Vol. 6. Apollo Books, Stenstrup, Denmark. 426 pp.
1109	Locke, J.M. 2012. Eastern Persimmon: Identification and Management in Pastures and Rangeland. NF-SO-12-03. The Samuel Roberts Nobel Foundation. 3 pp.
1110	Lockett, C.J., K. Dhileepan, M. Robinson, and K.J. Pukallus. 2012. Impact of a biological control agent, *Chiasmia assimilis*, on prickly acacia (*Acacia nilotica* ssp. *indica*) seedlings. Biological Control 62: 183-188.
1111	Lockett, C.J. and W.A. Palmer. 2003. Rearing and release of *Homichloda barkeri* (Jacoby) (Coleoptera: Chrysomelidae: Alticinae) for the biological control of prickly acacia, *Acacia nilotica* ssp. *indica* (Mimosaceae) in Australia. Australian Journal of Entomology 42: 287-293.
1112	Loflin, B. and S. Loflin. 2009. Texas Cacti, First edition. Texas A&M University Press, College Station, Texas. 291 pp.
1113	Logarzo, G. and M.B. Aguirre. 2012. *Harrisia* cactus mealybug. *In* South American Biological Control Laboratory Annual Report 2012. United States Department of Agriculture, Agriculture Research Service, Hurlingham, Argentina. pp. 78-80.
1114	Lonsdale, W.M., G. Farrel, and C.G. Wilson. 1995. Biological control of a tropical weed: a population model and experiment for *Sida acuta*. Journal of Applied Ecology 32: 391-399.
1115	Lonsdale, W.M. and G.S. Farrell. 1998. Testing the effects on *Mimosa pigra* of a biological control agent *Neurostrota gunniella* (Lepidoptera: Gracillariidae), plant competition and fungi under field conditions. Biocontrol Science and Technology 8: 485-500.

Code	Reference
1116	Louda, S.M. and C.W. O'Brien. 2002. Unexpected ecological effects of distributing the exotic weevil, *Larinus planus* (F.), for the biological control of Canada thistle. Conservation Biology 16: 717-727.
1117	Löyttyniemi, K. 1982. Evaluation of the use of insects for biological control of *Lantana camara* L. (Verbenaceae) in Zambia. Tropical Pest Management 28(1): 14-19.
1118	Lu, G.-Z., H. Yang, X.-D. Sun, R.-X. Yang, and Z.-H. Zhao. 2004. *Puccinia xanthii* f. sp. *ambroisae-trifidae* a newly recorded rust taxon on *Ambrosia* in China. Mycosystema 23(2): 310-311.
1119	Lu, J., L. Zhao, R. Ma, P. Zhang, R. Fan, and J. Zhang. 2010. Performance of the biological control agent flea beetle *Agasicles hyrophila* (Coleoptera: Chrysomelidae), on two plant species *Alternanthera philoxeroides* (alligatorweed) and *A. sessilis* (joyweed). Biological Control 54: 9-13.
1120	Lubbe, C.M., S. Denman, P.F. Cannon, J.Z.E. Groenewald, S.C. Lamprecht, and P.W. Crous. 2004. Characterization of *Colletotrichum* species associated with diseases of Proteaceae. Mycologia 96(6): 1268-1279.
1121	Lukitsch, B. and A. Wilson. 1999. Distribution and impact of the mature seed feeding bruchid, *Penthobruchus germaini* on *Parkinsonia aculeata* in northern Australia. *In* A.C. Bishop, M. Boersma, and C.D. Barnes, Eds. Proceedings of the 12th Australian Weeds Conference. 12-16 September 1999, Hobart, Tasmania, Australia; Tasmanian Weeds Society. pp. 436-440.
1122	Lym, R.G. and R.B. Carlson. 2002. Effect of leafy spurge (*Euphorbia esula*) Genotype on feeding damage and reproduction of *Aphthona* spp.: implications for biological weed control. Biological Control 23: 127-133.
1123	Ma, J., F.H. Wan, J.Y. Guo, and X.N. Hu. 2008. Biological control of *Ambrosia artemisiifolia* and *A. trifida* (Asteraceae). *In* F.H. Wan, B.P. Li, and J.Y. Guo, Eds. Biological Invasions: Biological Control Theory and Practice. Science Press, Beijing. pp. 157-185.
1124	Mabuda, K. 2005. *Eutreta xanthochaeta* (Diptera: Tephritidae) is unsuitable for biocontrol of *Lantana camara* in Africa. Biocontrol Science and Technology 15(6): 635-639.
1125	Macanawai, A. 2013. (personal communication) Tropical Weed Research Unit, Plant Protection Section, Department of Agriculture, Koronivia Research Station, P.O Box 77, Nausori, Fiji.
1126	Macfarlane, B. 1980. (personal communication) Ministry of Agriculture and Lands, P.O. Box G11, Honiara, Solomon Islands.
1127	MacKinnon, D.K., R.A. Hufbauer, and A.P. Norton. 2005. Host-plant preference of *Brachypterolus pulicarius*, an inadvertently introduced biological control insect of toadflaxes. Entomologia Experimentalis et Applicata 116: 183-189.
1128	Maddox, D.M. 1976. History of weevils on puncturevine in and near the United States. Weed Science 24: 414-419.
1129	Maddox, D.M. and L.A. Andres. 1979. Status of puncturevine weevils and their host plant in California. California Agriculture 22(6): 7-9.
1130	Maddox, D.M., R. Sobhian, D.B. Joley, A. Mayfield, and D. Supkoff. 1986. New biological control for yellow starthistle. California Agriculture 40(11): 4-6.
1131	Madire, L.G., A.R. Wood, H.E. Williams, and S. Neser. 2011. Potential agents for the biological control of *Tecoma stans* (L.) Juss. ex Kunth var. *stans* (Bignoniaceae) in South Africa. African Entomology 19(2): 434-442.
1132	Magagula, C.N. 2010. Determination of *Lantana camara* L. (Verbenaceae) varieties and evaluation of its biological control agents in selected areas of Swaziland. Journal of Entomological Research 34(2): 103-109.
1133	Mahaffee, W., K. Johnson, T. Neil, and C. Finn. 2008. The distribution and epidemiology of *Phragmidium violaceum* (black-berry rust) in the western United States. Phytopathology 98(6 Supplement): S96.
1134	Mahmood, R. 2013. (personal communication) CABI, Opposite 1-A, Data Gunj Baksh Road, Satellite Town, P.O. Box 8, Rawalpindi, Pakistan.
1135	Mahr, F.A., R.M. Kwong, D.A. McLaren, and P.W. Jupp. 1997. Redistribution and present status of the mite *Aculus hyperici* for the control of St John's wort, *Hypericum perforatum*, in Australia. Plant Protection Quarterly 12: 84-88.
1136	Mailu, A.M. 2001. Preliminary assessment of the social, economic and environmental impacts of water hyacinth in the Lake Victoria Basin and status of control. *In* M.H. Julien, M.P. Hill, T.D. Center, and J. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 130-139.
1137	Majka, C.G. 2006. Nitidulidae and Kateretidae (Coleoptera: Cucujoidea) of the Maritime provinces of Canada. I. New records from Nova Scotia and Prince Edward Island. The Canadian Entomologist 138: 314-332.
1138	Majka, C.G., R.S. Anderson, and E. Georgeson. 2007. Introduced Apionidae and Brentidae (Coleoptera: Curculionidae) in the maritime provinces of Canada. Proceedings of the Entomological Society of Washington 109(1): 66-74.
1139	Majka, C.G., R.S. Anderson, and D.B. McCorquodale. 2007. The weevils (Coleoptera: Curculionoidea) of the Maritime Provinces of Canada, II: New records from Nova Scotia and Prince Edward Island and regional zoogeography. The Canadian Entomologist 139: 397-442.
1140	Majka, C.G. and L. LeSage. 2006. Introduced leaf beetles of the Maritime Provinces, 1: *Sphaeroderma testaceum* (F.) (Coleoptera: Chrysomelidae). Proceedings of the Entomological Society of Washington 108(1): 243-247.

Code	Reference
1141	Mallya, G., P.I. Mjema, and J. Ndunguru. 2001. Water hyacinth control through integrated weed management strategies in Tanzania. *In* M.H. Julien, M.P. Hill, T.D. Center, and J. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 120-122.
1142	Mann, K.D. 2013. (personal communication) United States Department of Agriculture, Agricultural Research Service, Northern Plains Agricultural Research Laboratory, 1500 North Central Avenue, Sidney, MT 59270, USA.
1143	Manners, A.G., W.A. Palmer, A. Burgos, J. McCarthy, and G.H. Walter. 2011. Relative host plant species use by the lantana biological control agent *Aconophora compressa* (Membracidae) across its native and introduced ranges. Biological Control 58: 262-270.
1144	Manson, D.C.M. 1989. New species and records of eriophyid mites from New Zealand. New Zealand Journal of Zoology 16(1): 37-49.
1145	Markin, G.P. 2001. Notes on the biology and release of *Caloptilia sp. nr. schinella* (Walsingham) (Lepidoptera: Gracillariidae), a biological control moth for the control of the weed firetree (*Myrica faya* Aiton) in Hawaii. Proceedings of the Hawaiian Entomological Society 35: 67-76.
1146	Markin, G.P. 2009. *Passiflora mollissima* (HBK) Bailey (Passifloraceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 319-331.
1147	Markin, G.P. and R.M. Burkhart. 1995. *Clidemia* (Koster's Curse). *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 306-308.
1148	Markin, G.P., P. Conant, E. Killgore, and E. Yoshioka. 2002. Biological control of gorse in Hawai'i: a program review. *In* C.W. Smith, J. Denslow, and S. Hight, Eds. Proceedings of workshop on biological control of native ecosystems in Hawaii, Technical Report 129. Pacific Cooperative Studies Unit, University of Hawaii at Manoa, Department of Botany, Honolulu, Hawaii, USA. pp. 122.
1149	Markin, G.P., P.-Y. Lai, and G.Y. Funasaki. 1992. Status of biological control of weeds in Hawai'i and implications for managing native ecosystems. *In* C.P. Stone, C.W. Smith, and J.T. Tunison, Eds. Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. University of Hawaii Press, Honolulu, Hawaii. pp. 460-482.
1150	Markin, G.P. and R.F. Nagata. 1995. Failure in Hawaii of the sawfly, *Priophorus morio* (Hymenoptera: Tenthredinidae), a biological control agent for *Rubus argutus*, due to a virus. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 309-312.
1151	Markin, G.P. and R.F. Nagata. 2000. Host suitability studies of the moth, *Pyrausta perelegans* Hampson (Lepidoptera: Pyralidae), as a control agent of the forest weed banana poka, *Passiflora mollissima* (HBK) Bailey, in Hawaii. Proceedings of the Hawaiian Entomological Society 34: 149-159.
1152	Markin, G.P., R.F. Nagata, and G. Taniguchi. 1989. Biology and behavior of the South American moth, *Cyanotricha necyria* (Felder and Rogenhofer) (Lepidoptera: Notodontidae), a potential biocontrol agent in Hawaii of the forest weed, *Passiflora mollissima* (HBK) Bailey. Proceedings of the Hawaiian Entomological Society 29: 115-123.
1153	Markin, G.P. and R.W. Pemberton. 1995. Banana Poka. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 309-311.
1154	Markin, G.P. and E.R. Yoshioka. 1989. Present status of biological control of the weed gorse (*Ulex europaeus* L.) in Hawaii. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 357-362.
1155	Markin, G.P. and E.R. Yoshioka. 1998. Introduction and establishment of the biological control agent *Apion ulicis* (Forster) (Coleoptera: Apionidae) for control of the weed gorse (*Ulex europaeus* L.) in Hawai'i. Proceedings of the Hawaiian Entomological Society 33: 35-42.
1156	Markin, G.P., E.R. Yoshioka, and R.E. Brown. 1995. Gorse. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California, USA. pp. 299-302.
1157	Markin, G.P., E.R. Yoshioka, and P. Conant. 1996. Biological control of gorse in Hawaii. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 371-375.
1158	Marks, G.C., I.G. Pascoe, and E. Bruzzese. 1984. First record of *Phragmidium violaceum* on blackberry in Victoria. Australasian Plant Pathology 13: 12-13.
1159	Marlin, D. 2010. The role of the mite *Orthogalumna terebrantis* in the biological control programme for water hyacinth, *Eichhornia crassipes*, in South Africa. Thesis, Doctor of Philosophy. Rhodes University, Grahamstown, South Africa. 240 pp.
1160	Marshall, B.E. and F.J.R. Junor. 1981. The decline of *Salvinia molesta* on Lake Kariba. Hydrobiologia 83: 477-484.

Code	Reference
1161	Martínez Jiménez, M. 1997. (personal communication) Instituto Mexicano de Technologia del Agua, Subcoordinacion Impacto Ambiental, Paseo Cuaunhuac 8532 Progreso, Jiutepec Mor. Mexico.
1162	Martínez Jiménez, M. and R. Charudattan. 1998. Survey and evaluation of Mexican native fungi for potential biocontrol of waterhyacinth. Journal of Aquatic Plant Management 36: 145-148.
1163	Martínez Jiménez, M. and M.A. Gómez Balandra. 2007. Integrated control of *Eichhornia crassipes* by using insects and plant pathogens in Mexico. Crop Protection 26(8): 1234-1238.
1164	Martínez Jiménez, M., E. Gutiérrez López, R. Huerto Delgadillo, and E. Ruíz Franco. 2001. Importation, rearing, release and establishment of *Neochetina bruchi* (Coleoptera Curculionidae) for the biological control of waterhyacinth in México. Journal of Aquatic Plant Management 39: 140-143.
1165	Mathenge, C.W., P. Holford, J.H. Hoffmann, R. Spooner-Hart, G.A.C. Beattie, and H.G. Zimmermann. 2009. The biology of *Dactylopius tomentosus* (Hemiptera: Dactylopiidae). Bulletin of Entomological Research 99: 551-559.
1166	Mathenge, C.W., P. Holford, J.H. Hoffmann, H.G. Zimmermann, R. Spooner-Hart, and G.A.C. Beattie. 2009. Distinguishing suitable biotypes of *Dactylopius tomentosus* (Hemiptera: Dactylopiidae) for biological control of *Cylindropuntia fulgida* var. *fulgida* (Caryophyllales: Cactaceae) in South Africa. Bulletin of Entomological Research 99: 619-627.
1167	Mathenge, C.W., P. Holford, J.H. Hoffmann, H.G. Zimmermann, R.N. Spooner-Hart, and G.A.C. Beattie. 2010. Hybridization between *Dactylopius tomentosus* (Hemiptera: Dactylopiidae) biotypes and its effects on host specificity. Bulletin of Entomological Research 100: 331-338.
1168	Matov, A.Y. 2011. (personal communication) Zoological Institute of Russian Academy of Science, St. Petersburg, Russia, 199034, ZI-SP.
1169	Matsunaga, J.N. 2013. (personal communication) Hawaii Department of Agriculture, Plant Pest Control Branch, 1428 S. King Street, Honolulu, Hawaii 96814 USA.
1170	Mau, R. 1977. *Oidaematophorus* sp. Proceedings of the Hawaiian Entomological Society 22(3): 411.
1171	Mauritius Sugar Industry Research Institute. 2003. Biological control of nutgrass (*Cypertus rotundus*). Mauritius Sugar Industry Research Institute, Annual Report 2003.
1172	Mauritius Sugar Industry Research Institute. 2004. Biological control of nutgrass (*Cypertus rotundus*). Mauritius Sugar Industry Research Institute, Annual Report 2004.
1173	Maw, M.G. 1984. *Convolvulus arvensis* L., field bindweed (Convolvulaceae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 155-157.

Code	Reference
1174	May, B.M. and D.P.A. Sands. 1986. Descriptions of larvae and biology of *Cyrtobagous* (Coleoptera: Curculionidae): agents for the biological control of salvinia. Proceedings of the Entomological Society of Washington 88: 303-312.
1175	Mays, W.T. and L.T. Kok. 1996. Establishment and dispersal of *Urophora affinis* (Diptera: Tephritidae) and *Metzneria paucipunctella* (Lepidoptera: Gelechiidae) in southwestern Virginia. Biological Control 6: 299-305.
1176	Mazzeo, G., P. Suma, and A. Russo. Scale insects on succulent plants in Southern Italy. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 480-481.
1177	Mbati, G. and P. Neuenschwander. 2005. Biological control of three floating water weeds, *Eichhornia crassipes*, *Pistia, stratiotes*, and *Salvinia molesta* in the Republic of Congo. Biocontrol 50: 635-645.
1178	McArthur, K. and I. Faithfull. 1999. English broom suppression with the broom psyllid. Note LC0157. Department of Primary Industries, Victoria. 3 pp.
1179	McCaffrey, J.P., C.L. Campbell, and L.A. Andres. 1995. St. Johnswort. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 281-285.
1180	McClay, A.S. 1989. The potential of *Larinus planus* (Coleoptera: Curculionidae), an accidentally introduced insect in North America, for biological control of *Cirsium arvense* (Compositae). *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 173-179.
1181	McClay, A.S. 1992. Effects of *Brachypterolus pulicarius* (L.) (Coleoptera: Nitidulidae) on flowering and seed production of common toadflax. The Canadian Entomologist 124: 631-636.
1182	McClay, A.S. 2002. Canada Thistle. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 217-228.
1183	McClay, A.S. 2005. Field evaluation of a gall mite for biological control of false cleavers. Final Report. Canola Agronomic Research Program Project #AG-2002-20. McClay Ecoscience, Sherwood Park, Alberta, Canada. 30 pp.
1184	McClay, A.S. 2013. *Galium spurium* L., false cleavers, and *G. aparine* L., cleavers (Rubiaceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 49. CABI Publishing Wallingford, U.K. pp. 329-332.

Code	Reference
1185	McClay, A.S. 2013. (personal communication) McClay Ecoscience, 15 Greenbriar Crescent, Sherwood Park, Alberta, Canada T8H 1H8.
1186	McClay, A.S., R.S. Bourchier, R.A. Butts, and D.P. Peschken. 2002. *Cirsium arvense* (L.) Scopoli, Canada thistle (Asteraceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 318-330.
1187	McClay, A.S., D.E. Cole, P. Harris, and C.J. Richardson. 1995. Biological control of leafy spurge in Alberta: progress and prospects. AECV95-R2. Alberta Environmental Centre, Vegreville, Alberta, Canada. 63 pp.
1188	McClay, A.S. and R. De Clerck-Floate. 1999. Establishment and early effects of *Omphalapion hookeri* (Kirby) (Coleoptera: Apionidae) as a biological control agent for scentless chamomile, *Matricaria perforata* Mérat (Asteraceae). Biological Control 14(2): 85-95.
1189	McClay, A.S. and R.A. De Clerck-Floate. 2002. *Convolvulus arvensis* L., field bindweed (Convolvulaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CABI Publishing, Wallingford, U.K. pp. 331-337.
1190	McClay, A.S. and R.A. De Clerck-Floate. 2002. *Linaria vulgaris* Miller, yellow toadflax (Scrophulariaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 375-382.
1191	McClay, A.S. and R.A. De Clerck-Floate. 2013. *Convolvulus arvensis* L., field bindweed (Convolvulaceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 45. CABI Publishing Wallingford, U.K. pp. 307-309.
1192	McClay, A.S. and R.B. Hughes. 1995. Effects of temperature on developmental rate, distribution, and establishment of *Calophasia lunula* (Lepidoptera: Noctuidae), a biocontrol agent for Toadflax *(Linaria* spp.). Biological Control 5: 368-377.
1193	McClay, A.S. and R.B. Hughes. 2007. Temperature and host-plant effects on development and population growth of *Mecinus janthinus* (Coleoptera: Curculionidae), a biological control agent for invasive *Linaria* spp. Biological Control 40: 405-410.
1194	McClay, A.S., R.E. McFadyen, and J.D. Bradley. 1990. Biology of *Bucculatrix parthenica* Bradley sp. n. (Lepidoptera: Bucculatricidae) and its establishment in Australia as a biological control agent for *Parthenium hysterophorus* (Asteraceae). Bulletin of Entomological Research 80: 427-432.
1195	McClay, A.S., G. Peng, K.L. Bailey, R.K. Hynes, and H.L. Hinz. 2013. *Tripleurospermum inodorum* (L.) Sch. Bip., scentless chamomile (Asteraceae). *In* P.G. Mason and D. Gillespie, Eds. Biological Control Programmes in Canada 2001-2012. Chapter 59. CABI Publishing Wallingford, U.K. pp. 391-401.

Code	Reference
1196	McClay, A.S. and D.P. Peschken. 2002. *Sonchus arvensis* L., perennial sow-thistle (Asteraceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 416-424.
1197	McClay, A.S., R. Sobhian, and W. Zhang. 2002. *Galium spurium* L., false cleavers (Rubiaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CABI Publishing, Wallingford, U.K. pp. 358-361.
1198	McConnachie, A.J. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag 6006, Hilton 3245 South Africa.
1199	McConnachie, A.J., M.P. Hill, and M.J. Byrne. 2004. Field assessment of a frond-feeding weevil, a successful biological control agent of red water fern, *Azolla filiculoides*, in southern Africa. Biological Control 29: 326-331.
1200	McConnachie, A.J., E. Retief, L. Henderson, and F. McKay. 2011. The initiation of a biological control programme against pompom weed, *Campuloclinium macrocephalum* (Less.) DC. (Asteraceae), in South Africa. African Entomology 19(2): 258-268.
1201	McDermott, G.J., R.M. Nowierski, and J.M. Story. 1990. First report of establishment of *Calophasia lunula* Hufn. (Lepidoptera: Noctuidae) on Dalmatian toadflax, *Linaria genistifolia* ssp. *dalmatica* (L.) Maire and Petitmengin, in North America. The Canadian Entomologist 122: 767-768.
1202	McEvoy, P.B., C. Cox, and E. Coombs. 1991. Successful biological control of ragwort, *Senecio jacobaea*, by introduced insects in Oregon. Ecological Applications 1: 430-442.
1203	McFadyen, P.J. 1978. A review of the biocontrol of groundsel-bush (*Baccharis halimifolia* L.) in Queensland. *In* W.T. Parsons, F.C. Eady, and R.G. Richardson, Eds. Proceedings of the 1st Conference of the Council of Australian Weed Science Societies. 12-14 April 1978, Parkville, Victoria, Australia; Council of Australian Weed Science Societies. pp. 123-125.
1204	McFadyen, P.J. 1983. Host specificity and biology of *Megacyllene mellyi* (Coleoptera: Cerambycidae) introduced into Australia for the biological control of *Baccharis halimifolia* (Compositae). Entomophaga 28: 65-72.
1205	McFadyen, P.J. 1985. Introduction of the gall fly, *Rhopalomyia californica* from the U.S.A. into Australia for the control of the weed *Baccharis halimifolia*. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 779-796.
1206	McFadyen, P.J. 1986. (personal communication) Department of Lands, Alan Fletcher Research Station, Sherwood, Queensland 4075, Australia.
1207	McFadyen, P.J. 1987. Host specificity and biology of *Lioplacis elliptica* [Col.: Chrysomelidae] introduced into Australia for the biological control of *Baccharis halimifolia* [Compositae]. Entomophaga 32(1): 19-21.

Code	Reference
1208	McFadyen, P.J. 1987. Host-specificity and biology of *Metallactus patagonicus* (Col.: Chrysomelidae) introduced into Australia for the biological control of *Baccharis halimifolia* (Compositae). Entomophaga 32(4): 329-331.
1209	McFadyen, R.C. 1992. Biological control against parthenium weed in Australia. Crop Protection 11: 400-407.
1210	McFadyen, R.C. 1998. The ACIAR project for the biological control of *Chromolaena odorata*: future developments. *In* P. Ferrar, R. Muniappan, and K.P. Jayanth, Eds. Proceedings of the 4th International Workshop on Biological Control and Management of *Chromolaena odorata*. October 1996, Bangalore, India; University of Guam. pp. 115-118.
1211	McFadyen, R.C. 1997. Parasitoids of the arctiid moth *Pareuchaetes pseudoinsulata* (Lep.: Arctiidae), an introduced biocontrol agent against the weed *Chromolaena odorata* (Asteraceae) in Asia and Africa. Entomophaga 42: 467-470.
1212	McFadyen, R.C. 1998 Biological control of weeds. Annual Review of Entomology 43: 369-393.
1213	McFadyen, R.C. 2003. Chromolaena in Southeast Asia and Pacific. *In* H. da Costa, C. Piggin, C.J. da Cruz, and J.J. Fox, Eds. New Directions for a New Nation - East Timor (Timor-Leste). 1–3 October 2002, Dili, East Timor; Australian Centre for International Agricultural Research. pp. 129-133.
1214	McFadyen, R.E. 1980. A *Cactoblastis* (Lep.: Phycitidae) for the biological control of *Eriocereus martinii* (Cactaceae) in Australia. Entomophaga 25: 37-42.
1215	McFadyen, R.E. 1985. The biological control programme against *Parthenium hysterophorus* in Queensland. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 789-796.
1216	McFadyen, R.E., Cruttwell. 2013. (personal communication) PO Box 88, Mt Ommaney Qld 4074 Australia.
1217	McFadyen, R.E. and A.P. Fidalgo. 1976. Investigations on *Alcidion cereicola* (Col.: Cerambycidae) a potential agent for the biological control of *Eriocereus martinii* (Cactaceae) in Australia. Entomophaga 21: 103-110.
1218	McFadyen, R.E. and J.J. Marohasy. 1990. A leaf feeding moth, *Euclasta whalleyi* (Lep.: Pyralidae), for the biological control of *Cryptostegia grandiflora* (Asclepiadaceae) in Queensland, Australia. Entomophaga 35: 431-435.
1219	McFadyen, R.E. and A.S. McClay. 1981. Two new insects for the biological control of parthenium in Queensland. *In* B.J. Wilson and J.T. Swarbrick, Eds. Proceedings of the 6th Australian Weeds Conference. 13-18 September 1981, Gold Coast, Queensland, Australia; Queensland Weed Science Society. pp. 145-149.
1220	McFadyen, R.E. and A.J. Tomley. 1981. The successful biological control of Harrisia cactus (*Eriocereus martinii*) in Queensland. *In* B.J. Wilson and J.T. Swarbrick, Eds. Proceedings of the 6th Australian Weeds Conference. 13-18 September 1981, Gold Coast, Queensland, Australia; Queensland Weed Science Society. pp. 139-144.
1221	McFadyen, R.E.C. 1995. The Accidental Introduction of the *Chromolaena* Mite, *Acalitus adoratus*, Into South-East Asia. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/ CSIRO. pp. 649-652.
1222	McFadyen, R.E.C. 2000. Biology and host specificity of the stem galling weevil *Conotrachelus albocinereus* Fiedler (Col.: Curculionidae), a biocontrol agent for parthenium weed *Parthenium hysterophorus* L. (Asteraceae) in Queensland, Australia. Biocontrol Science and Technology 10: 195-200.
1223	McFadyen, R.E.C. 2012. *Ageratina adenophora* (Spreng.) King & Robinson - crofton weed. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 29-32.
1224	McFadyen, R.E.C. 2012. *Harrisia* (*Eriocereus*) *martinii* - Harrisia cactus and *Acanthocereus tetragonus* - sword pear. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 274-281.
1225	McFadyen, R.E.C. 2012. *Mimosa diplotricha* C. Wright ex Sauvalle - giant sensitive plant. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 373-377.
1226	McFadyen, R.E.C., R.D. de Chenon, and A. Sipayung. 2003. Biology and host specificity of the chromolaena stem gall fly *Cecidochares connexa* (Macquart) (Diptera: Tephritidae). Australian Journal of Entomology 42: 294-297.
1227	McFadyen, R.E.C., M.P. Vitelli, and C. Setter. 2002. Host specificity of the rubber vine moth, *Euclasta whalleyi* Popescu-Gorj and Constantinescu (Lepidoptera: Crambidae: Pyraustinae): field host-range compared to that predicted by laboratory tests. Australian Journal of Entomology 41: 321-323.
1228	McLaren, D.A. 1992. Observations on the life cycle and establishment of *Cochylis atricapitana* (Lep: Cochylidae), a moth used for biological control of *Senecio jacobaea* in Australia. Entomophaga 37: 641-648.
1229	McLaren, D.A., J.E. Ireson, and R.M. Kwong. 2000. Biological Control of Ragwort (*Senecio jacobaea* L.) in Australia. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 67-79.

Code	Reference
1230	Medal, J.C., N. Bustamante, W. Overholt, R. Diaz, P. Stansly, D. Amalin, A. Roda, K. Hibbard, B. Sellers, S. Hight, and J.P. Cuda. 2003. Biology of *Gratiana boliviana*, the first biocontrol agent released to control tropical soda apple in the USA. ENY-826. University of Florida IFAS Extension. 3 pp.
1231	Medal, J.C. and J.P. Cuda. 2010. Establishment and initial impact of the leaf-beetle *Gratiana boliviana* (Chrysomelidae), first biocontrol agent released against tropical soda apple in Florida. Florida Entomologist 93(4): 493-500.
1232	Medal, J.C., D. Sudbrink, D. Gandolfo, D. Ohashi, and J.P. Cuda. 2002. *Gratiana boliviana*, a potential biocontrol agent of *Solanum viarum*: Quarantine host-specificity testing in Florida and field surveys in South America. Biocontrol 47(4): 445-461.
1233	Menninger, H. 2011. A review of the science and management of Eurasian watermilfoil: recommendations for future action in New York state. New York Invasive Species Research Institute, Cornell University, Ithaca, New York. 46 pp.
1234	Meyer, J. and E. Killgore. 2000. First and successful release of a bio-control pathogen agent to combat the invasive alien tree *Miconia calvescens* (Melastomataceae) in Tahiti. Aliens 12: 8.
1235	Meyer, J.A., A. Duplouy, and R. Taputuarai. 2007. Dynamique des populations de l'arbre endémique *Myrsine longifolia* (Myrsinacées) dans les Foréts de Tahiti (Polynésie Française) Envahies par *Miconia calvescens* (Mélastomatacées) après introduction d'un champignon pathogène de lutte biologique: premières investigations. Rev. Écol. (Terre Vie) 62: 17-33.
1236	Meyer, J.-Y. 2013. (personal communication) Délégation à la Recherche, Gouvernement de la Polynésie Française B.P. 20981 Papeete, Tahiti.
1237	Meyer, J.-Y., M. Fourdrigniez, and R. Taputuarai. 2012. Restoring habitat for native and endemic plants through the introduction of a fungal pathogen to control the alien invasive tree *Miconia calvescens* in the island of Tahiti. Biocontrol 57: 191-198.
1238	Meyer, J.-Y., R. Taputuarai, and E. Killgore. 2008. Dissemination and impacts of the fungal pathogen, *Colletotrichum gloeosporioides* f. sp. *miconiae*, on the invasive alien tree, *Miconia calvescens*, in Tahiti (South Pacific). *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 594-690.
1239	Micinski, S., R.A. Goyer, B.J. Fitzpatrick, F.D. Forrester, and P.D. Boldt. 1995. Establishment of *Rhinocyllus conicus* Froelich in Northwest Louisiana. Southwestern Entomologist 20(4): 407-412.
1240	Middleton, K. 1999. Who killed 'Malagasy cactus'? Science, environment and colonialism in Southern Madagascar (1924-1930). Journal of Southern African Studies 25(2): 215-248.
1241	Milan, J.D., B.L. Harmon, T.S. Prather, and M. Schwarzländer. 2006. Winter mortality of *Aceria chondrillae*, a biological control agent released to control rush skeletonweed (*Chondrilla juncea*) in the western United States. Journal of Applied Entomology 130(9-10): 473-479.
1242	Milbrath, L. and J.R. Nechols. 2004. Individual and combined effects of *Trichosirocalus horridus* and Rhinocyllus conicus (Coleoptera: Curculionidae) on musk thistle. Biological Control 30: 418-429.
1243	Miles, J.E. 2013. (personal communication) Bureau of Agriculture, P.O. Box 460 Ministry of Natural Resources, Environment & Tourism Republic of Palau 96940.
1244	Millar, I.M. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Biosystematics, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
1245	Miller, D. 1948. Control of St. John's Wort by imported beetle. New Zealand Journal of Agriculture 76: 351-352.
1246	Miller, D. 1970. Biological control of weeds in New Zealand 1927 - 48. Information Serial, New Zealand Department of Scientific and Industrial Research 74.
1247	Mironga, J.M. 2006. The effect of water hyacinth, *Eichhornia crassipes*, infestation on phytoplankton productivity in Lake Naivasha and the status of control. *In* E. Odada, D. Olago, W. Ochola, and M. Ntiba, Eds. Proceedings of the 11th World Lakes Conference. 31 October - 4 November 2005, Nairobi, Kenya; International Lake Environment Committee. pp. 573-579.
1248	Mitchell, A., A.S. McClay, G.R. Pohl, and F.A.H. Sperling. 2005. PCR-based methods for identification of two *Eteobalea* species (Lepidoptera: Cosmopterigidae) used as biocontrol agents of weedy *Linaria* species (Scrophulariaceae). The Canadian Entomologist 137: 129-137.
1249	Mitchell, D.S. and D.J.W. Rose. 1979. Factors affecting fluctuations in extent of *Salvinia molesta* on Lake Kariba. Pest Articles and News Summaries (PANS) 25: 171-177.
1250	Miyazaki, M. and A. Naito. 1981. Biological Control of *Rumex obtusifolius* L. by *Gastrophysa atrocyanea* Mots. (Coleoptera: Chrysomelidae): biology of the insect. *In* Proceedings of the 1st Japan/USA Symposium on IPM. 29-30 September 1981, Tsukuba, Japan. pp. 181-190.
1251	Mo, J., M. Treviño, and W.A. Palmer. 2000. Establishment and distribution of the rubber vine moth, *Euclasta whalleyi* Popescu-Gorj and Constantinescu (Lepidoptera: Pyralidae), following its release in Australia. Australian Journal of Entomology 39: 344-350.
1252	Monné, M.A. and L.G. Bezark. 2010. Checklist of the Cerambycidae, or longhorned beetles (Coleoptera) of the Western Hemisphere. BioQuip Products, Rancho Dominguez, USA. 456 pp.

Code	Reference
1253	Moore, G.R. and M.P. Hill. 2012. A quantitative post-release evaluation of biological control of water lettuce, *Pistia stratiotes* L. (Araceae) by the weevil *Neohydronomus affinis* Hustache (Coleoptera: Curculionidae) at Cape Recife Nature Reserve, Eastern Cape Province, South Africa. African Entomology 20(2): 380-385.
1254	Moorehouse, T.M., P. Agaba, and T.J. McNabb. 2001. Recent efforts in biological control of water hyacinth in the Kagera River headwaters of Rwanda. *In* M.H. Julien, M.P. Hill, T.D. Center, and J. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 39-42.
1255	Moran, P.J. 2011. Release of two biological control agents against giant reed (*Arundo donax*) in the Lower Rio Grande Basin of Texas and Mexico. Presentation. *In* Texas Invasive Plant and Pest Council 2011. 8-10 November 2011, Austin, Texas, USA.
1256	Moran, V.C. and D.P. Annecke. 1979. Critical reviews of biological control in South Africa. 3. The jointed cactus, *Opuntia aurantiaca* Lindley. Journal of the Entomological Society of South Africa 42: 299-329.
1257	Moran, V.C. and J.H. Hoffmann. 1989. The effects of herbivory by a weevil species, acting alone and unrestrained by natural enemies, on growth and phenology of the weed *Sesbania punicea.* Journal of Applied Ecology 26: 967-977.
1258	Moran, V.C. and H.G. Zimmermann. 1991. Biological control of cactus weeds of minor importance in South Africa. Agriculture, Ecosystems & Environment 37: 37-55.
1259	Moran, V.C. and H.G. Zimmermann. 1991. Biological control of jointed cactus, *Opuntia aurantiaca* (Cactaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 5-27.
1260	Morgan, C. 2012. In South Florida, a tiny new weapon against the invasive potato vine. The Miami Herald, Miami, Florida. 21 September 2012.
1261	Morin, L. 2013. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia.
1262	Morin, L. and B.A. Auld. 2012. *Xanthium spinosum* L. - Bathurst burr. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 601-608.
1263	Morin, L., B.A. Auld, J.F. Brown, and M.A. Cholil. 1994. Pathogenic fungi occurring on the noogoora burr complex in Australia. Proceedings of the Linnean Society NSW 114: 133-148.
1264	Morin, L. and K.J. Evans. 2012. *Rubus fruticosus* L. aggregate - European blackberry. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 499-509.

Code	Reference
1265	Morin, L., K.J. Evans, M. Jourdan, D.R. Gomez, and J.K. Scott. 2011. Use of a trap garden to find additional genetically distinct isolates of the rust fungus *Phragmidium violaceum* to enhance biological control of European blackberry in Australia. European Journal of Plant Pathology 131: 289-303.
1266	Morin, L., D.R. Gomez, K.J. Evan, T.M. Neill, W.F. Mahaffee, and C.C. Linde. 2013. Invaded range of the blackberry pathogen *Phragmidium violaceum* in the Pacific Northwest of the USA and the search for its provenance. Biological Invasions 15: 1847-1861.
1267	Morin, L., M. Neave, K. Batchelor, and A. Reid. 2006. Biological control: a promising tool for managing bridal creeper, *Asparagus asparagoides* (L.) Druce, in Australia. Plant Protection Quarterly 21(2): 69-77.
1268	Morin, L., M. Piper, and A. White. 2012. Spread, specificity and initial impact of the white-smut fungus *Entyloma ageratinae* on mistflower in Australia. *In* V. Eldershaw, Ed. Proceedings of the 18th Australasian Weeds Conference. 8-11 October 2012, Melbourne, Victoria, Australia; Weed Society of Victoria Inc. pp. 88-91.
1269	Morin, L. and J.K. Scott. 2012. *Asparagus asparagoides* (L.) Druce - bridal creeper. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 73-82.
1270	Morin, L. and P. Syrett. 1996. Prospects for biological control of *Hieracium pilosella* with the rust *Puccinia hieracii* var. *piloselloidarum* in New Zealand. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 199-204.
1271	Moriya, S. and S. Shiyake. 2001. Spreading the distribution of an exotic ragweed beetle, *Ophraella communa* LeSage (Coleoptera: Chrysomelidae), in Japan. Japanese Journal of Entomology, New Series 4(3): 99-102.
1272	Morley, T. 2005. Lacy-winged seed fly releases for biological control of boneseed and bitou bush. Under Control - Pest Plant and Animal News 31: 19-20.
1273	Morley, T. 2010. A new attempt to introduce the lacy-winged seed fly *Mesoclanis magnipalpis* to Australia for biological control of boneseed *Chrysanthemoides monilifera* subsp. *monilifera*. *In* S.M. Zydenbos, Ed. Proceedings of the 17th Australasian Weeds Conference. 26-30 September 2010, Christchurch, New Zealand; New Zealand Plant Protection Society Inc. pp. 243-244.
1274	Morley, T. 2012. *Silybum marianum* (L.) Gaertner - variegated thistle. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 551-554.
1275	Morley, T. and J. Bonilla. 2008. Ragwort plume moth (*Platyptilia isodactyla*) reduces ragwort (*Senecio jacobaea*) plant vigour and makes a new and useful contribution to biological control of ragwort in Australia. *In* Proceedings of the 1st Australia and New Zealand Biocontrol Conference. 10-14 February 2008, Sydney, New South Wales, Australia; International Organization for Biological Control. pp. 38.

Code	Reference
1276	Morley, T., D.A. McLaren, K. Roberts, and J. Bonilla. 2004. Paterson's curse crown weevil (*Mogulones larvatus*) impacts in north-eastern Victoria, Australia. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 608.
1277	Morley, T.B. 1997. (personal communication) Keith Turnbull Research Institute, P.O. Box 48, Frankston, Victoria 3199, Australia.
1278	Morley, T.B., S. Faulkner, and I.G. Faithfull. 2004. Establishment and dispersal of dock moth *Pyropteron doryliformis* (Ochsenheimer) (Lepidoptera: Sesiidae) in Victoria. In: Weed management: balancing people, planet, profit. *In* B.M. Sindel and S.B. Johnson, Eds. Proceedings of the 14th Australian Weeds Conference. 6-9 September 2004, Wagga Wagga, New South Wales, Australia; Weed Society of New South Wales. pp. 381-384.
1279	Morley, T.B. and L. Morin. 2008. Progress on boneseed (*Chrysanthemoides monilifera* subsp. *monilifera* (L.) Norlindh) biological control: the boneseed leaf buckle mite *Aceria* (Keifer) sp., the lacy-winged seed fly *Mesoclanis magnipalpis* Bezzi and the boneseed rust *Endophyllum osteospermi* (Doidge) A.R. Wood. Plant Protection Quarterly 23(1): 29-31.
1280	Morris, M.J. 1990. *Cercospora piaropi* recorded on the aquatic weed *Eichhornia crassipes*, in South Africa. Phytophylactica 22: 255-256.
1281	Morris, M.J. 1991. The use of pathogens for biological weed control in South Africa. Agriculture, Ecosystems & Environment 37: 239-255.
1282	Morris, M.J. 1999. The contribution of the gall-forming rust fungus *Uromycladium tepperianum* (Sacc.) McAlp. to the biological control of *Acacia saligna* (Labill.) Wendl. (Fabaceae) in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 125-128.
1283	Morris, M.J. and C.J. Cilliers. 1992. New fungus against water hyacinth. Plant Protection News 30: 7.
1284	Morris, M.J., A. Wood, and A. Den Breeÿen. 1999. Plant pathogens and biological control of weeds in South Africa: a review of projects and progress during the last decade. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 129-137.
1285	Morrison, K.D., E.G. Reekie, and K.I.N. Jensen. 1998. Biocontrol of common St. Johnswort (*Hypericum perforatum*) with *Chrysolina hyperici* and a host-specific *Colletotrichum gloeosporioides*. Weed Technology 12(3): 426-435.
1286	Morrone, J.J. 1997. The impact of cladistics on weevil classification, with a new scheme of families and subfamilies (Coleoptera: Curculionoidea). Trends in Entomology 1: 129-136.
1287	Mortensen, K. 1988. The potential of an endemic fungus, *Colletotrichum gloeosporioides*, for biological control of round-leaved mallow (*Malva pusilla*) and velvetleaf (*Abutilon theophrasti*). Weed Science 36: 473-478.
1288	Mortensen, K. and K.L. Bailey. 2002. *Malva pusilla* Smith, round-leaved mallow (Malvaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 391-395.
1289	Mortensen, K. and R.M.D. Makowski. 1995. Tolerance of strawberries to *Colletotrichum gloeosporioides* f. sp. *malvae,* a mycoherbicide for control of round-leaved mallow (*Malva pusilla*). Weed Science 43: 429-433.
1290	Mortensen, K. and M.M. Molloy. 1989. Fungi detected on *Acroptilon repens* (Russian knapweed) during surveys from 1981 to 1988. Canadian Plant Disease Survey 69: 143-145.
1291	Moseyko, A.G. 2011. (personal communication) Zoological Institute of Russian Academy of Science, St. Petersburg, Russia, 199034, ZI-SP.
1292	Moth Photographers Group. 2005. Digital Guide to Moth Identification. Moth Photographers Group at the Mississippi Entomological Museum, Mississippi State University, http://mothphotographersgroup.msstate.edu/AboutMPG.shtml. 30 August 2012.
1293	Moutia, L.A. and R. Mamet. 1946. A review of twenty-five years of economic entomology in the island of Mauritius. Bulletin of Entomological Research 36: 439-472.
1294	Mpedi, P. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
1295	Mpofu, B. 1995. Biological control of waterhyacinth in Zimbabwe. Dissertation, Doctor of Philosophy. Macdonald College of McGill University, Montreal, Quebec, Canada. 175 pp.
1296	Mráz, P., R.S. Bourchier, U.A. Treier, U. Schaffner, and H. Müller-Schärer. 2011. Polyploidy in phenotypic space and invasion context: a morphometric study of *Centaurea stoebe* S.L. International Journal of Plant Sciences 172(3): 386-402.
1297	Müller, H. and R.D. Goeden. 1990. Parasitoids acquired by *Coleophora parthenica* (Lepidoptera: Coleophoridae), ten years after its introduction into southern California for the biological control of Russian thistle. Entomophaga 35: 257-268.
1298	Müller, H., G.S. Nuessly, and R.D. Goeden. 1990. Natural enemies and host-plant asynchrony contributing to the failure of the introduced moth, *Coleophora parthenica* Meyrick (Lepidoptera: Coleophoridae), to control Russian thistle. Agriculture, Ecosystems & Environment 32: 133-142.
1299	Müller, H., D. Schroeder, and A. Gassmann. 1988. *Agapeta zoegana* (L.) (Lepidoptera: Cochylidae), a suitable prospect for biological control of spotted knapweed and diffuse knapweed, *Centaurea maculosa* Monnet de la Marck and *Centaurea diffusa* Monnet de la Marck (Compositae) in North America. The Canadian Entomologist 120: 109-124.

Code	Reference
1300	Muniappan, R. 1988. Biological control of the weed, *Lantana camara* in Guam. Journal of Plant Protection in the Tropics 5: 99-101.
1301	Muniappan, R. 1991. (personal communication) Virginia Tech, 526 Prices Fork Road, Blacksburg, VA 24061, USA.
1302	Muniappan, R. 2013. (personal communication) Virginia Tech, IPM IL (CRSP), 526 Prices Fork Road, Blacksburg, VA 24061 USA.
1303	Muniappan, R. and J. Bamba. 2002. Host-specificty testing of *Cecidochares connexa*, a biolgoical control agent for *Chromolaena odorata*. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 134-136.
1304	Muniappan, R., K. Englberger, and G.V.P. Reddy. 2007. Biological control of *Chromolaena odorata* in the American Pacific Micronesian Islands. *In* P.Y. Lai, G.V.P. Reddy, and R. Muniappan, Eds. Proceedings of the 7th International Workshop on the Biological Control and Management of *Chromolaena odorata* and *Mikania micrantha*. 12-15 September 2006, Taiwan; National Pingtung University of Science and Technology. pp. 49-52.
1305	Muniappan, R. and M. Marutani. 1991. Distribution and control of *Chromolaena odorata* (Asteraceae). Micronesica Supplement 3: 103-107.
1306	Muniappan, R., M. Marutani, and G.R.W. Denton. 1988. Introduction and establishment of *Pareuchaetes pseudoinsulata* Rego Barros (Arctiidae) against *Chromolaena odorata* in the Western Caroline Islands. Journal of Biological Control 2: 141-142.
1307	Muniappan, R., A. Raman, and G.V.P. Reddy. 2009. *Ageratina adenophora* (Sprengel) King and Robinson (Asteraceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 63-73.
1308	Muniappan, R. and G.V.P. Reddy. 2003. Fortuitous introduction of two natural enemies of *Lantana camara* to Chuuk. Proceedings of the Hawaiian Entomological Society 36: 123-124.
1309	Muniappan, R., G.V.P. Reddy, and P.Y. Lai. 2005. Distribution and biological control of *Chromolaena odorata*. *In* Inderjit, Ed. Invasive Plants: Ecological and Agricultural Aspects. Birkhauser Verlag, Basel, Switzerland. pp. 223-233.
1310	Muniappan, R., G.V.P. Reddy, and A. Raman. 2009. *Coccinia grandis* (L.) Voigt (Cucurbitaceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 175-182.
1311	Muniappan, R., V.T. Sundaramurthy, and C.A. Viraktamath. 1989. Distribution of *Chromolaena odorata* (Asteraceae) and bionomics and consumption and utilization of food by *Pareuchaetes pseudoinsulata* (Lepidoptera: Arctiidae) in India. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 401-409.
1312	Muniappan, R. and C.A. Viraktamath. 1986. Status of biological control of the weed, *Lantana camara* in India. Tropical Pest Management 32: 40-42.
1313	Murray, D. 2011. Arizona field releases of the salvinia weevil, *Cyrtobagous salviniae* Calder and Sands (Curculionidae: Coleoptera) for control of giant salvinia, *Salvinia molesta* Mitchell on the lower Colorado River. Release Report. USDA APHIS PPQ. 6 pp.
1314	Mwansa, C. 1991. (personal communication) Ndola Urban District Council, P.O. Box 70197, Ndola, Zambia.
1315	Myers, J.H., C. Jackson, H. Quinn, S.R. White, and J.S. Cory. 2009. Successful biological control of diffuse knapweed, *Centaurea diffusa*, in British Columbia, Canada. Biological Control 50(1): 66-72.
1316	Na, S., Y. Cho, Y. Park, Y. Kim, Y.-G. Han, S.-H. Nam, and O. Kwon. 2008. Study on population dynamics of *Ophraella communa* LeSage and *Epiblema sugii* Kawabe, biological control agents against *Ambrosia* species. Korean Journal of Weed Science 28(3): 279-285.
1317	Nafus, D. and I. Schreiner. 1989. Biological control activities in the Mariana Islands from 1911 to 1988. Micronesica 22: 65-106.
1318	Nagata, R.F. and G.P. Markin. Status of insects introduced into Hawaii for the biological control of the wild blackberry *Rubus argutus* Link. *In* Proceedings of the 6th Conference in Natural Sciences. 10-13 June 1986, Hawaii Volcanoes National Park; University of Hawaii. pp. 53-64.
1319	Naito, A. 1987. (personal communication) Ministry of Agriculture, Forestry and Fisheries, National Agriculture Research Center, Yatabe, Tsukuba 305, Japan.
1320	Naito, A., M. Miyazaki, and K. Kanda. 1979. Studies on the biological control of *Rumex obtusifolius* L., a grassland weed, by *Gastrophysa atrocyanea* Mots. (Coleoptera: Chrysomelidae). II. Dispersal of overwintered adult insects. Applied Entomology and Zoology 14: 51-55.
1321	Nakahara, L.M., R.M. Burkhart, and G.Y. Funasaki. 1992. Review and status of biological control of *Clidemia* in Hawai'i. *In* C.P. Stone, C.W. Smith, and J.T. Tunison, Eds. Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. University of Hawaii Press, Honolulu, Hawaii. pp. 452-465.
1322	Nakao, H.K. 1967. Releases of blackberry insects. Proceedings of the Hawaiian Entomological Society 19: 339 and 376.

Code	Reference
1323	Nakao, H.K. and G.Y. Funasaki. 1976. Introductions for biological control in Hawaii, 1974. Proceedings of the Hawaiian Entomological Society 22: 329-331.
1324	Nakao, H.K. and G.Y. Funasaki. 1979. Introductions for biological control in Hawaii: 1975 and 1976. Proceedings of the Hawaiian Entomological Society 13: 125-128.
1325	Nakao, H.K., G.Y. Funasaki, and C.J. Davis. 1975. Introductions for biological control in Hawaii 1973. Proceedings of the Hawaiian Entomological Society 22: 109-112.
1326	Napompeth, B. 1990. Country Report: Thailand. Biological control of weeds in Thailand. *In* B.A. Auld, R.C. Umaly, and S.S. Tjitrosomo, Eds. Proceedings of the Symposium on Weed Management. 7-9 June 1989, Bogor, Indonesia; SEAMEO-BIOTROP. pp. 23-36.
1327	Napompeth, B. 1991. Brief review of biological control activities in Thailand. *In* Y. Hirose, Ed. Biological Control in South and East Asia. Kyushu University Press, Fukuoko. pp. 51-68.
1328	Napompeth, B. 1992. Biological control of paddy and aquatic weeds in Thailand. *In* Proceedings of the International Symposium on Biological and Integrated Management of Paddy and Aquatic Weeds in Asia. 20-23 October 1992, Tsukuba, Japan; National Agricultural Research Centre. pp. 249-258.
1329	Napompeth, B. 1997. (personal communication) National Biological Control Research Centre, Kasetsart University and National Research Council of Thailand, PO Box 9-52, Bangkok 10900, Thailand.
1330	Napompeth, B. 2004. Management of invasive alien species in Thailand. Extension Bulletin 544. Food and Fertilizer Technology Center (FFTC), Taiwan. 11 pp.
1331	Napompeth, B., N. Thi Hai, and A. Winotai. 1988. Attempts on biological control of Siam weed, *Chromolaena odorata*, in Thailand. *In* R. Muniappan, Ed. Proceedings of the 1st International Workshop on Biological Control of *Chromolaena odorata*. Feb 29 - March 4 1988, Bangkok, Thailand; Agricultural Experiment Station. pp. 57-62.
1332	Napompeth, B. and A. Winotai. 1991. Progress on biological control of Siam weed, *Chromolaena odorata* in Thailand. *In* R. Muniappan and P. Ferrar, Eds. Proceedings of the 2nd International Workshop on Biological Control of *Chromolaena odorata*. 4-8 February 1991, Bogor, Indonesia; CRSTAM. pp. 91-97.
1333	NAPPO. 2008. Eradication of cactus moth (*Cactoblastis cactorum* Berg) outbreak in Isla Mujeres, Quintana Roo, Mexico. 09/15/2008. *In* Phytosanitary Alert System. North America Plant Protection Organization, http://www.pestalert.org/oprDetail.cfm?oprID=345. 31 May 2013.

Code	Reference
1334	NAPPO. 2009. Detection and eradication of cactus moth (Cactoblastis cactorum Berg) outbreak in Isla Contoy, Isla Contoy municipality of Isla Mujeres, Quintana Roo, Mexico. 04/24/2009. *In* Phytosanitary Alert System. North America Plant Protection Organization, http://www.pestalert.org/oprDetail.cfm?oprID=376&keyword=Cactoblastis%20cactorum. 31 May 2013.
1335	Naughton, M., J. Kidston, P. Sullivan, and C. Bourker. 2006. Paterson's curse. NSW DPI August 2006. Primefact 109: 1-11.
1336	Naumann, I.D., M.A. Williams, and S. Schmidt. 2002. Synopsis of the Tenthredinidae (Hymenoptera) in Australia, including two newly recorded, introduced sawfly species associated with willows (*Salix* spp.). Australian Journal of Entomology 41: 1-6.
1337	Ndunguru, J., P. Mjema, C.A. Rajabu, and F. Katagira. 2001. Water hyacinth infestation in ponds and satellite lakes in the Lake Victoria basin on Tanzania: status and efforts to manage it. *In* Proceedings of the 1st Lake Victoria Environmental Management Project Regional Scientific Conference. 3-7 December 2001, Kisumu, Kenya; KIDACE, KMFRI. pp. 199-210.
1338	Nelson, J.A. and R.B. Carlson. 1999. Observations on the biology of *Spurgia capitigena* Bremi on leafy spurge in North Dakota. Biological Control 16(2): 128-132.
1339	Neser, S. 1985. A most promising bud-galling wasp, *Trichilogaster acaciaelongifoliae* (Pteromalidae), established against *Acacia longifolia* in South Africa. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 797-803.
1340	Neser, S. 1998. (personal communication) Agricultural Research Council, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, Republic of South Africa.
1341	Neser, S. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
1342	Neser, S. and D.P. Annecke. 1973. Biological control of weeds in South Africa. Entomology Memoir 28: 1-27.
1343	Neser, S. and R.L. Kluge. 1985. A seed-feeding insect showing promise in the control of a woody invasive plant: the weevil *Erytenna consputa* Pascoe on *Hakea sericea* (Proteaceae) in South Africa. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 805-809.
1344	Neser, S., H.G. Zimmermann, H.E. Erb, and J.H. Hoffmann. 1989. Progress and prospects for the biological control of two *Solanum* weeds in South Africa. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 371-381.

Code	Reference
1345	Neuenschwander, P. 2000. Classical biological control of floating water weeds by means of specific insects: water hyacinth. *In* International Institute of Tropical Agriculture, Benin Annual Report 1999. IITA, Plant Health Management Division, Cotonou, Benin. pp. 20.
1346	Neuenschwander, P., O. Ajuonu, and V. Schade. 1996. Biological control of water hyacinth in Benin, West Africa. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 15-25.
1347	Neuenschwander, P., M.H. Julien, T.D. Center, and M.P. Hill. 2009. *Pistia stratiotes* L. (Araceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge. pp. 130-162.
1348	Nieman, E. 1991. The introduction of *Mimorista pulchellalis* (Lepidoptera: Pyraustidae) into South Africa for the biological control of jointed cactus, *Opuntia aurantiaca*. 2. Field evaluation. Entomophaga 36: 77-86.
1349	Nishida, G.M. 2002. Bishop Museum - Hawaiian arthropod checklist. Version: 9 April 2002. http://hbs.bishopmuseum.org/checklist/query.asp. 31 December 2012.
1350	Nishida, G.M. 2008. French Polynesia bug checklist (preliminary). Version 19 November 2008. http://essigdb.berkeley.edu/checklists/fpHemiptera.doc. 31 March 2013.
1351	Nishida, G.M. 2008. French Polynesia fly checklist (preliminary). Version 13 November 2008. http://essigdb.berkeley.edu/checklists/fpDiptera.doc. 31 March 2013.
1352	Nishino, T. 1999. Utilization of a phytopathogenic bacterium as a biological control agent for annual bluegrass. Journal of Pesticide Science 24(3): 336-345.
1353	Njoka, S.W. 2004. The biology and impact of *Neochetina* weevils on water hyacinth, *Eichhornia crassipes* in Lake Victoria Basin, Kenya. Thesis, Doctor of Philosophy. Moi University, Eldoret, Kenya. 180 pp.
1354	Norambuena, H. 2003. Control biológico de malezas en Chile: experiencias para la implementación rápida de proyectos. Manejo Integrado de Plagas y Agroecología (Costa Rica) 69: 96-98.
1355	Norambuena, H. 2013. (personal communication) Pasaje El Acantilado Oriente 740, Temuco, Chile.
1356	Norambuena, H. and G. Cabrera Walsh. Biological control of invasive weeds in Latin America. Presentation. *In* Nearctic and Neotropic Regional Sections Conference. 11-13 May 2010, Niagara Falls, Ontario, Canada; International Organization for Biological Control. pp. 39.
1357	Norambuena, H., R. Carrillo, and M. Neira. 1986. Introduccion, establecimento y potencial de *Apion ulicis* como antagonista de *Ulex europaeus* en el sur de Chile. Entomophaga 31: 3-10.

Code	Reference
1358	Norambuena, H., S. Escobar, and J. Díaz. 2004. Release strategies for the moth *Agonopterix ulicetella* in the biological control of *Ulex europaeus* in Chile. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 27 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 440-446.
1359	Norambuena, H., S. Escobar, and F. Rodriguez. 2000. The Biocontrol of Gorse, *Ulex europaeus*, in Chile: A Progress Report. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 955-961.
1360	Norambuena, H., G. Martínez, R. Carrillo, and M. Neira. 2007. Host specificity and establishment of *Tetranychus lintearius* (Acari: Tetranychidae) for biological control of gorse, *Ulex europaeus* (Fabaceae) in Chile. Biological Control 40(2): 204-212.
1361	Norambuena, H. and G.L. Piper. 2000. Impact of *Apion ulicis* Forster on *Ulex europaeus* L. seed dispersal. Biological Control 17(3): 267-271.
1362	Norambuena, H.M. and J.N. Ormeño. 1991. Control biologico de malezas: Fundamentos y perspectivas en Chile. Agricultura Tecnica (Chile) 51: 210-219.
1363	Northam, F.E. and C.C. Orr. 1982. Effects of a nematode on biomass and density of silverleaf nightshade. Journal of Range Management 35(4): 536-537.
1364	Nowierski, R.M. 1995. Dalmatian toadflax. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 312-317.
1365	Nowierski, R.M. 2004. Toadflax. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 379-395.
1366	Nowierski, R.M. 2013. (personal communication) United States Department of Agriculture, National Institute of Food and Agriculture, Division of Plant Systems-Protection, 3322 Waterfront Centre, 800 9th Street SW, Washington, DC 20024 USA.
1367	Nowierski, R.M. and R.W. Pemberton. 2002. Leafy Spurge. *In* R. Van Driesche, S. Lyon, B. Blossey, M. Hoddle, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 181-194.
1368	O'Brien, C. 1976. A taxonomic revision of the new world subaquatic genus *Neochetina* (Coleoptera: Curculionidae: Bagoini). Annals of the Entomological Society of America 69: 165-174.

Code	Reference
1369	O'Brien, J.M., G.B. Kyser, D.M. Woods, and J.M. DiTomaso. 2010. Effects of the rust *Puccinia jaceae* var. *solstitialis* on *Centaurea solstitialis* (yellow starthistle) growth and competition. Biological Control 52: 174-181.
1370	Ochiel, G.R.S. and S.W. Njoka. 2001. Biological control and monitoring of water hyacinth *Eichhornia crassipes* during the post-resurgence period in Lake Victoria, Kenya. *In* Proceedings of the 1st Lake Victoria Environmental Management Project Regional Scientific Conference. 3-7 December 2001, Kisumu, Kenya; KIDACE, KMFRI. pp. 206-210.
1371	Ochiel, G.R.S. and S.W. Njoko. 2001. Biological control and monitoring of water hyacinth, *Eichhornia crassipes* Marts. Solms-Laubach (Liliales: Ponteridiaceae), during the post-resurgence period in Lake Victoria basin, Kenya. *In* Proceedings of the 1st Lake Victoria Environmental Management Project Regional Scientific Conference. 3-7 December 2001, Kisumu, Kenya; KIDACE, KMFRI. pp. 18-29.
1372	Ochoa, R., E.F. Erbe, W.P. Wergin, C. Frye, and J. Lydon. 2001. The presence of *Aceria anthocoptes* (Nalepa) (Acari: Eriophyidae) on *Cirsium* species in the United States. International Journal of Acarology 27(3): 179-187.
1373	O'Connor, B.A. 1950. Biological control of insects and plants in Fiji. Agricultural Journal of Fiji 21: 43-54.
1374	O'Connor, B.A. 1952. An introduced parasite of Noogoora burr. Agricultural Journal of Fiji 23: 105-106.
1375	O'Connor, B.A. 1957. Entomological notes. Agricultural Journal of Fiji 28: 79-87.
1376	O'Connor, B.A. 1960. A decade of biological control work in Fiji. Agricultural Journal of Fiji 30: 44-54.
1377	Oehrens, E. 1977. Biological control of the blackberry through the introduction of rust, *Phragmidium violaceum*, in Chile. FAO Plant Protection Bulletin 25: 26-28.
1378	Oehrens, E. and S. Gonzalez. 1977. Dispersion, ciclo biologico y danos causados por *Phragmidium violaceum* (Schultz) Winter en zarzamora (*Rubus constrictus* Lef. et M. y *R. ulmifolius* Schott.) en las zonas centro-sur y sur de Chile. Agro Sur 5: 73-85.
1379	Oehrens, E.B. and S.M. Gonzalez. 1974. Introduccion de *Phragmidium violaceum* (Schultz) Winter como factor de control biologico de zarza mora (*Rubus constrictus* Lef. et M. y *R. ulmifolius* Schott.). Agro Sur 2: 30-33.
1380	Ogwang, J.A. 1997. (personal communication) NARO, Namulonge Research Institute, PO Box 7084, Kampala, Uganda.
1381	Oishi, D.E. 2011. (personal communication) Hawaii Department of Agriculture, Plant Pest Control Branch, 1428 S. King Street, Honolulu, Hawaii 96814 USA.
1382	Okamba, P. 2000. Environment-Congo: Insects control spread of dangerous aquatic plants. Inter Press Service News Agency, Dongou, Republic of Congo. 22 September 2000.

Code	Reference
1383	Oke, O.A., B.A. Adelaja, C.N. Emuh, and O.J. Taiwao. 2012. Establishment of the presence of the moth: *Niphograpta albiguttalis* (Warner) (Lepidoptera: Pyralidae), biological control agent of water hyacinth (*Eichhornia crassipes*) in waterways of Lagos and Ogun States, southwestern Nigeria. Environmental Research Journal 6: 158-163.
1384	Olckers, T. 1995. Indigenous parasitoids inhibit the establishment of a gall-forming moth imported for the biological control of *Solanum elaeagnifolium* Cav. (Solanaceae) in South Africa. African Entomology 3(1): 85-87.
1385	Olckers, T. 2003. Assessing the risks associated with the release of a flowerbud weevil, *Anthonomus santacruzi*, against the invasive tree *Solanum mauritianum* in South Africa. Biological Control 28(3): 302-312.
1386	Olckers, T. 2004. Targeting emerging weeds for biological control in South Africa: the benefits of halting the spread of alien plants at an early stage of their invasion. South African Journal of Science 100: 64-68.
1387	Olckers, T. 2008. *Anthonomus santacruzi* Hustache (Curculionidae), a new biological control agent for bugweed, *Solanum mauritianum* Scopoli, in South Africa, poses no risks to cotton production. African Entomology 16(1): 137-139.
1388	Olckers, T. 2011. Biological control of *Leucaena leucocephala* (Lam.) de Wit (Fabaceae) in South Africa: a tale of opportunism, seed-feeders and unanswered questions. African Entomology 19(2): 356-365.
1389	Olckers, T. 2011. Biological control of *Solanum mauritianum* Scop. (Solanaceae) in South Africa: will perseverance pay off? African Entomology 19(2): 416-426.
1390	Olckers, T. 2013. (personal communication) University of Kwazulu-Natal, School of Biological & Conservation Sciences, Private Bag X01, Scottsville, 3209 South Africa.
1391	Olckers, T. and C.K. Borea. 2009. Assessing the risks of releasing a sap-sucking lace bug, *Gargaphia decoris*, against the invasive tree *Solanum mauritianum* in New Zealand Biocontrol 54: 143-154.
1392	Olckers, T., J.H. Hoffmann, V.C. Moran, F.A.C. Impson, and M.P. Hill. 1999. The initiation of biological control programmes against two herbaceous *Solanum* weed species in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 55-63.
1393	Olckers, T. and P.E. Hulley. 1994. Resolving ambiguous results of host-specificity tests: the case of two *Leptinotarsa* species (Coleoptera: Chrysomelidae) for biological control of *Solanum elaeagnifolium* Cavanilles (Solanaceae) in South Africa. African Entomology 2(2): 137-144.
1394	Olckers, T. and H.G. Zimmermann. 1991. Biological control of silverleaf nightshade, *Solanum elaeagnifolium*, and bugweed, *Solanum mauritianum*, (Solanaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 137-155.

Code	Reference
1395	Olckers, T., H.G. Zimmermann, and J.H. Hoffmann. 1995. Interpreting ambiguous results of host-specificity tests in biological control of weeds: assessment of two *Leptinotarsa* species (Chrysomelidae) for the control of *Solanum eleagnifolium* (Solanaceae) in South Africa. Biological Control 5: 336-344.
1396	Ooi, P.A.C. 1981. *Eurytoma attiva* Burks (Hym., Eurytomidae) attacking *Cordia curassavica* (Jacq.) R. and S. in Kedah and Perlis, Malaysia. II. Incidence of *E. attiva*. The Malaysian Agricultural Journal 53: 1-8.
1397	Ooi, P.A.C. 1987. A fortuitous biological control of *Lantana* in Malaysia. Tropical Pest Management 33: 234-235.
1398	Ooi, P.A.C., C.H. Sim, and E.B. Tay. 1988. Status of the Arctiid moth introduced to control Siam weed in Sabah, Malaysia. Planter, Kuala Lumpur 64: 298-304.
1399	Oosthuizen, M.J. 1964. The biological control of *Lantana camara* L. in Natal. Journal of the Entomological Society of South Africa 27: 3-16.
1400	Orapa, W. 2005. Biological control of weeds in Papua New Guinea. *In* Proceedings of the 20th Asian-Pacific Weed Sciences Society Conference. 7-11 November 2005, Ho Chi Min City, Vietnam. pp. 457-465.
1401	Orapa, W. 2009. History of weed biological control in the Pacific Islands. Presentation. *In* Pacific Biocontrol Strategy Workshop. 16-18 November 2009, Auckland, New Zealand; Landcare Research.
1402	Orapa, W. 2009. The role of Secretariat of the Pacific Community in the biological control of weeds in the Pacific Islands region - past, present and future activities. *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 465-480.
1403	Orapa, W. 2013. (personal communication) National Agricultural Quarantine and Inspection Authority, PO Box 741, Port Moresby, NCD, Papua New Guinea.
1404	Orapa, W. and I. Bofeng. 2004. Mass production, establishment and impact of *Cecidochares connexa* on C*hromolaena* in Papua New Guinea. *In* M. Day and R.E. McFadyen, Eds. Proceedings of the 6th International Workshop on the Biological Control and Management of *Chromolaena*. 6-9 May 2003, Cairns, Queensland, Australia; Australian Centre for International Agricultural Research. pp. 30-35.
1405	Orr, C.C., J.R. Abernathy, and E.B. Hudspeth. 1975. *Nothanguina phyllobia*, a nematode parasite of silverleaf nightshade. Plant Disease Reporter 59: 416-418.
1406	Ortega, Y., D.E. Pearson, L.P. Waller, N. Sturdevant, and J.L. Maron. 2012. Population-level compensation impedes biological control of an invasive forb and indirect release of a native grass. Ecology 93(4): 783-792.
1407	Osterbauer, N., A. Trippe, K. French, T. Butler, M.C. Aime, J. McKerny, W.L. Bruckart, T. Peerbolt, and D. Kaufman. 2005. First report of *Phragmidium violaceum* infecting Himalaya and evergreen blackberries in North America. Plant Health Progress.

Code	Reference
1408	Ostermeyer, N. and B.S. Grace. 2007. Establishment, distribution and abundance of *Mimosa pigra* biological control agents in northern Australia: implications for biological control. Biocontrol 52: 703-720.
1409	Ouedraogo, L.R., R.J. Dabire, M. Ouedrago, M. Belem, and O. Bognounou. 1999. Integrated management of water hyacinth in Burkina Faso *In* M. Hill, M.H. Julien, and T. Center, Eds. Proceedings of the 1st IOBC Global Working Group Meeting for the Biological and Integrated Control of Water Hyacinth. 16-19 November 1998, Harare, Zimbabwe; Plant Protection Research Institute. pp. 153-159.
1410	Overholt, W.A., R. Diaz, K.L. Hibbard, A.L. Roda, D. Amalin, A.J. Fox, S.D. Hight, J.C. Medal, P.A. Stansly, B. Carlisle, J.H. Walter, P.J. Hogue, L.A. Gary, L.F. Wiggins, C.L. Kirby, and S.C. Crawford. 2009. Releases, distribution and abundance of *Gratiana boliviana* (Coleoptera: Chrysomelidae), a biological control agent of tropical soda apple (*Solanum viarum*, Solanaceae) in Florida. Florida Entomologist 92(3): 450-457.
1411	Overholt, W.A., R. Diaz, L. Markle, and J.C. Medal. 2010. The effect of *Gratiana boliviana* (Coleoptera: Cyrsomelidae) herbivory on growth and population density of tropical soda apple (*Solanum viarum*) in Florida. Biocontrol Science and Technology 20(8): 791-807.
1412	Painter, D.S. and K.J. McCabe. 1988. Investigation into the disappearance of Eurasian watermilfoil from the Kawartha Lakes. Journal of Aquatic Plant Management 26: 3-12.
1413	Palmer, W.A. 2013. (personal communication) Research Fellow, Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia; Adjunct Associate Professor, University of Queensland, School of Biological Sciences.
1414	Palmer, W.A. and G. Diatloff. 1987. Host specificity and biology of *Bucculatrix ivella* Busck, a potential biological control agent for *Baccharis halimifolia* in Australia. Journal of the Lepidopterists' Society 41: 23-28.
1415	Palmer, W.A., G. Diatloff, and J. Melksham. 1993. The host specificity of *Rhopalomyia californica* Felt (Diptera: Cecidomyiidae) and its importation into Australia as a biological control agent for *Baccharis halimifolia* L. Proceedings of the Entomological Society of Washington 95: 1-6.
1416	Palmer, W.A. and W.H. Haseler. 1992. Foodplant specificity and biology of *Oidaematophorus balanotes* (Pterophoridae): a North American moth introduced into Australia for the biological control of *Baccharis halimifolia.* Journal of the Lepidopterists' Society 46: 195-202.
1417	Palmer, W.A. and W.H. Haseler. 1992. The host specificity and biology of *Trirhabda bacharidis* (Weber) (Coleoptera: Chrysomelidae), a species introduced into Australia for the biological control of *Baccharis halimifolia* L. The Coleopterists Bulletin 46: 61-66.
1418	Palmer, W.A., T.A. Heard, and A.W. Sheppard. 2010. A review of Australian classical biological control of weeds programs and research activities over the past 12 years. Biological Control 52(3): 271-287.

Code	Reference
1419	Palmer, W.A. and C.J. Lockett. 2012. *Acacia nilotica* subsp. *indica* (Benth.) Brenan - prickly acacia. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 18-28.
1420	Palmer, W.A., C.J. Lockett, K.A.D.W. Senaratne, and A. McLennan. 2007. The introduction and release of *Chiasmia inconspicua* and *C. assimilis* (Lepidoptera: Geometridae) for the biological control of *Acacia nilotica* in Australia. Biological Control 41: 368-378.
1421	Palmer, W.A. and R. McFadyen. 2012. *Ambrosia artemisiifolia* L. - annual ragweed. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 52-59.
1422	Palmer, W.A. and K.A.D.W. Senaratne. 2007. The host range and biology of *Cometaster pyrula*; a biocontrol agent for *Acacia nilotica* subsp. *indica* in Australia. Biocontrol 52: 129-143.
1423	Palmer, W.A. and W. Senaratne. 2012. *Anredera cordifolia* (Ten.) Steenis - Madeira vine. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 60-64.
1424	Palmer, W.A. and N. Sims-Chilton. 2012. *Baccharis halimifolia* L. - groundsel bush. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 86-95.
1425	Palmer, W.A. and W.D. Vogler. 2012. *Cryptostegia grandifolia* (Roxb.) R. Br. - rubber vine. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 190-197.
1426	Palmer, W.A., B.W. Willson, and K.R. Pullen. 1996. The host range of *Aconophora compressa* Walker (Homoptera: Membracidae): a potential biological control agent for *Lantana camara* L. (Verbenaceae). Proceedings of the Entomological Society of Washington 98: 617-624.
1427	Papua New Guinea Department of Agriculture Stock and Fisheries. 1969. Insect pest survey for the year ending 30th June, 1967. Papua New Guinea Agricultural Journal 21: 49-75.
1428	Papua New Guinea Department of Agriculture Stock and Fisheries. 1971. Insect pest survey for the year ending 30th June, 1968. Papua New Guinea Agricultural Journal 22: 181-197.
1429	Park, I.J. 2013. (personal communication) University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339 Moscow, ID 83844-2339 USA.
1430	Park, J.-E., J. Park, I.-Y. Lee, and O. Kwon. 2008. Biological weed control of *Rumex obtusifolius* by releasing control agents, *Gastrophysa atrocyanea* and *Ostrinia palustralis memnialis* in pasture. Korean Journal of Weed Science 28(2): 146-151.
1431	Parker, A., A.N.G. Holdern, and A.J. Tomley. 1994. Host specificity testing and assessment of the pathogenicity of the rust, *Puccinia abrupta* var. *partheniicola,* as a biological control agent of parthenium weed (*Parthenium hysterophorus*). Plant Pathology 43: 1-16.
1432	Parker, P.E., R.D. Richard, and L.E. Wendel. 2000. Biological control of purple loosestrife-cooperative implementation. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 428-429.
1433	Parmelee, J.A. 1967. The autoecious species of *Puccinia* on Heliantheae in North America. Canadian Journal of Botany 45: 2267-2340.
1434	Parris, S.D. 1980. Aquatic plant control activity in the Panama Canal zone. Miscellaneous Paper A-80-3. U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, USA. 384-389 pp.
1435	Parsons, W.T. 1957. St. John's wort in Victoria. History, distribution and control. The Journal of Agriculture, Victoria 55: 781-788.
1436	Parys, K.A. and S.J. Johnson. 2012. Impact of the red imported fire ant, *Solenopsis invicta* (Hymenoptera: Formicidae), on biological control of *Salvinia minima* (Hydropteridales: Salviniaceae) by *Cyrtobagous salviniae* (Coleoptera: Curculionidae). Florida Entomologist 95(1): 136-142.
1437	Paterson, I.D., J.H. Hoffmann, H. Klein, C.W. Mathenge, S. Neser, and H.G. Zimmermann. 2011. Biological control of Cactaceae in South Africa. African Entomology 19(2): 230-246.
1438	Pauku, R. 1991. (personal communication) Ministry of Agriculture and Fisheries, Dodo Creek Research Station, PO Box G13, Honiara, Solomon Islands.
1439	Pawar, A.D. and M. Gupta. 1984. Importation of exotic phytophagous insects for the control of water hyacinth in India. Plant Protection Bulletin 36: 79-82.
1440	Paynter, Q. 2004. Evaluating *Mimosa pigra* biological control in Australia. *In* M. Julien, G. Flanagan, T. Heard, B. Hennecke, Q. Paynter, and C. Wilson, Eds. Research and Management of *Mimosa pigra*. CISRO Entomology, Canberra. pp. 141-148.
1441	Paynter, Q. 2005. Evaluating the impact of a biological control agent *Carmenta mimosa* on the woody wetland weed *Mimosa pigra* in Australia. Journal of Applied Entomology 42: 1054-1062.
1442	Paynter, Q. 2006. Evaluating the impact of biological control against *Mimosa pigra* in Australia: comparing litterfall before and after the introduction of biological control agents. Biological Control 38: 166-173.
1443	Paynter, Q. 2013. (personal communication) Land Care Research, Biodiversity and Conservation, Private Bag 92170, Auckland Mail Centre, Auckland 1142 New Zealand.
1444	Paynter, Q. and G.J. Flanagan. 2002. Integrated management of *Mimosa pigra*. *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 165-168.

Code	Reference
1445	Paynter, Q., A. Main, A.H. Gourlay, P.G. Peterson, S.V. Fowler, and Y.M. Buckley. 2010. Disruption of an exotic mutualism can improve management of an invasive plant: varroa mite, honeybees and biological control of Scotch broom *Cytisus scoparius* in New Zealand. Journal of Applied Ecology 47: 309-317.
1446	Paynter, Q., N. Martin, J. Berry, S. Hona, P. Peterson, A.H. Gourlay, J. Wilson-Davey, L. Smith, C. Winks, and S.V. Fowler. 2008. Non-target impacts of *Phytomyza vitalbae* a biological control agent of European weed *Clematis vitalba* in New Zealand. Biological Control 44: 248-258.
1447	Paynter, Q., N. Waipara, P. Peterson, S. Hona, S. Fowler, A. Gianotti, and P. Wilkie. 2006. The impact of two introduced biocontrol agents, *Phytomyza vitalbae* and *Phoma clematidina*, on *Clematis vitalba* in New Zealand. Biological Control 36: 350-357.
1448	Peck, A. 2007. Rose Rosette Disease. Web Book updated 20 May 2007. http://www.rosegeeks.com/index.htm. 5 January 2013.
1449	Pecora, P., R.W. Pemberton, M. Stazi, and G.R. Johnson. 1991. Host specificity of *Spurgia esulae* Gagné (Diptera: Cecidomyiidae), a gall midge introduced into the United States for control of leafy spurge (*Euphorbia esula* L. "Complex"). Environmental Entomology 20: 282-287.
1450	Pelser, P.B., J.-F. Veldkamp, and R. van der Meijden. 2006. New combinations in *Jacobaea* Mill. (Asteraceae - Senecioneae). Compositae Newsletter 44: 1-11.
1451	Pemberton, C.E. 1950. Miscellaneous notes. Proceedings of the Hawaiian Entomological Society 14: 14.
1452	Pemberton, C.E. 1957. Progress in the biological control of undesirable plants in Hawaii. *In* Proceedings of the 9th Pacific Science Congress. 18 November-9 December 1957, Bangkok, Thailand; Secretariat, Ninth Pacific Science Congress. pp. 124-126.
1453	Pemberton, C.E. 1964. Highlights in the history of entomology in Hawaii 1778-1963. Pacific Insects 6: 689-729.
1454	Pemberton, R.W. 1986. The distribution of halogeton in North America. Journal of Range Management 39: 281-282.
1455	Pemberton, R.W. 1995. *Cactoblastis cactorum* (Lepidoptera: Pyralidae) in the United States: An immigrant biological control agent or an introduction of the nursery industry? American Entomologist 41: 230-232.
1456	Pemberton, R.W. 1995. Leafy spurge. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 289-295.
1457	Pemberton, R.W. 2000. Predictable risk to native plants in weed biological control. Oecologia 125(4): 489-494.
1458	Pemberton, R.W. and G.R. Johnson. 1986. *Aphthona cyparissiae*, a new flea beetle for leafy spurge control in the United States. *In* 1986 Leafy Spurge Symposium. 9-10 July 1986, Riverton, Wyoming, USA; Great Plains Agricultural Council. pp. 42-48.
1459	Pemberton, R.W. and H. Liu. 2007. Control and persistence of native *Opuntia* on Nevis and St. Kitts 50 years after the introduction of *Cactoblastis cactorum*. Biological Control 41: 272-282.
1460	Pemberton, R.W. and N.E. Rees. 1990. Host specificity and establishment of *Aphthona flava* Guill. (Chrysomelidae), a biological control agent of leafy spurge (*Euphorbia esula* L.) in the United States. Proceedings of the Entomological Society of Washington 92: 351-357.
1461	Pemberton, R.W. and C.E. Turner. 1990. Biological control of *Senecio jacobaea* in northern California, an enduring success. Entomophaga 35: 71-77.
1462	Percy, D.M., A. Rung, and M.S. Hoddle. 2012. An annotated checklist of the psyllids of California (Hemiptera: Psylloidea). Zootaxa 3193: 1-27.
1463	Pérez-de-Luque, A., S. Fondevilla, B. Pérez-Vich, R. Aly, S. Thoiron, P. Simier, M.A. Castillejo, J.M. Fernández-Martinez, J. Jorrín, D. Rubiales, and P. Delavault. 2009. Understanding *Orobanche* and *Phelipanche*-host plant interactions and developing resistance. Weed Research 49(Supplement 1): 8-22.
1464	Perkins, R.C.L. and O.H. Swezey. 1924. The introduction into Hawaii of insects that attack lantana. Bulletin of the Hawaiian Sugar Plantation Association Experimental Station 16: 1-83.
1465	Perrin, p.H., J. Poussereau, S. Quilici, and e.J.-F. Voisin. 2007. Trois espèces de Curculionides nouvelles pour l'île de la Réunion (Coleoptera). Bulletin de la Société entomologique de France 112(1): 127-130.
1466	Perry, J.E., D.M.E. Ware, and A. McKenney-Mueller. 1998. *Aeschynomene indica* L. (Fabaceae) in Virginia. Castanea 63(2): 191-194.
1467	Peschken, D.P. 1971. *Cirsium arvense* (L.) Scop., Canada Thistle. *In* Biological Control Programmes Against Insects and Weeds in Canada 1956-1968. Technical Communication 4. Commonwealth Institute of Biological Control. pp. 79-83.
1468	Peschken, D.P. 1977. Biological control of creeping thistle (*Cirsium arvense*): analysis of releases of *Altica carduorum* (Col.: Chrysomelidae) in Canada. Entomophaga 22: 425-428.
1469	Peschken, D.P. 1979. Biological control of weeds in Canada with the aid of insects and nematodes. Zeitschrift für Angewandte Entomologie 88: 1-16.
1470	Peschken, D.P. 1979. Host specificity and suitability of *Tephritis dilacerata* (Dip.: Tephritidae): a candidate for the biological control of perennial sow-thistle (*Sonchus arvensis*) (Compositae) in Canada. Entomophaga 24: 455-461.

Code	Reference
1471	Peschken, D.P. 1984. *Cirsium arvense* (L.) Scop., Canada thistle (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 139-146.
1472	Peschken, D.P. 1984. *Sonchus arvensis* L., perennial sow-thistle, *S. oleraceus* L. annual sow-thistle and *S. asper* (L.) Hill, spiny annual sow-thistle (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 205-209.
1473	Peschken, D.P. 2012. (personal communicaiton) (Retired) 2900 Rae Street Regina, SK S4S 1R5 Canada.
1474	Peschken, D.P. and R.W. Beecher. 1973. *Ceutorhynchus litura* (Coleoptera: Curculionidae): biology and first releases for the biological control of the weed Canada thistle (*Cirsium arvense*) in Ontario, Canada. The Canadian Entomologist 105: 1489-1494.
1475	Peschken, D.P. and J.L. Derby. 1988. Host specificity of *Liriomyza sonchi* Hendel (Diptera: Agromyzidae), a potential biological agent for the control of weedy sow-thistles *Sonchus* spp., in Canada. The Canadian Entomologist 120: 593-600.
1476	Peschken, D.P. and J.L. Derby. 1992. Effect of *Urophora cardui* (L.) (Diptera: Tephritidae) and *Ceutorhynchus litura* (F.) (Coleoptera: Curculionidae) on the weed Canada thistle, *Cirsium arvense* (L.) Scop. The Canadian Entomologist 124: 145-150.
1478	Peschken, D.P. and J.L. Derby. 1997. Establishment of *Urophora cardui* (Diptera: Tephritidae) on Canada thistle, *Cirsium arvense* (Asteraceae), and colony development in relation to habitat and parasitoids in Canada. *In* K. Dettner, G. Bauer, and W. V., Eds. Ecological Studies, Vol. 130. Vertical Food Web Interactions: Evolutionary Patterns and Driving Forces. Springer Publishing, New York. pp. 53-66.
1477	Peschken, D.P., D.B. Finnamore, and A.K. Watson. 1982. Biocontrol of the weed Canada thistle (*Cirsium arvense*) : releases and development of the gall fly *Urophora cardui* (Diptera : Tephritidae) in Canada. The Canadian Entomologist 114: 349-357.
1479	Peschken, D.P., A.S. McClay, and R.A. De Clerck-Floate. 2002. *Silene vulgaris* (Moench) Garcke, bladder campion (Caryophyllaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000, Wallingford, U.K. pp. 411-416.
1480	Peschken, D.P., A.S. McClay, J.L. Derby, and R. De Clerk. 1989. *Cystiphora sonchi* (Bremi) (Diptera: Cecidomyiidae), a new biological control agent established on the weed perennial sow-thistle (*Sonchus arvensis* L.) (Compositae) in Canada. The Canadian Entomologist 121: 781-791.

Code	Reference
1481	Peschken, D.P. and K.C. Sawchyn. 1993. Host specificity and suitability of *Apion hookeri* Kirby (Coleoptera: Curculionidae), a candidate for the biological control of scentless chamomile, *Matricaria perforata* Mérat (Asteraceae), in Canada. The Canadian Entomologist 125: 619-628.
1482	Peschken, D.P., K.C. Sawchyn, and D.E. Bright. 1993. First record of *Apion hookeri* Kirby (Coleoptera: Curculionidae) in north America. The Canadian Entomologist 125: 629-631.
1483	Peschken, D.P. and A.T.S. Wilkinson. 1981. Biocontrol of Canada thistle (*Cirsium arvense*): releases and effectiveness of *Ceutorhynchus litura* (Coleoptera: Curculionidae) in Canada. The Canadian Entomologist 113: 777-785.
1484	Pest Management Regulatory Agency. 2002. *Chondrostereum purpureum* (HQ1). Proposed regulatory decision document PRDD2002-01. Pest Management Regulatory Agency; Health Canada. 35 pp.
1485	Pest Management Regulatory Agency. 2004. *Chondrostereum purpureum* strain PFC2139 Cp-PF2139 (technical grade of active ingredient) Chontrol paste (end-use product). Pest Management Regulatory Agency; Health Canada. 33 pp.
1486	Pest Management Regulatory Agency. 2007. *Chondrostereum purpureum* strain PFC2139 Cp-PFC2139 Chontrol paste. Pest Management Regulatory Agency; Health Canada. 8 pp.
1487	Pest Management Regulatory Agency. 2010. *Sclerotinia minor* strain IMI 344141. Pest Management Regulatory Agency; Health Canada. 10 pp.
1488	Peters, A. 2012. Blackberry rust fungus: possible new biological control. CCES 213. Oregon State University, Extension Service Coos County. 5 pp.
1489	Peterson, P., S.V. Fowler, and P. Barrett. 2004. Is the poor establishment and performance of heather beetle in Tongariro National Park due to the impact of parasitoids, predators or disease? New Zealand Plant Protection 57: 89-93.
1490	Pettey, F.W. 1948. The biological control of prickly pears in South Africa. Science Bulletin, South African Department of Agriculture 271: 163 pp.
1491	Phatak, S.C., M.B. Callaway, and C.S. Vavrina. 1987. Biological control and its integration in weed management systems for purple and yellow nutsedge (*Cyperus rotundus* and *C. esculentus*). Weed Technology 1: 84-91.
1492	Phatak, S.C., D.R. Sumner, H.D. Wells, D.K. Bell, and N.C. Glaze. 1983. Biological control of yellow nutsedge with the indigenous rust fungus *Puccinia canaliculata*. Science, New Series 219(4591): 1446-1447.
1493	Philip, B.A., C.J. Winks, P.W. Joynt, and O.R.W. Sutherland. 1988. Current status of biological control of alligator weed in New Zealand. *In* A.J. Popay, Ed. Proceedings of the 41st New Zealand Weed and Pest Control Conference. 9-11 August 1988, Auckland, New Zealand; New Zealand Weed and Pest Control Society Inc. pp. 61-65.

Code	Reference
1494	Phiri, G. 1997. (personal communication) CAB International Institute of Biological Control, PO Box 76520, Nairobi, Kenya.
1495	Phiri, G., L. Navarro, M. Bashir, C. Cilliers, O. Diop, Y. Fayad, and A. Khattab. 2000. Water-hyacinth management capability in AME: key issues emerging from surveys and case studies. *In* L. Navarro and G. Phiri, Eds. Water Hyacinth in Africa and Middle East. IDRC, Canada. pp. 45-64.
1496	Phiri, P.M., R.K. Day, S. Chimatiro, M.P. Hill, M.J.W. Cock, M.G. Hill, and E. Nyando. 2001. Progress with biological control of water hyacinth in Malawi. *In* M.H. Julien, M.P. Hill, T.D. Center, and J. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 47-52.
1497	Pierce, W.D. 1919. Contributions to our knowledge of the weevils of super-family Curculionoidea. Proceedings of the Entomological Society of Washington 21(2): 21-36.
1498	Pieterse, A.H., M. Kettunen, S. Diouf, I. Ndao, K. Sarr, A. Tarvainen, S. Kloff, and S. Hellsten. 2003. Effective biological control of *Salvinia molesta* in the Senegal River by means of the weevil *Cyrtobagous salviniae*. Ambio 32(7): 458-462.
1499	Pieterse, A.H., A. Mangane, M. Traoré, G. van de Klashorst, and P.J. van Rijn. 1996. The water hyacinth problem in West Africa and proposals for control strategies. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 47-55.
1500	Piggin, C.M. and A.W. Sheppard. 1995. *Echium plantagineum* L. *In* R.H. Groves, R.C.H. Shepherd, and R.G. Richardson, Eds. The Biology of Australian Weeds. Vol. 1. R.G. and F.J. Richardson, Melbourne. pp. 87-110.
1501	Piper, G.L. 1985. Biological control of weeds in Washington: status report. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 817-826.
1502	Piper, G.L. 1997. (personal communication) Washington State University, Department of Entomology, Pullman, Washington 99164-6382, United States of America.
1503	Piper, G.L. 2004. St. Johnswort, *Hypericum perforatum*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 322-334.
1504	Piper, G.L. and L.A. Andres. 1995. Canada thistle. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 233-236.
1505	Piper, G.L. and L.A. Andres. 1995. Rush skeletonweed. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 252-255.
1506	Piper, G.L. and E.M. Coombs. 2004. Thistles. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 345-378.
1507	Piper, G.L., E.M. Coombs, B. Blossey, P.B. McEvoy, and S. Schooler. 2004. Purple loosestrife, *Lythrum salicaria*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 281-292.
1508	Piper, G.L., E.M. Coombs, G.P. Markin, and D.B. Joley. 2004. Rush skeletonweed, *Chondrilla juncea*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 293-303.
1509	Piper, G.L. and S.S. Rosenthal. 1995. Diffuse knapweed. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 237-241.
1510	Pitan, O.O.R., J.A. Odebiyi, T.A. Akinlosotu, T. Hassan, and G. Nwamsat. 2006. Importation, releases and establishment of *Neochetina eichhorniae* Warner (Coleoptera: Curculionidae) for the biological control of water hyacinth (*Eichhornia crassipes*) in Nigerian waters. ASSET Series A 6(1): 89-102.
1511	Pitcairn, M. 2004. Russian thistle, *Salsola tragus*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 304-310.
1512	Pitcairn, M. 2013. (personal communication) California Department of Food and Agriculture, Biological Control Program, 3288 Meadowview Road, Sacramento, California 95832 USA.
1513	Pitcairn, M.J., G.L. Piper, and E.M. Coombs. 2004. Yellow starthistle, *Centaurea solstitialis*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco Jr., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 421-435.

Code	Reference
1514	Pitcairn, M.J., B. Villegas, D.M. Woods, R. Yacoub, and D.B. Joley. 2008. Evaluating implementation success for seven seed head insects on *Centaurea solstitialis* in California, USA. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 610-616.
1515	Pitcairn, M.J., D.M. Woods, and V. Popescu. 2005. Update on the long-term monitoring of the combined Impact of biological control Insects on yellow starthistle. *In* D.M. Woods, Ed. Biological Control Program 2004 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, CA. pp. 27-30.
1516	Pitt, W.M., K. Bailey, Y.-B. Fu, and G.W. Peterson. 2012. Biological and genetic characterization of *Phoma macrostoma* isolates with bioherbicidal activity. Biocontrol Science and Technology 22(7): 813-835.
1517	Podlussány, A. 2001. Curculionoid beetle species new for the fauna of Hungary (Coleoptera: Curculionoidea). Folia Entomologica Hungarica 62: 372-378.
1518	Poinar, G.O.J. 1964. Observations on nutgrass insects in Hawaii with notes on the host range of *Bactra truculenta* Meyrick and *Athesapeuta cyperi* Marshall. Proceedings of the Hawaiian Entomological Society 18: 417-423.
1519	Politis, D.J. and W.L. Bruckart. 1984. *Puccinia carduorum*, a potential biocontrol agent of musk thistle. Abstract. Phytopathology 73: 822.
1520	Poltavsky, A.N., V.I. Shchurov, and K.S. Artokhin. 2008. The introduction, establishment, and spread of the olive-shaded bird-dropping moth, *Tarachidia candefacta* (Hübner, 1831) (Lepidoptera, Noctuidae), in southern Russia and the Ukraine. Entomological News 119(5): 531-536.
1521	Popay, A.I., L.A. Lyttle, D.K. Edmonds, and H.T. Phung. 1984. Incidence of the nodding thistle receptacle weevil on nodding and slender winged thistles. *In* M.J. Hartley, Ed. Proceedings of the 37th New Zealand Weed and Pest Control Conference. 1984, Christchurch, New Zealand; New Zealand Weed and Pest Control Society Inc. pp. 28-32.
1522	Post, J.A., C.A. Kleinjan, J.H. Hoffmann, and F.A.C. Impson. 2010. Biological control of *Acacia cyclops* in South Africa: the fundamental and realized host range of *Dasineura dielsi* (Diptera: Cecidomyiidae). Biological Control 53: 68-75.
1523	Potter, K.J.B., J.E. Ireson, and G.R. Allen. 2007. Survival of larvae of the ragwort flea beetle, *Longitarsus flavicornis* (Coleoptera: Chrysomelidae), in water-logged soil. Biocontrol Science and Technology 17(7): 765-770.
1524	Powell, J.A. 1991. Rapid colonization of the western United States by the palearctic moth, *Agonopterix alstroemeriana* (Oecophoridae). Journal of the Lepidopterists' Society 45: 234-236.
1525	Powell, R.D. and J.H. Myers. 1988. The effect of *Sphenoptera jugoslavica* Obenb. (Col., Buprestidae) on its host plant *Centaurea diffusa* Lam. (Compositae). Journal of Applied Entomology 106: 25-45.

Code	Reference
1526	Pratt, C. and L. Hill. 2011. Biological control of fairy fern, *Azolla filiculoides*, using the North American weevil *Stenopelmus rufinasus*. *In* CABI Annual Report, Europe UK 2010. CABI, Egham, U.K. pp. 22.
1527	Pratt, P.D. 2010. Establishment and spread of *Lophodiplosis trifida*, a biological control agent of the invasive tree *Melaleuca quinquenervia*. Abstract. *In* 58th Annual Meeting of the Entomological Society of America. 12-15 December, San Diego, California; Entomological Society of America.
1528	Pratt, P.D. 2013. (personal communication) United States Department of Agriculture, Agricultural Research Service, Invasive Plant Research Laboratory, 3225 College Ave. Fort Lauderdale, FL 33314 USA.
1529	Pratt, P.D. and T.D. Center. 2011. Biocontrol without borders: the unintended spread of introduced weed biological control agents. Biocontrol 57(2): 319-329.
1530	Pratt, P.D., T.D. Center, M.B. Rayamajhi, and T.K. Van. 2004. Melaleuca, *Melaleuca quinquenervia*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 268-275.
1531	Pratt, P.D., E.M. Coombs, and B.A. Croft. 2003. Predation by phytoseiid mites on *Tetranychus lintearius* (Acari: Tetranychidae), an established weed biological control agent of gorse (*Ulex europaeus*). Biological Control 26: 40-47.
1532	Pratt, P.D., M.B. Rayamajhi, L. Bernier, and T.D. Center. 2006. Geographic range expansion of *Boreioglycaspis melaleucae* (Hemiptera: Psyllidae) to Puerto Rico. Florida Entomologist 89(4): 529-531.
1533	Pratt, P.D., M.B. Rayamajhi, and T.D. Center. 2008. Geographic range expansion of *Oxyops vitiosa* (Coleoptera: Curculionidae) to the Bahamian Archipelago. Florida Entomologist 91(4): 695-697.
1534	Preston, R.E. and M. Wetherwax. 2011. *L. dalmatica* (L.) Mill, subsp. *dalmatica*, Dalmatian toadflax. *In* Jepson Flora Project. Jepson eFlora, http://http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=51304. 2 January 2013.
1535	Procter, D.L.C. 1984. Biological control of the aquatic weed *Salvinia molesta* D.S.Mitchell in Botswana using the weevils *Cyrtobagous singularis* and *Cyrtobagous* sp. nov. Botswana Notes and Records 15: 99-101.
1536	Progar, R.A., G. Markin, J. Milan, T. Barbouletos, and M.J. Rinella. 2011. Population dynamics and impacts of the red-headed leafy spurge stem borer on leafy spurge (*Euphorbia esula*). Invasive Plant Science and Management 4: 183-188.
1537	Pühringer, F. and A. Kallies. 2004. Provisional checklist of the Sesiidae of the world (Lepidoptera: Ditrysia). Mitt. Ent. Arb.gem. Salzkammergut 4: 1-85.

Code	Reference
1538	Puliafico, K.P., J.L. Littlefield, G.P. Markin, and U. Schaffner. 2008. Field and laboratory observations of the life history of the Swiss biotype of *Longitarsus jacobaeae* (Coleoptera: Chrysomelidae). *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 200-205.
1539	Purea, M. 1981. (personal communication) Ministry of Agriculture and Fisheries, P.O. Box 96, Rarotonga, Cook Islands.
1540	Puttler, B., S.H. Long, and E.J. Peters. 1978. Establishment in Missouri of *Rhinocyllus conicus* for the biological control of musk thistle. Weed Science 26: 188-190.
1541	Quarles, W. 2010. Alternative herbicides in turfgrass and organic agriculture. The IPM Practitioner 32(5/6): 1-16.
1542	Rabindra, J. and B. Bhumannavar. 2009. Biological control of weeds in India. *In* R. Muniappan, A. Raman, and G.V.P. Reddy, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, U.K. pp. 438-452.
1543	Racelis, A.E., J.A. Goolsby, and P. Moran. 2009. Seasonality and movement of adventive populations of the Arundo wasp (Hymenoptera: Eurytomidae), a biological control agent of giant reed in the Lower Rio Grande Basin in South Texas. Southwestern Entomologist 34(4): 347-357.
1544	Radford, I.J., D.M. Nicholas, and J.R. Brown. 2001. Assessment of the biological control impact of seed predators on the invasive shrub *Acacia nilotica* (Prickly Acacia) in Australia. Biological Control 20: 261-268.
1545	Raghu, S., C. Wiltshire, and K. Dhileepan. 2005. Intensity of pre-dispersal seed predation in the invasive legume *Leucaena leucocephala* is limited by the duration of pod retention. Austral Ecology 30: 310-318.
1546	Rao, R. 1920. Lantana insects in India. *In* Memoirs, Department of Agriculture in India. Entomology Series. India Imperial Department of Agriculture, Calcutta. pp. 239-314.
1547	Rao, V.P. 1971. Biological control of pests in Fiji. Miscellaneous Publication 2. Commonwealth Institute of Biological Control, Farnham Royal, England. 38 pp.
1548	Rao, V.P., M.A. Ghani, T. Sankaran, and K.C. Mathur. 1971. Review of biological control of insects and other pests in Southeast Asia and the Pacific region. Technical Communication No. 6. Commonwealth Institute of Biological Control, Farnham Royal, England. 149 pp.
1549	Rayachhetry, M.B., M.L. Elliott, and T.K. Van. 1997. Natural epiphytotic of the rust *Puccinia psidii* on *Melaleuca quin-quenervia* in Florida. Plant Disease 81(7): 831.
1550	Rayachhetry, M.B., T.K. Van, T.D. Center, and M.L. Elliott. 2001. Host range of *Puccinia psidii,* a potential biological control agent of *Melaleuca quinquenervia* in Florida. Biological Control 22: 38-45.

Code	Reference
1551	Rayamajhi, M.B., P.B. Pratt, T.D. Center, and T.K. Van. 2010. Insects and a pathogen suppress *Melaleuca quinquenervia* cut-stump regrowth in Florida. Biological Control 53(1): 1-8.
1552	Razowski, J. and J.W. Brown. 2008. New species, new combinations, and new synonymies in *Neotropical episimus* Walsingham, 1892 (Lepidoptera: Tortricidae: Olethreutinae). Acta Zoologica Cracoviensia 51B(1-2): 83-144.
1553	Reddy, G.V.P. 2013. (personal communication) Montana State University, Western Triangle Ag Research Center, 9546 Old Shelby Rd, Conrad, MT 59425 USA.
1554	Reddy, G.V.P., Z.T. Cruz, and R. Muniappan. 2009. Life-history, host preference and establishment status of *Melittia oedipus* (Lepidoptera: Sesiidae), a biological control agent for *Coccinia grandis* (Curcubitaceae) in the Mariana Islands. Plant Protection Quarterly 24(1): 27-31.
1555	Redmon, S.G., T.G. Forrest, and G.P. Markin. 2000. Biology of *Bruchidius villosus* (Coleoptera: Bruchidae) on Scotch broom in North Carolina. Florida Entomologist 83(3): 242-253.
1556	Reed, C.C., D.L. Larson, and J.L. Larson. 2006. Canada thistle biological control agents on two South Dakota wildlife refuges. Natural Areas Journal 26(1): 47-52.
1557	Rees, N.E. 1977. Impact of *Rhinocyllus conicus* on thistles in southwestern Montana. Environmental Entomology 6: 839-842.
1558	Rees, N.E. 1990. Establishment, dispersal, and influence of *Ceutorhynchus litura* on Canada thistle (*Cirsium arvense*) in the Gallatin Valley of Montana. Weed Science 38: 198-200.
1559	Rees, N.E., Q.P.C. Jr, G.L. Piper, E.M. Coombs, C.E. Turner, N.R. Spencer, and L.V. Knutson. 1996. Biological Control of Weeds in the West. Western Society of Weed Science, Bozeman, Montana.
1560	Rees, N.E., R.W. Pemberton, A. Rizza, and P. Pecora. 1986. First recovery of *Oberea erythrocephala* on the leafy spurge complex in the United States. Weed Science 34: 395-397.
1561	Reimer, N.J. 1988. Predation on *Liothrips urichi* Karny (Thysanoptera: Phlaeothripidae): A case of biotic interference. Environmental Entomology 17(1): 132-134.
1562	Reimer, N.J. and J.W. Beardsley. 1986. Some notes on parasitization of *Blepharomastix ebulealis* (Guenee) (Lepidoptera: Pyralidae) in Oahu Forests. Proceedings of the Hawaiian Entomological Society 27: 91-93.
1563	Reimer, N.J. and J.W.J. Beardsley. 1989. Effectiveness of *Liothrips urichi* (Thysanoptera: Phlaeothripidae) introduced for biological control of *Clidemia hirta* in Hawaii. Environmental Entomology 18: 1141-1146.
1564	Reznik, S.Y. 1991. The effects of feeding damage in ragweed *Ambrosia artemisiifolia* (Asteraceae) on populations of *Zygogramma suturalis* (Coleoptera, Chrysomelidae). Oecologia 88: 204-210.

Code	Reference
1565	Reznik, S.Y. 1996. Classical biocontrol of weeds in crop rotation: a story of failure and prospects for success. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 503-506.
1566	Reznik, S.Y. 2000. What we learned from the failure of the ragweed leaf beetle in Russia. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 195-196.
1567	Reznik, S.Y. 2009. Common ragweed (*Ambrosia artemisiifolia* L.) in Russia: spread, distribution, abundance, harmfulness and control measures. Ambroisie, the first international ragweed review 26: 88-97.
1568	Reznik, S.Y. 2013. (personal communication) Zoological Institute, Universitetskaya nab., 1, St. Petersburg 199034 Russia.
1569	Reznik, S.Y., I.A. Spasskaya, M.Y. Dolgovskaya, M.G. Volkovitsh, and V.F. Zaitzev. 2008. The ragweed leaf beetle *Zygogramma suturalis* F. (Coleoptera: Chrysomelidae) in Russia: current distribution, abundance and implication for biological control of common ragweed, *Ambrosia artemisiifolia* L. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 614-619.
1570	Richards, K. 1986. (personal communication) Department of Agriculture, South Perth, Western Australia 6151, Australia.
1571	Ridings, W.H., D.J. Mitchell, C.L. Schoulties, and N.E. El-Gholl. 1978. Biological control of milkweed vine in Florida citrus groves with a pathotype of *Phytophthora citrophthora*. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 224-240.
1572	Rieder, J.P., E.W. Evans, and S.L. Durham. 2001. Distribution of insect attacks in biological control of weeds: Infestation of *Centaurea virgata* flowerheads by a gall fly. Biological Control 20(3): 254-260.
1573	Ring, R.A., N.N. Winchester, and I.V. MacRae. 2002. *Myriophyllum spicatum* L., Eurasian water milfoil (Haloragaceae). *In* P.G. Mason and J.T. Huber, Eds. Biological Control Programmes in Canada 1981-2000. CAB International, Wallingford, U.K. pp. 402-407.
1574	Roberts, K. 2003. A natural cure for Paterson's curse. Australian Organic Journal Winter 2003: 37.
1575	Roberts, L.I.N. and O.R.W. Sutherland. 1989. *Alternanthera philoxeroides* (C. Martius) Grisebach, alligator weed (Amaranthaceae). *In* P.J. Cameron, R.L. Hill, J. Bain, and W.P. Thomas, Eds. A review of biological control of invertebrate pests and weeds in New Zealand 1874 to 1987. CAB International, London. pp. 325-330.

Code	Reference
1576	Roberts, L.I.N., C.J. Winks, O.R.W. Sutherland, and R.A. Galbreath. 1984. Progress of biological control of alligator weed in New Zealand. *In* M.J. Hartley, Ed. Proceedings of the 37th New Zealand Weed and Pest Control Conference. 1984, Christchurch, New Zealand; New Zealand Weed and Pest Control Society Inc. pp. 50-54.
1577	Robinson, A.F., C.C. Orr, and J.R. Abernathy. 1978. Distribution of *Nothanguina phyllobia* and its potential as a biological control agent of silverleaf nightshade. Journal of Nematology 10: 362-366.
1578	ROBO Database. 2012. Release of beneficial organisms in the United States and Territories. USDA ARS. www.ars-grin.gov/nigrp/robo.html. 10 September 2012.
1579	Robson, N.K. 1990. Studies in the genus *Hypericum* L. (Guttiferae) 8. Sections 29. *Brathys* (part 2) and 20. *Trigynobrathys*. Bulletin of the British Museum (Natural History) 20: 1-151.
1580	Roché, C.T. and B.F.J. Roché. 1989. Introductory notes on squarrose knapweed (*Centaurea virgata* Lam. ssp. *squarrosa* Gugl.). Northwest Science 63: 246-252.
1581	Roda, A.L. 2012. (personal communication) United States Department of Agriculture, Agricultural Research Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology, 13601 Old Cutler Rd. Miami, FL 33158.
1582	Rodríguez, N.S. 2012. (personal communication) Universidad Autonoma Metropolitana Xochimilco, Departamento de Producción Agrícola y Animal, Calzada del Hueso No. 1100, Col. Villa Quietud, CP 04960, México.
1583	Rodríguez, N.S., A.M. Flores, and G.M. Torres. 2008. Evaluation of infesting field bindweed (*Convolvulus arvensis* L.) with *Aceria malherbae* Nuzzaci (Acari: Eriophyidae) under glasshouse conditions. International Journal of Acarology 34(2): 151-154.
1584	Rodríguez, S. 2004. Biological control of field bindweed (*Convolvulus arvensis* L.) using *Aceria malherbae* (Acari: Eriophyidae) in Mexico. International Journal of Acarology 30(2): 153.
1585	Roehrdanz, R., R. Bourchier, A. Cortilet, D. Olson, and S. Sears. 2011. Phylogeny and genetic diversity of flea beetles (*Aphthona* sp.) introduced to North America as biological control agents for leafy spurge. Annals of the Entomological Society of America 104: 966-975.
1586	Roehrdanz, R., D. Olson, G. Fauske, R. Bourchier, A. Cortilet, and S. Sears. 2009. New DNA markers reveal presence of *Aphthona* species (Coleoptera: Chrysomelidae) believed to have failed to establish after release into leafy spurge. Biological Control 49: 1-5.
1587	Room, P.M. 1991. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, Long Pocket Laboratories, Private Bag No. 3, Indooroopilly, Queensland 4068, Australia.

Code	Reference
1588	Room, P.M. and I.V.S. Fernando. 1992. Weed invasions countered by biological control: *Salvinia molesta* and *Eichhornia crassipes* in Sri Lanka. Aquatic Botany 42: 99-107.
1589	Room, P.M., I.W. Forno, and M.F.J. Taylor. 1984. Establishment in Australia of two insects for the biological control of the floating weed *Salvinia molesta.* Bulletin of Entomological Research 74: 505-516.
1590	Room, P.M., G.A. Gunatilaka, P. Shivanathan, and I.V.S. Fernando. 1989. Control of *Salvinia molesta* in Sri Lanka by *Cyrtobagous salviniae*. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 285-290.
1591	Room, P.M., K.L.S. Harley, I.W. Forno, and D.P.A. Sands. 1981. Successful control of the floating weed salvinia. Nature 294: 78-80.
1592	Room, P.M., M.H. Julien, and I.W. Forno. 1989. Vigorous plants suffer most from herbivores: latitude, nitrogen and biological control of the weed *Salvinia molesta*. Oikos 54: 92-100.
1593	Room, P.M. and P.A. Thomas. 1985. Nitrogen and establishment of a beetle for biological control of the floating weed *Salvinia molesta* in Papua New Guinea. Journal of Applied Ecology 22: 139-156.
1594	Rose, R. 2009. Eradication of South America cactus moth, *Cactoblastis cactorum*, from 11 Parishes in Southeastern Louisiana. Environmental Assessment, September 2008. 34 pp.
1595	Rosenthal, S.S. 1995. Field Bindweed. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 286-288.
1596	Rosenthal, S.S., E.M. Coombs, B. Haglan, and G.L. Piper. 1993. Use of critical nontarget plants by the Russian knapweed nematode, (*Subanguina picridis*). Weed Technology 7: 759-762.
1597	Rosenthal, S.S. and G.L. Piper. 1995. Russian knapweed. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 256-257.
1598	Rosenthal, S.S. and B.E. Platts. 1990. Host specificity of *Aceria (Eriophyes) malherbe*, (Acari: Eriophyidae), a biological control agent for the weed *Convolvulus arvensis* (Convolvulaceae). Entomophaga 35: 459-463.
1599	Routley, B.M. and L.A. Wirf. 2006. Advancements in biocontrol of *Mimosa pigra* in the Northern Territory. *In* C. Preston, J.H. Watts, and N.D. Crossman, Eds. Proceedings of the 15th Australian Weeds Conference. 24-28 September 2006, Adelaide, South Australia; Weed Management Society of South Australia. pp. 561-564.
1600	Rowe, D.J. and L.T. Kok. 1984. Potential of *Rhinocyllus conicus* to adapt to the plumeless thistle, *Carduus acanthoides*, in Virginia. Virginia Journal of Science 35: 192-196.
1601	Sagliocco, J.L., A. Sheppard, J. Hosking, P. Hodge, Q. Paynter, H. Gourlay, and J. Ireson. 2013. Host specificity testing, release and successful establishment of the broom gall mite *Aceria genistae* in Australia and New Zealand for the biological control of broom (*Cytisus scoparius*). *In* Y. Wu, T. Johnson, S. Sing, S. Raghu, G. Wheeler, P. Pratt, K. Warner, T. Center, J. Goolsby, and R. Reardon, Eds. Proceedings of the XIII International Symposium on Biological Control of Weeds. 11-16 September 2011, Kohala Coast, Hawaii, USA; Forest Health Technology Enterprise Team, Morgantown, WV, USA. pp. 409-416.
1602	Sagliocco, J.-L., R.M. Kwong, and T.B. Morley. 2012. *Cirsium vulgare* (Savi) Ten. - spear thistle. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 184-189.
1603	Sandler, H. 2008. Dodder Management without Kerb. May 2008. Cranberry Station Newsletter, University of Massachusetts Extension. 2 pp.
1604	Sands, D.P.A. and R.C. Kassulke. 1983. *Acigona infusella* (Walker) (Lepidoptera: Pyralidae), an agent for biological control of waterhyacinth (*Eichhornia crassipes*) in Australia. Bulletin of Entomological Research 73: 625-632.
1606	Sankaran, K.V., K.C. Puzari, C.A. Ellison, P.S. Kumar, and U. Dev. 2008. Field release of the rust fungus *Puccinia spegazzinii* to control *Mikania micrantha* in India: protocols and awareness raising. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International.
1607	Sankaran, T. 1973. Biological control of weeds in India. A review of introductions and current investigations of natural enemies. *In* P.H. Dunn, Ed. Proceedings of the II International Symposium on Biological Control of Weeds. 4-7 October 1971, Rome, Italy; CAB. pp. 82-88.
1608	Sankaran, T. 1979. (personal communication) Commonwealth Institute of Biological Control, Bellary Road, P.O. Box 603, Bangalore, 560 006, India.
1609	Santis, L.d., N.C. Monetti, and A.E.d. Briano. 1987. Natural enemies of *Rhinocyllus conicus* (Froelich, 1792) (Coleoptera: Curculionidae), a biological control agent of *Carduus thoermeri* Kazmi and *Carduus acanthoides* L. (Compositae) in Castelar, Buenos Aires Province, Argentina. Revista de Investigación - Centro de Investigaciones para la Regulación de Poblaciones de Organismos Nocivos 5(1-4): 27-35.
1610	Sasakawa, M. 1963. Oriental Agromyzidae (Diptera) in Bishop Museum, Part 1. Pacific Insects 5(1): 23-50.
1611	Sasakawa, M. 1963. A revision of Polynesian Agromyzidae (Diptera). Pacific Insects 5(3): 489-506.

Code	Reference
1612	Satheesan, N.V., K.R. Lyla, P.J. Joy, and D. Joseph. 1987. Establishment of *Pareuchaetes pseudoinsulata* Rego Barros (= *Ammalo insulata* Walk.), an arctiid caterpillar, for the biological control of *Chromolaena odorata*. Agricultural Research Journal, Kerala 25: 142-143.
1613	Schaffner, U. 2013. (personal communication) CABI, Rue des Grillons 1, CH-2800 Delémont, Switzerland.
1614	Schaffner, U., M. Cristofaro, C. Krebs, and G. Grosskopf. 2010. Biological control of Russian knapweed, *Acroptilon repens*. Annual Report 2009. CABI Europe - Switzerland. 24 pp.
1615	Schat, M., S.E. Sing, R.K.D. Peterson, F.D. Menalled, and D.K. Weaver. 2011. Growth inhibition of Dalmatian toadflax, *Linaria dalmatica* (L.) Miller, in response to herbivory by the biological control agent *Mecinus janthinus* Germar. Journal of Entomological Science 46(3): 232-246.
1616	Scheele, S.M. and P. Syrett. 1987. The broom twigminer, *Leucoptera spartifoliella* (Lepidoptera: Lyonetiidae) in New Zealand. New Zealand Entomologist 10: 133-137.
1617	Scheffer, S.J. and E.E. Grissell. 2003. Tracing the geographical origin of *Megastigmus transvaalensis* (Hymenoptera: Torymidae): an African wasp feeding on a South American plant in North America. Molecular Ecology 12: 415-421.
1618	Scheibelreiter, G.K. 1980. Biological control of *Lantana camara* L. (Verbenaceae) in Ghana. Zeitschrift für Angewandte Entomologie 90: 99-103.
1619	Schlettwein, C.H.G. 1985. Distribution and densities of *Cyrtobagous singularis* Hustache (Coleoptera: Curculionidae) on *Salvinia molesta* Mitchell in the Eastern Caprivi Zipfel. Madoqua 14: 291-293.
1620	Schlettwein, C.H.G. and P.F. Hamman. 1984. The control of *Salvinia molesta* in the Eastern Caprivi Zipfel. South West Africa Annual: 49-51.
1621	Schmidl, L. 1972. Studies on the control of ragwort, *Senecio jacobaea* L., with the cinnabar moth, *Callimorpha jacobaeae* (L.) (Arctiidae: Lepidoptera), in Victoria. Weed Research 12: 46-57.
1622	Schmidl, L. 1981. Ragwort, *Senecio jacobaea* L. in Victoria and renewed attempts to establish the cinnabar moth, *Tyria jacobaeae* L. for its control. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 603-607.
1623	Schooler, S.S. 2013. (personal communication) University of Wisconsin-Superior, Lake Superior National Estuarine Research Reserve, 14 Marina Drive, Superior, WI 54880 USA.
1624	Schooler, S.S., E.M. Coombs, and P.B. McEvoy. 2003. Nontarget effects on crepe myrtle by *Galerucella pusilla* and *G. calmariensis* (Chrysomelidae), used for biological control of purple loosestrife (*Lythrum salicaria*). Weed Science 51(3): 449-455.

Code	Reference
1625	Schooler, S.S., W.A. Palmer, and L. Morin. 2012. *Ageratina riparia* (Regel) K. and R. - mistflower. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 33-42.
1626	Schooler, S.S., B. Salau, M.H. Julien, and A.R. Ives. 2011. Alternative stable states explain unpredictable biological control of *Salvinia molesta* in Kakadu. Nature 470: 86-89.
1627	Schreiner, I. 1989. Biological control introductions in the Caroline and Marshall Islands. Proceedings of the Hawaiian Entomological Society 29: 57-69.
1628	Schroder, D. 1980. The biological control of thistles. Biocontrol News and Information 1: 9-26.
1629	Schwarzländer, M. 2000. Host specificity of *Longitarsus quadriguttatus* Pont., a below-ground herbivore for the biological control of houndstongue. Biological Control 18: 18-26.
1630	Schwarzländer, M. 2013. (personal communication) University of Idaho, Department of Plant, Soil and Entomological Sciences, 875 Perimeter Drive, MS 2339 Moscow, ID 83844-2339 USA.
1631	Scott, J.K. 2012. *Tribulus terrestris* L. - caltrop. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 576-580.
1632	Scott, J.K. and J.L. Sagliocco. 1991. *Chamaesphecia doryliformis* (Lep.: Sesiidae), a second root borer for the control of *Rumex* spp. (Polygonaceae) in Australia. Entomophaga 36: 245-251.
1633	Scott, J.K. and P.B. Yeoh. 2005. Biology and host specificity of *Apion miniatum* (Coleoptera: Apionidae) from Israel, a potential biological control agent for *Emex australis* and *Emex spinosa* (Polygonaceae) in Australia. Biological Control 33: 20-31.
1634	Scudder, G.G.E. and R.A. Cannings. 2007. The Lepidoptera Families and Associated Orders of British Columbia. *In* B. Klinkenberg, Ed. E-Fauna BC: Electronic Atlas of the Fauna of British Columbia. University of British Columbia, www.efauna.bc.ca. 21 May 2013.
1635	Seasted, T.R., D.G. Knochel, M. Garmoe, and S.A. Shosky. 2007. Interactions and effects of multiple biological control insects on diffuse and spotted knapweed in the Front Range of Colorado. Biological Control 42: 345-354.
1636	Seeno, T.N. 1997. (personal communication) California Department of Food and Agriculture, Plant Pest Diagnostics Branch, California, United States of America (from collection records housed in the California State Collection of Arthropods).
1637	Segarra-Carmona, A.E., A. Ramírez-Lluch, I. Cabrera-Asencio, and A.N. Jiménez-López. 2010. First report of a new invasive mealybug, the Harrisia cactus mealybug *Hypogeococcus pungens* (Hemiptera: Pseudococcidae). Journal of Agriculture of the University of Puerto Rico 94(1/2): 183-187.

Code	Reference
1638	Seibert, F. 1989. Biological control of the weed, *Chromolaena odorata* (Asteraceae) by *Pareuchaetes pseudoinsulata* (Lep.: Arctiidae) on Guam and the Northern Mariana Islands. Entomophaga 34: 531-539.
1639	Seier, M.K. and H.C. Evans. 1996. Two fungal pathogens of Mimosa pigra var. pigra from Mexico: the finishing touch for biological control of this weed in Australia? *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch South Africa; University of Cape Town Press. pp. 87-92.
1640	Senaratne, K.A.D.W., W.A. Palmer, and R.W. Sutherst. 2006. Use of CLIMEX modeling to identify prospective areas for exploration to find new biological control agents for prickly acacia. Australian Journal of Entomology 45: 298-302.
1641	Senaratne, W. 2012. (personal communication) Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia.
1642	Shabana, Y.M. 2005. The use of oil emulsions for improving the efficacy of *Alternaria eichhorniae* as a mycoherbicide for waterhyacinth (*Eichhornia crassipes*). Biological Control 32: 78-89.
1643	Shabana, Y.M., M.A. Elwakii, and R. Charudattan. 2001. Biological control of water hyacinth by a mycoherbicide in Egypt. *In* M.H. Julien, M.P. Hill, T.D. Center, and J.Q. Ding, Eds. Proceedings of the 2nd Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth. 9-12 October 2000, Beijing, China; Australian Center for International Agricultural Research. pp. 53-56.
1644	Shambaugh, B. 2009. Salt cedar biological control in Wyoming using *Diorhabda elongata*, the saltcedar leaf beetle. Missouri River Watershed Coalition. United States Department of Agriculture, Animal and Plant Health Inspection Service, Spearfish, South Dakota, USA. 37 pp.
1645	Sharkey, M., A. Arthur, J.R. Baars, G. Bisdee, C. Yoshimoto, and J. Barron. 1987. The parasitic Hymenoptera associated with sunflower (*Helianthus* spp.) in mid-western Canada. The Canadian Entomologist 119: 611-628.
1646	Sharratt, M.E.J. and T. Olckers. 2012. The biological control agent *Acanthoscelides macrophthalmus* (Chrysomelidae: Bruchinae) inflicts moderate levels of seed damage on its target, the invasive tree *Leucaena leucocephala* (Fabaceae), in the KwaZulu-Natal coastal region of South Africa. African Entomology 20(1): 44-51.
1647	Shaw, R.H. 2013. (personal communication) CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, United Kingdom.
1648	Shaw, R.H., S. Bryner, and R. Tanner. 2009. The life history and host range of of the Japanese knotweed psyllid, *Aphalara itadori* Shinji: Potentially the first classical biological weed control agent for the European Union. Biological Control 49: 105-113.
1649	Shaw, R.H., R. Tanner, D. Djeddour, and G. Cortat. 2011. Classical biological control of *Fallopia japonica* in the United Kingdom - lessons for Europe. Weed Research 51(6): 552-558.

Code	Reference
1650	Shea, K. and D. Kelly. 2004. Estimating biocontrol agent impact with matrix models: *Carduus nutans* in New Zealand. Ecological Applications 8(3): 824-832.
1651	Shea, K., M. Smyth, A. Sheppard, R. Morton, and J. Chalimbaud. 2000. Effect of patch size and plant density of Paterson's curse (*Echium plantagineum*) on the oviposition of a specialist weevil, *Mogulones larvatus*. Oecologia 124(4): 614-621.
1652	Sheat, J.J., H.M. Harman, and P. Syrett. 1996. Progress towards establishment of a seed beetle, *Bruchidius villosus*, for biological control of broom (*Cytisus scoparius*) in New Zealand. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 419.
1653	Sheldon, S.P. and R.P. Creed Jr. 2003. The effect of a native biological control agent for Eurasian watermilfoil on six North American watermilfoils. Aquatic Botany 76: 259-265.
1654	Sheldon, S.P. and R.P.J. Creed. 1995. Use of a native insect as a biological control for an introduced weed. Ecological Applications 5: 1122-1132.
1655	Sheppard, A.W. 1997. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P.O. Box 1700, Canberra, Australian Capital Territory 2601, Australia.
1656	Sheppard, A.W. 2013. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, GPO Box 1700, Canberra, Australian Capital Territory 2601 Australia.
1657	Sheppard, A.W. and K. Henry. 2012. *Genista monspessulana* (L.) L. Johnson - cape broom. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 267-273.
1658	Sheppard, A.W., R.C. Lewis, and E.S. Delfosse. 1993. The establishment of *Uromyces heliotropii* Sred., a biological control agent of *Heliotropium europaeum* L. *In* J.T. Swarbrick, Ed. Proceedings of the 10th Australian and 14th Asian-Pacific Weed Conference. 6-10 September 1993, Brisbane, Queensland, Australia; Weed Society of Queensland. pp. 89-93.
1659	Sheppard, A.W., L. Morin, and J. Cullen. 2012. *Heliotropium europaeum* L. - common heliotrope. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 289-298.
1660	Sheppard, A.W., R.H. Shaw, and R. Sforza. 2006. Top 20 environmental weeds for classical biological control in Europe: a review of opportunities, regulations and other barriers to adoption. Weed Research 46: 93-117.
1661	Sheppard, A.W. and M. Smyth. 2012. *Echium plantagineum* L. - Paterson's curse. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 211-226.

Code	Reference
1662	Sheppard, A.W., M. Smyth, and A. Swirepik. 1999. Impact of the root-crown weevil (*Mogulones larvatus*) and other biocontrol agents on Paterson's curse in Australia: an update. *In* A.C. Bishop, M. Boersma, and C.D. Barnes, Eds. Proceedings of the 12th Australian Weeds Conference. 12-16 September 1999, Hobart, Tasmania, Australia; Tasmanian Weeds Society. pp. 343-346.
1663	Shoba, Z. and T. Olckers. 2010. Reassessment of the biology and host range of *Acanthoscelides macrophthalmus* (Chrysomelidae: Bruchinae), a seed-feeding beetle released for the biological control of *Leucaena leucocephala* in South Africa. African Entomology 18(2, Supplement No. 1): 1-9.
1664	Shrestha, B.B. 2012. Parthenium research in Nepal: an update. International Parthenium News 6: 6-8.
1665	Shrestha, B.B. 2013. (personal communication) Tribhuvan University, Central Deptartment of Botany, Kirtipur, PO Box 5275, Kathmandu, Nepal.
1666	Shrestha, B.B., A. Poudel, J. KC, D. Karki, R.D. Gautam, and P.K. Jha. 2010. Fortuitous biological control of *Parthenium hysterophorus* by *Zygogramma bicolorata* in Nepal. Journal of Natural History Museum 25: 333-338.
1667	Shrestha, B.B., K.B. Thapa-Magar, A. Paudel, and U.B. Shrestha. 2011. Beetle on the battle: defoliation of *Parthenium hysterophorus* by *Zygogramma bicolorata* in Kathmandu valley, Nepal. Botanica Orientalis: Journal of Plant Science 8: 100-104.
1668	Simelane, D. 2005. Biological control of *Lantana camara* in South Africa: targeting a different niche with a root-feeding agent, *Longitarsus* sp. Biocontrol 50(2): 375-387.
1669	Simelane, D.O. 2002. Biology and host range of *Ophiomyia camarae*, a biological control agent for *Lantana camara* in South Africa. Biocontrol 47(5): 575-585.
1670	Simelane, D.O. 2007. Influence of soil texture, moisture, and surface cracks on the performance of a root-feeding flea beetle, *Longitarsus bethae* (Coleoptera: Chrysomelidae), a biological control agent for *Lantana camara* (Verbenaceae). Environmental Entomology 36(3): 512-517.
1671	Simelane, D.O. 2010. Potential impact of an introduced root-feeding flea beetle, *Longitarsus bethae*, on the growth and reproduction of an invasive weed, *Lantana camara*. Biological Control 54: 114-118.
1672	Simelane, D.O. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
1673	Simelane, D.O. and M.S. Phenye. 2004. Preliminary assessment of release and establishment of lantana herringbone leafminer, *Ophiomyia camarae* (Diptera: Agromyzidae), in South Africa. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 447-450.

Code	Reference
1674	Simelane, D.O. and M.S. Phenye. 2005. Suppression of growth and reproductive capacity of the weed *Lantana camara* (Verbenaceae) by *Ophiomyia camarae* (Diptera: Agromyzidae) and *Teleonemia scrupulosa* (Heteroptera: Tingidae). Biocontrol Science and Technology 15: 153-163.
1675	Simmonds, F.J. 1949. Initial success of attempts at the biological control of the weed *Cordia macrostachya* (Jacq.) R. and S. in Mauritius. Tropical Agriculture 26: 135-136.
1676	Simmonds, F.J. 1960. Report on a tour of Commonwealth countries. Commonwealth Agricultural Bureau. 108 pp.
1677	Simmonds, F.J. 1967. Biological control of pests of veterinary importance. The Veterinary Bulletin 37: 71-85.
1678	Simmonds, F.J. 1980. Biological control of *Cordia curassavica* (Boraginaceae) in Malaysia. Entomophaga 25: 363-364.
1679	Simmonds, F.J. 1981. Control of *Cordia curassavica* in Sri Lanka. Biocontrol News and Information 2: 2.
1680	Simmonds, F.J. and F.D. Bennett. 1966. Biological control of *Opuntia* spp. by *Cactoblastis cactorum* in the Leeward Islands (West Indies). Entomophaga 11: 183-189.
1681	Simmonds, H.W. 1928. Lantana bug, "*Teleonemia lantanae* Distant". Agricultural Journal of Fiji 1: 16-21.
1682	Simmonds, H.W. 1931. Noxious weeds and their control in Fiji. II. Biological Control. Agricultural Journal of Fiji 4: 29-31.
1683	Simmonds, H.W. 1932. A list of insects introduced into Fiji for the biological control of pests and weeds. Agricultural Journal of Fiji 5: 5-9.
1684	Simmonds, H.W. 1933. The biological control of the weed *Clidemia hirta* D. Don, in Fiji. Bulletin of Entomological Research 24: 345-348.
1685	Simmonds, H.W. 1934. Biological control of noxious weeds with special reference to the plants *Clidemia hirta* (the curse) and *Stachytarpheta jamaicensis* (blue rat tail). Agricultural Journal of Fiji 7: 3-10.
1686	Simmonds, H.W. 1937. The biological control of the weed, *Clidemia hirta* commonly known in Fiji as "the curse". Agricultural Journal of Fiji 8: 37-39.
1687	Sing, S. and R.K.D. Peterson. 2011. Assessing environmental risks for established invasive weeds: Dalmatian (*Linaria dalmatica*) and yellow (*L. vulgaris*) toadflax in North America. International Journal of Environmental Research and Public Health 8: 2828-2853.
1688	Sing, S.E. 2013. (personal communication) United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, 1648 South 7th Avenue – MSU Campus, Bozeman, MT 59717-2780 USA.
1689	Sing, S.E., R.K.D. Peterson, D.K. Weaver, R.W. Hansen, and G.P. Markin. 2005. A retrospective analysis of known and potential risks associated with exotic toadflax-feeding insects. Biological Control 35(3): 276-287.

Code	Reference
1690	Sing, S.E., D.K. Weaver, R.M. Nowierski, and G.P. Markin. 2008. Long-term field evaluation of *Mecinus janthinus* releases against Dalmatian toadflax in Montana (USA). *In* M. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 620-624.
1691	Singh, R.S., R.S. Prasad, and R.K. Solly. 1982. The status of *Neochetina eichhorniae* (Coleoptera Curculionidae) as biological control agent for water hyacinth *Eichhornia crassipes* (Mart) Solms (Fam.: Pontederiaceae) in Fiji. *In* Regional Workshop on Biological Control of Water Hyacinth. May 1982, Bangalore, India. pp. 35-38.
1692	Singh, S.P. 1998. A review of biological suppression of *Chromolaena odorata* (Linnaeus) King and Robinson in India. *In* P. Ferrar, R. Muniappan, and K.P. Jayanth, Eds. Proceedings of the 4th International Workshop on Biological Control and Management of *Chromolaena odorata*. October 1996, Bangalore, India; University of Guam. pp. 86-92.
1693	Singh, S.P. 2004. Some success stories in classical biological control of agricultural pests in India. Apaari Publication 2004/2. Asia-Pacific Association of Agricultural Research Institutions. 80 pp.
1694	Skinner, L.C. and D.W. Ragsdale. 2008. Population dynamics and long-term effects of *Galerucella* spp. on purple loosestrife, *Lythrum salicaria,* and non-target native plant communities in Minnesota. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 643.
1695	Smith, D.R. 1973. Sawflies of Chile: a new genus and species and key to genera of Tenthredinidae (Hymenoptera: Symphyta). Proceedings of the Entomological Society of Washington 75(4): 402-408.
1696	Smith, J.J., D.R. Jones, E. Karamura, G. Blomme, and F.L. Turyagyenda. 2008. An analysis of the risk from *Xanthomonas campestris* pv. *musacearum* to banana cultivation in Eastern, Central and Southern Africa. Bioversity International, Montpellier, France. 35 pp.
1697	Smith, J.M. 1959. Notes on insects especially *Gymnaetron* spp. (Coleoptera: Curculionidae), associated with toadflax, *Linaria vulgaris* Miller (Scrophulariaceae), in North America. The Canadian Entomologist 41: 116-121.
1698	Smith, L., E. de Lillo, and J.W. Amrine Jr. 2010. Effectiveness of eriophyid mites for biological control of weedy plants and challenges for future research. Experimental and Applied Acarology 51(1): 115-149.
1699	Smith, L., G.F. Hrusa, and J.F. Gaskin. 2013. How many species of *Salsola* tumbleweeds (Russian thistle) occur in the Western USA? *In* Y. Wu, T. Johnson, S. Sing, S. Raghu, G. Wheeler, P. Pratt, K. Warner, T. Center, J. Goolsby, and R. Reardon, Eds. Proceedings of the XIII International Symposium on Biological Control of Weeds. 11-16 September 2011, Kohala Coast, Hawaii, USA; Forest Health Technology Enterprise Team, Morgantown, WV, USA. pp. 177.
1700	Smith, L. and M. Mayer. 2005. Field cage assessment of interference among insects attacking seed heads of spotted and diffuse knapweed. Biocontrol Science and Technology 15(5): 427-442.
1701	Smith, L. and J.M. Story. 2003. Plant size preference of *Agapeta zoegana* L. (Lepidoptera: Tortricidae), a root-feeding biological control agent of spotted knapweed. Biological Control 26: 270-278.
1702	Smith, L.A. 2013. (personal communication) Land Care Research, Biodiversity and Conservation, P.O. Box 69040, Lincoln 7640 New Zealand.
1703	Smith, R.J.J. 1986. Biological control of northern jointvetch (*Aeschynomene virginica*) in rice (*Oryza sativa*) and soybean (*Glycine max*) - a researcher's view. Weed Science 34 (Supplement 1): 17-23.
1704	Snow, E.L., W.A. Palmer, and K.A.D.W. Senaratne. 2012. The release of *Plectonycha correntina*, a leaf feeding beetle for the biological control of Madeira vine. *In* V. Eldershaw, Ed. Proceedings of the 18th Australasian Weeds Conference. 8-11 October 2012, Melbourne, Victoria, Australia; Weed Society of Victoria Inc. pp. 339-342.
1705	Sobhian, R. and L. Fornasari. 1994. Biology of *Larinus curtus* Hochhut (Coleoptera: Curculionidae), a European weevil for biological control of yellow starthistle, *Centaurea solstitialis* (Asteraceae) in the United States. Biological Control 4: 328-335.
1706	Sobhian, R., J. Littlefield, M. Cristofaro, and K. Mann. 2000. Biology and host specificity of *Spurgia capitigena* (Bremi) (Dipt., Cecidomyiidae), for the biological control of *Euphorbia esula* L. in North America. Journal of Applied Entomology 124: 333-338.
1707	Sobhian, R., A. McClay, S. Hasan, M. Peterschmitt, and R.B. Hughes. 2004. Safety assessment and potential of *Cecidophyes rouhollahi* (Acari, Eriophyidae) for biological control of *Galium spurium* (Rubiaceae) in North America. Journal of Applied Entomology 128(4): 258-266.
1708	Soh, J.C., S.L. An, J.E. Lee, and K.T. Park. 2002. Notes on exotic species, *Ophraella communa* LeSage (Coleoptera: Chrysomelidae) in Korea. Korean Journal of Weed Science 41(2): 145-150.
1709	Sohn, J.C. 2013. (personal communication) University of Maryland, Department of Entomology, College Park, MD 20742 USA.
1710	Solis, M.A., M.A. Metz, and C. Zachariades. 2008. Identity and generic placement of *Phestinia costella* Hampson (Lepidoptera: Pyralidae: Phycitinae) reared on the invasive plant *Chromolaena odorata* (L.) R. M. King & H. Rob. (Asteraceae). Proceedings of the Entomological Society of Washington 110(3): 679-692.
1711	Son, N.H., P.V. Lam, N.V. Cam, D.V.T. Thanh, M.V. Dung, L.D. Khanh, and I.W. Forno. 2004. Preliminary studies on control of *Mimosa pigra* in Vietnam. *In* M. Julien, G. Flanagan, T. Heard, B. Hennecke, Q. Paynter, and C. Wilson, Eds. Research and Management of *Mimosa pigra*. CSIRO Entomology, Canberra. pp. 110-116.

Code	Reference
1712	Space, J.C. and T. Flynn. 2000. Observations in invasive plant species in American Samoa. USDA FS, Pacific Southwest Research Station, Institute of Pacific Islands Forestry. 51 pp.
1713	Sparks, H.E. 1999. The initiation of a biological control programme against *Macfadyena unguis-cati* (L.) Gentry (Bignoniaceae) in South Africa. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 153-157.
1714	Species Fungorum. 2013. CABI (RBG Kew Coordinated Intitiative), http://www.speciesfungorum.org. 31 December 2012.
1715	Spencer, K.A. 1962. Some Agromyzidae (Diptera) from New Guinea, Melanesia, and Polynesia. Pacific Insects 43(3): 651-660.
1716	Spencer, K.A. 1973. Agromyzidae (Diptera) of Economic Importance. Dr. W. Junk, B.V., The Hague. 418 pp.
1717	Spencer, K.A. 1981. A revisionary study of the leaf-mining flies (Agromyzidae) of California. Special Publication 3273. UCANR Publications. 489 pp.
1718	Spencer, N.R. 1988. Inundative biological control of velvetleaf, *Abutilon theophrasti* (Malvaceae) with *Niesthrea louisianica* (Hem.: Rhopalidae). Entomophaga 33(4): 421-429.
1719	Spencer, N.R. and J.R. Coulson. 1976. The biological control of alligatorweed, *Alternanthera philoxeroides*, in the United States of America. Aquatic Botany 2: 177-190.
1720	Starmer, W.T., V. Aberdeen, and M. Lachance. 1988. The yeast community associated with decaying *Opuntia stricta* (Haworth) in Florida with regard to the moth, *Cactoblastis cactorum* (Berg.). Biological Science 51: 7-11.
1721	Starr, F., K. Starr, and L. Loope. 2003. *Salsola tragus*. United States Geological Survey, Biological Resources Division, Haleakala Field Station, Maui, Hawaii, USA. 1-6 pp.
1722	Stegmaier, C.E.J. 1973. Colonization of the puncturevine stem weevil, *Microlarinus lypriformis* (Coleoptera: Curculionidae) with notes on parasitism in South Florida. Florida Entomologist 56: 235-241.
1723	Stejskal, R. 2012. First record of *Stenopelmus rufinasus* Gyllenhal, 1835 (Coleoptera: Erirhinidae) for Slovakia, with distribution and binomic notes. Weevil News 74: 5.
1724	Stephens, A.E.A., P.G. Krannitz, and J.H. Myers. 2009. Plant community changes after the reduction of an invasive rangeland weed, diffuse knapweed, *Centaurea diffusa*. Biological Control 51(1): 140-146.
1725	Stewart, C.A., R.M. Emberson, and P. Syrett. 1996. Temperature effects on the alligator weed flea-beetle, *Agasicles hygrophila* (Coleoptera: Chrysomelidae): implications for biological control in New Zealand. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 393-398.
1726	Stewart, R.M., C.A.F. Jr, and L.G. Bezark. 1988. Biological control of waterhyacinth in the California delta. Technical Report A-88-7. U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS, USA. 46 pp.
1727	Stinson, C.S.A., D. Schroeder, and K. Marquardt. 1994. Investigations on *Cyphocleonus achates* (Fahr.) (Col., Curculionidae), a potential biological control agent of spotted knapweed (*Centaurea maculosa* Lam.) and diffuse knapweed (*C. diffusa* Lam.) (Compositae) in North America. Journal of Applied Entomology 117: 35-50.
1728	Story, J. 2002. Spotted Knapweed. *In* R.V. Driesche, B. Blossey, M. Hoddle, S. Lyon, and R. Reardon, Eds. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. pp. 169-180.
1729	Story, J. and G.L. Piper. 2001. Status of biological control effects against spotted and diffuse knapweed. *In* L. Smith, Ed. Proceedings of the First International Knapweed Symposium of the Twenty-First Century. 15-16 March 2001, Coeur d'Alene, Idaho, USA; USDA Agricultural Research Service. pp. 11-17.
1730	Story, J.M. 1979. Biological weed control in Montana. Bulletin, Montana Agricultural Experimental Station 717: 1-15.
1731	Story, J.M. 1985. Status of biological weed control in Montana. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 837-842.
1732	Story, J.M. 1995. Spotted knapweed. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 258-263.
1733	Story, J.M., N.W. Callan, J.G. Corn, and L.J. White. 2006. Decline of spotted knapweed density at two sites in western Montana with large populations of the introduced root weevil, *Cyphocleonus achates* (Fahraeus). Biological Control 38(2): 227-232.
1734	Story, J.M., W.R. Good, L.J. White, and L. Smith. 2000. Effects of the Interaction of the biocontrol agent *Agapeta zoegana* L. (Lepidoptera: Cochylidae) and Grass competition on spotted knapweed. Biological Control 17: 182-190.
1735	Story, J.M., G.L. Piper, and E.M. Coombs. 2004. Knapweeds. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 196-232.

Code	Reference
1736	Story, J.M., L. Smith, J.G. Corn, and L.J. White. 2008. Influence of seed head-attacking biological control agents on spotted knapweed reproductive potential in Western Montana over a 30-year period. Environmental Entomology 37(2): 510-519.
1737	Strathie, L. 2012. Progress towards biological control of parthenium weed in South Africa. International Parthenium News 6: 3-4.
1738	Strathie, L.W. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag 6006, Hilton 3245 South Africa.
1739	Strathie, L.W., A.J. McConnachie, and E. Retief. 2011. Initiation of biological control against *Parthenium hysterophorus* L. (Asteraceae) in South Africa. African Entomology 19(2): 378-392.
1740	Strathie, L.W. and C. Zachariades. 2002. Biological control of *Chromolaena odorata* in South Africa: developments in research and implementation. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 74-79.
1741	Strathie, L.W. and C. Zachariades. 2004. Insects for the biological control of *Chromolaena odorata*: surveys in the northern Caribbean and efforts undertaken in South Africa. *In* M.D. Day and R.E.C. McFadyen, Eds. Proceedings of the 6th International Workshop on Biological Control and Management of *Chromolaena*. 6-9 May 2003, Cairns, Queensland, Australia; Australian Centre for International Agricultural Research. pp. 45-52.
1742	Strathie, L.W., C. Zachariades, M. Gareeb, and D. Sharp. 2007. Establishment of two biocontrol agents on *Chromolaena odorata* in South Africa. *In* P.-Y. Lai, G.V.P. Reddy, and R. Muniappan, Eds. Proceedings of the 7th International Workshop on Biological Control and Management of *Chromolaena odorata* and *Mikania micrantha*. 12-15 September 2006, Taiwan; National Pingtung University of Science and Technology. pp. 81-93.
1743	Strickland, G.R., R. Fogliani, and J.K. Scott. 2012. *Rumex* species - docks. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 510-517.
1744	Sturdevant, N., S. Kegley, Y. Ortega, and D. Pearson. 2006. Evaluation of establishment of *Cyphocleonus achates* and its potential impact on spotted knapweed. Forest Health Protection. Numbered Report 06-08. USDA FS, Northern Region, Missoula, Montana, USA. 9 pp.
1745	Suasa-ard, W. and B. Napompeth. 1982. Investigations on *Episammia pectinicornis* (Hampson) (Lepidoptera: Noctuidae) for biological control of the waterlettuce in Thailand. Technical Bulletin No. 3. National Biological Control Research Centre, Kasetsart University/National Research Council, Bangkok, Thailand. 10 pp.

Code	Reference
1746	Suasa-ard, W., P. Sommartya, and S. Jaitui. 2004. Evaluation of seed feeding bruchids, *Acanthoscelides* species, as biological control agents for *Mimosa pigra* in Thailand. *In* J. M., G. Flanagan, T. Heard, B. Hennecke, Q. Paynter, and C. Wilson, Eds. Research and Management of *Mimosa pigra*. CISRO Entomology, Canberra. pp. 122-125.
1747	Subramanian, T.V. 1934. The lantana seedfly in India, *Agromyza (*Ophiomyia*) lantanae* Froggatt. Indian Journal of Agricultural Science 4: 468-471.
1748	Summerville, W.A.T. 1933. Two insect enemies of nut grass. Queensland Agricultural Journal 40: 284-287.
1749	Supkoff, D.M., D.B. Joley, and J.J. Marois. 1988. Effect of introduced biological control organisms on the density of *Chondrilla juncea* in California. Journal of Applied Ecology 25: 1089-1095.
1750	Surles, W.W. and L.T. Kok. 1977. Ovipositional preference and synchronization of *Rhinocyllus conicus* with *Carduus nutans* and *Carduus acanthoides.* Environmental Entomology 6: 222-224.
1751	Surles, W.W. and L.T. Kok. 1978. *Carduus* thistle seed destruction by *Rhinocyllus conicus.* Weed Science 26: 264-269.
1752	Sutherland, D. 2013. Unpublished data. Nez Perce Biocontrol Center, P.O. Box 365, Lapwai, Idaho 834540, USA.
1753	Swarbrick, J.T. and J.F. Donaldson. 1991. Host range studies with the *Lantana* mealybug (*Phenacoccus parvus* Morrison). Plant Protection Quarterly 6: 68-69.
1754	Sweetman, H.L. 1935. Successful examples of biological control of pest insects and plants. Bulletin of Entomological Research 26: 373-377.
1755	Swezey, O.H. 1923. Records of introduction of beneficial insects into the Hawaiian Islands. Proceedings of the Hawaiian Entomological Society 5: 299-304.
1756	Swirepik, A., R. Aveyard, R. Holtkamp, and P. Stephenson. 2004. The release and establishment of the bitou bush agent *Tortrix* sp. in New South Wales from 2001-2004. *In* B.M. Sindel and S.B. Johnson, Eds. Proceedings of the 14th Australian Weeds Conference. 6-9 September 2004, Wagga Wagga, New South Wales, Australia; Weed Society of New South Wales. pp. 353-356.
1757	Swirepik, A., Aveyard Ruth, and A.W. Sheppard. 2004. The post-release larval mortality of the *Chrysanthemoides* leaf roller *Tortrix* sp. in Australia. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 480-481.
1758	Swirepik, A. and D.T. Briese. 2000. Agent release techniques: what is appropriate for redistribution projects that involve community groups? *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 783-189.

Code	Reference
1759	Swirepik, A. and Woodburn. 2002. A new biological control project against stemless thistle (*Onopordum acaulon*) in Western Australia. *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 426-429.
1760	Swirepik, A.E., A.W. Sheppard, and M.J. Smyth. 1996. *Meligethes planiusculus* (Heer) (Nitidulidae) an inflorescence-feeding beetle, with good potential as biological control agent for *Echium plantagineum*. *In* R.C.H. Shepherd, Ed. Proceedings of the 11th Australian Weeds Conference. 30 September-3 October 1996, Melbourne, Victoria, Australia; Weed Science Society of Victoria Inc. pp. 294-297.
1761	Swirepik, A.E., M.J. Smyth, and D.T. Briese. 2004. Delivering pasture weed biological control through community networks in temperate Australia. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 27 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 451-456.
1762	Swirepik, A.E., P.J. Turner, and D.T. Briese. 2008. Evaluation of the biological control agent, *Lixus cardui*, on *Onopordum* thistles: establishment and initial field impact. Biological Control 47: 108-114.
1763	Swope, S.M. and I.M. Parker. 2010. Trait-mediated interactions and lifetime fitness of the invasive plant *Centaurea solstitialis*. Ecology 918(8): 2284-2296.
1764	Swope, S.M. and I.M. Parker. 2010. Widespread seed limitation affects plant density but not population trajectory in the invasive plant *Centaurea solstitialis*. Oecologia 164: 117-128.
1765	Swope, S.M. and I.M. Parker. 2012. Complex interactions among biocontrol agents, pollinators, and an invasive weed: a structural equation modeling approach. Ecological Applications 22(8): 2122-2134.
1766	Swope, S.M. and W. Satterthwaite. 2012. Variable effects of a generalist parasitoid on a biocontrol seed predator and its target weed. Ecological Applications 22(1): 20-34.
1767	Swope, S.M. and I.R. Stein. 2012. Soil type mediates indirect interactions between *Centaurea solstitialis* and its biocontrol agents. Biological Invasions 14: 1697-1710.
1768	Syrett, P. 1983. Biological control of ragwort in New Zealand: a review. Australian Weeds 2: 96-101.
1769	Syrett, P. 1989. *Senecio jacobaea* L., ragwort (Asteraceae). *In* P.J. Cameron, R.L. Hill, J. Bain, and W.P. Thomas, Eds. A review of biological control of invertebrate pests and weeds in New Zealand 1874 to 1987. CAB International, London. pp. 361-366.
1770	Syrett, P., S.V. Fowler, H.M. Harman, L.M. Hayes, J. Memmott, and J.J. Sheat. 2007. Establishment of *Arytainilla spartiophila* Förster (Hemiptera: Psyllidae), a new biological control agent for broom, *Cytisus scoparius*, in New Zealand. New Zealand Entomologist 30: 53-62.
1771	Syrett, P. and N.A. Hancox. 1985. Effect of an introduced beetle on St John's wort. *In* Proceedings of the 38th New Zealand Weed and Pest Control Conference. 13-15 August 1985, Rotorua, New Zealand; New Zealand Weed and Pest Control Society Inc. pp. 154-157.
1772	Syrett, P. and H.M. Harman. 1995. *Leucoptera spartifoliella* Hübner as a biological control agent for broom in New Zealand. Plant Protection Quarterly 10: 75-78.
1773	Syrett, P., J.J. Sheat, H.M. Harman, R.J. Harris, L.M. Hayes, and E.A.F. Rose. 2000b. Strategies for achieving widespread establishment of broom seed beetle, *Bruchidius villosus* (Coleoptera: Chrysomelidae), a biological control agent for broom, *Cytisus scoparius*, in New Zealand. *In* N.R. Spencer, Ed. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Bozeman, Montana, USA; Montana State University. pp. 761-771.
1774	Székely, L. 2011. The Lepidoptera of Bucharest and its surroundings (Romania). Travaux de Muséum National d'Histoire Naturelle LIV (2): 461-512.
1775	Szent-Ivany, J.J.H. 1964. Pacific Entomology. Report of the Standing Committee Chairman. University of Hawaii Press, Honolulu, Hawaii. 93 pp.
1776	Szűcs, M. 2013. (personal communication) Colorado State University, Department of Bioagricultural Sciences and Pest Management, 1177 Campus Mail, Fort Collins, CO 80523 USA.
1777	Szűcs, M., M. Schwarzländer, and J.F. Gaskin. 2011. Reevaluating establishment and potential hybridization of different biotypes of the biological control agent *Longitarsus jacobaeae* using molecular tools. Biological Control 58: 44-52.
1778	Takahashi, M., S.M. Louda, T.E. Miller, and C.W. O'Brien. 2009. Occurrence of *Trichosirocalus horridus* (Coleoptera: Curculionidae) on native *Cirsium altissimum* versus exotic *C. vulgare* in North American tallgrass prairie. Environmental Entomology 38(3): 731-740.
1779	Tauili'ili, P. and A.M. Vargo. 1993. History of biological control in American Samoa. Micronesica Supplement 4: 57-60.
1780	Taye, T. 2007. The prospects of biological control of weeds in Ethiopia. Ethiopia Journal of Weed Management 1(1): 63-78.
1781	Taye, T., G. Einhorn, M. Gossmann, C. Buttner, and R. Metz. 2004. The potential of parthenium rust as biological control of parthenium weed in Ethiopia Pest Management Journal of Ethiopia 8: 39-50.
1782	Taylor, D.B.J., T.A. Heard, Q. Paynter, and H. Spafford. 2007. Nontarget effects of a weed biological control agent of a native plant in northern Australia. Biological Control 42: 25-33.
1783	Taylor, E.E. 1989. A history of biological control of *Lantana camara* in New South Wales. Plant Protection Quarterly 4: 61-65.

Code	Reference
1784	Taylor, S.J., D.A. Downie, and I.D. Paterson. 2011. Genetic diversity of introduced populations of the water hyacinth biological control agent *Eccritotarsus catarinensis* (Hemiptera: Miridae). Biological Control 58: 330-336.
1785	TeBeest, D.O. 2013. (personal communication) University of Arkansas, Plant Sciences Building 210 , 495 N. Campus Drive, Fayetteville, AR 72701 USA.
1786	Templeton, G.E. 1987. Mycoherbicides - achievements, developments and prospects. *In* D. Lemerle and A.R. Leys, Eds. Proceedings of the 8th Australian Weeds Conference. 21-25 September 1987, Sydney, New South Wales, Australia; Weed Society of New South Wales. pp. 489-497.
1787	Templeton, G.E., D.O. TeBeest, and R.J.J. Smith. 1978. Development of an endemic fungal pathogen as a mycoherbicide for biocontrol of northern jointvetch in rice. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 214-216.
1788	Terry, P.J. 1996. The water hyacinth problem in Malawi and foreseen methods of control. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 59-86.
1789	Tessmann, D.J., R. Charudattan, H.C. Kistler, and E.N. Rosskopf. 2001. A molecular characterization of *Cercospora* species pathogenic to water hyacinth and emendation of *C. piaropi*. Mycologia 93(2): 323-334.
1790	Tewari, S. and S.J. Johnson. 2011. Impact of two herbivores, *Samea multiplicalis* (Lepidoptera: Crambidae) and *Cyrtobagous salviniae* (Coleoptera: Curculionidae), on *Salvinia minima* in south Louisiana. Journal of Aquatic Plant Management 49: 36-43.
1791	The Angiosperm Phylogeny Group. 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Botanical Journal of the Linnean Society 141: 399-436.
1792	Thines, M. and O. Spring. 2005. A revision of *Albugo* (Chromista, Peronosporomycetes). Mycotaxon 92: 443-458.
1793	Thomas, P.A. 1985. Management of *Salvinia molesta* in Papua New Guinea. FAO Plant Protection Bulletin 33: 50-56.
1794	Thomas, P.A. and P.M. Room. 1986. Taxonomy and control of *Salvinia molesta*. Nature 320: 581-584.
1795	TIAR. 2010. Biological control of cape broom: Cape broom psyllid. April 2010. Tasmanian Institute of Agricultural Research. 2 pp.
1796	Timbilla, J.A. 1996. Status of *Chromolaena odorata* biological control using *Pareuchaetes pseudoinsulata*, in Ghana. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 327-331.

Code	Reference
1797	Timbilla, J.A., C. Zachariades, and H. Braimah. 2003. Biological control and management of the alien invasive shrub Chromolaena odorata in Africa. *In* P. Neuenschwander, C. Borgemeister, and J. Langewald, Eds. Biological Control in IPM Systems in Africa. CAB International, Wallingford, U.K. pp. 145-160.
1798	Tipping, P. 2004. Giant salvinia, *Salvinia molesta*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and J. Cofrancesco, A.F., Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 174-177.
1799	Tipping, P.W. 1997. (personal communication) Maryland Department of Agriculture, Integrated Pest Management Laboratory, 50 Harry S. Truman Parkway, Annapolis, Maryland 21401, United States of America.
1800	Tipping, P.W. 2013. (personal communication) United States Department of Agriculture, Agricultural Research Service, Invasive Plant Research Laboratory, 3225 College Ave. Fort Lauderdale, FL 33314 USA.
1801	Tipping, P.W. and T.D. Center. 2003. *Cyrtobagous salviniae* (Coleoptera: Curculionidae) successfully overwinters in Texas and Louisiana. Florida Entomologist 86(1): 92-93.
1802	Tipping, P.W. and T.D. Center. 2005. Influence of plant size and species on preference of *Cyrtobagous salviniae* adults from two populations. Biological Control 32: 263-268.
1803	Tipping, P.W. and T.D. Center. 2005. Population dynamics of *Cyrtobagous salviniae* on common salvinia in South Florida. Journal of Aquatic Plant Management 43: 47-50.
1804	Tipping, P.W., M.R. Martin, L. Bauer, E. Pokorny, and T.D. Center. 2010. Asymmetric impacts of two herbivore ecotypes on similar host plants. Ecological Entomology 35: 469-476.
1805	Tipping, P.W., M.R. Martin, T.D. Center, and T.R. Davern. 2008. Suppression of *Salvinia molesta* Mitchell in Texas and Louisiana by *Cyrtobagous salviniae* Calder and Sands. Aquatic Botany 88: 196-202.
1806	Tipping, P.W. and A.B. Sindermann. 2000. Natural and augmented spread of rose rosette disease of mulitflora rose in Maryland. Plant Disease 84(12): 1344.
1807	Tjitrosemito, S. 1998. Introduction of *Procecidochares connexa* (Diptera: Tephritidae) to Java Island to control *Chromolaena odorata*. *In* P. Ferrar, R. Muniappan, and K.P. Jayanth, Eds. Proceedings of the 4th International Workshop on Biological Control and Management of *Chromolaena odorata*. October 1996, Bangalore, India; University of Guam. pp. 66-72.
1808	Tjitrosemito, S. 1996. The management of *Chromolaena odorata* (L.) in Indonesia. *In* U.K. Prasad, R. Muniappan, P. Ferrar, and J.P. Aeschlimann, Eds. Proceedings of the 3rd International Workshop on the Biological Control and Management of *Chromolaena odorata*. November 1993, Abijan, Côte d'Ivoire; University of Guam. pp. 135-142.

Code	Reference
1809	Tjitrosemito, S. 1997. Infestation of *Mimosa pigra* in Mahakam River systems, East Kalimantan, Indonesia. Weedwatcher 28: 1-2.
1810	Tjitrosemito, S. 2002. Introduction and establishment of the gall fly *Cecidochares connexa* for control of Siam weed, *Chromolaena odorata*, In Java, Indonesia. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 140-147.
1811	Tjitrosemito, S. 2012. (personal communication) Seameo Biotrop, PO Box 116, Bogor 16001, Indonesia.
1812	Tomley, A.J. 1990. *Megacyllene mellyi* - a biological control agent for groundsel bush, *Baccharis halimifolia*, in Queensland. *In* J.W. Heap, Ed. Proceedings of the 9th Australian Weeds Conference. 6-10 August 1990, Adelaide, SouthAustralia; Crop Science Society of South Australia. pp. 513-515.
1813	Tomley, A.J. 1997. (personal communication) Department of Natural Resources, Alan Fletcher Research Station, Sherwood, Queensland 4075, Australia.
1814	Tomley, A.J. and H.C. Evans. 2004. Establishment of, and preliminary impact studies on, the rust, *Maravalia cryptostegiae*, of the invasive alien weed, *Cryptostegia grandiflora* in Queensland, Australia. Plant Pathology(53): 475-484.
1815	Tomley, A.J. and G. Hardwick. 1996. Bulking up, field distribution and establishment of rubber vine rust, *Maravalia cryptostegiae,* in far north Queensland. *In* R.C.H. Shepherd, Ed. Proceedings of the 11th Australian Weeds Conference. 30 September-3 October 1996, Melbourne, Victoria, Australia; Weed Science Society of Victoria Inc. pp. 237-238.
1816	Tomley, A.J. and R.E. McFadyen. 1985. Biological control of Harrisia cactus, *Eriocereus martinii*, in central Queensland by the mealybug, *Hypogeococcus festerianus*, nine years after release. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 843-847.
1817	Tomley, A.J. and N. Riding. 2002. *Prospodium tuberculatum*, lantana rust, a new agent released for the biocontrol of the woody shrub *Lantana camara*. *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 389-390.
1818	Tomley, A.J. and L. Willsher. 2002. Field release and initial impact of groundsel bush rust in Australia. *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 391-393.
1819	Torres, D.O. 1986. Potential insect biological control agents against the weed *Chromolaena odorata* R.M. King and H. Robinson in the Philippines. Philippines Entomology 6: 535-536.
1820	Toševski, I. 2013. (personal communication) CABI, Rue des Grillons 1, CH-2800 Delémont, Switzerland.
1821	Toševski, I., R. Caldara, J. Jovic, G. Hernández-Vera, C. Baviera, A. Gassmann, and B. Emerson. 2011. Morphological, molecular and biological evidence reveal two cryptic species in *Mecinus janthinus* Germar (Coleoptera, Curculionidae), a successful biological control agent of Dalmatian toadflax, *Linaria dalmatica* (Lamiales, Plantaginaceae). Systematic Entomology: 1-13.
1822	Tracy, J.L. and T.O. Robbins. 2009. Taxonomic revision and biogeography of the *Tamarix*-feeding *Diorhabda elongata* (Brulle, 1832) species group (Coleoptera: Chrysomelidae: Galerucinae: Galerucini) and analysis of their potential in biological control of Tamarisk. Zootaxa 2101: 1-152.
1823	Trujillo, E. 1997. Classical biological control of weeds with pathogens. IBG News 6(2): 11-13.
1824	Trujillo, E.E. 1985. Biological control of Hamakua pa-makani with *Cercosporella* sp. in Hawaii. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 661-671.
1825	Trujillo, E.E. 1991. (personal communication) University of Hawaii, Department of Plant Pathology, Honolulu 96822, United States of America.
1826	Trujillo, E.E. 2005. Biological control of bush lantana and invasive weed of Hawaii's forest. Biological Control 33(1): 113-122.
1827	Trujillo, E.E. 2005. History and success of plant pathogens for biological control of introduced weeds in Hawaii. Biological Control 33: 113-122.
1828	Trujillo, E.E., C. Kadooka, V. Tanimoto, S. Bergfeld, G. Shishido, and G. Kawakami. 2001. Effective biomass reduction of the invasive weed species banana poka by *Septoria* leaf spot. Plant Disease 85(4): 357-361.
1829	Trujillo, E.E. and F.P. Obrero. Cephalosporium wilt of *Cassia surattensis* in Hawaii. *In* T.E. Freeman, Ed. Proceedings of the IV International Symposium on Biological Control of Weeds. 30 August-2 September 1976, Gainesville, Florida, USA; University of Florida. pp. 217-220.
1830	Trumble, J.T. and L.T. Kok. 1982. Integrated pest management techniques in thistle suppression in pastures of North America. Weed Research 22: 345-359.
1831	Tryon, H. 1910. The wild cochineal insect, with reference to its injurious action on prickly pear (*Opuntia* spp.) in India, etc., and to its availability for the subjugation of this plant in Queensland and elsewhere. Queensland Agricultural Journal 25: 188-197.
1832	Tryon, H. 1912. Insects for checking growth or dissemination of lantana. Queensland Agricultural Journal 29: 493-498.

Code	Reference
1833	Tuda, M., L.-H. Wu, Y. Tateishi, C. Niyomdham, S. Buranapanichpan, K. Morimoto, W.-J. Wu, C.-P. Wang, Z.-Q. Chen, H.-Y. Zhu, Y.-C. Zhang, K. Murugan, L.-Y. Chou, and C.D. Johnson. 2009. A novel host shift and invaded range of a seed predator, *Acanthoscelides macrophthalmus* (Coleoptera: Chrysomelidae: Bruchinae), of an invasive weed, *Leucaena leucocephala*. Entomological Science 12: 1-8.
1834	Turienzo, P. 2006. First record in Argentina of a plant-insect association, with interest in biological control. Ecologia Austral 16: 95-98.
1835	Turner, C.E., J.B. Johnson, and J.P. McCaffrey. 1995. Yellow starthistle. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 270-275.
1836	Turner, C.E. and P.B. McEvoy. 1995. Tansy Ragwort. *In* J.R. Nechols, L.A. Andres, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, Eds. Biological Control in the Western United States: Accomplishments and Benefits of Regional Research Project W-84, 1964-1989. Publication 3361. University of California, Division of Agriculture and Natural Resources, Oakland, California. pp. 264-269.
1837	Turner, C.E., R.W. Pemberton, and S.S. Rosenthal. 1987. Host utilization of native *Cirsium* thistles (Asteraceae) by the introduced weevil *Rhinocyllus conicus* (Coleoptera: Curculionidae) in California. Environmental Entomology 16: 111-115.
1838	Turner, C.E., G.L. Piper, and E.M. Coombs. 1996. *Chaetorellia australis* (Diptera: Tephritidae) for biological control of yellow starthistle, *Centaurea solstitialis* (Compositae), in the western U.S.A.: establishment and seed destruction. Bulletin of Entomological Research 86: 177-182.
1839	Turner, C.E., R. Sobhian, D.B. Joley, E.M. Coombs, and G.L. Piper. 1994. Establishment of *Urophora sirunaseva* (Hering) (Diptera: Tephritidae) for the biological control of starthistle in the western United States. Pan-Pacific Entomologist 70: 206-211.
1840	Turner, C.E. and B. Villegas. 1995. Releases of cold-hardy weevils for the biological control of puncturevine in northern California. *In* L.G. Bezark, Ed. Biological Control Program 1994 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry., Sacramento, California. pp. 50.
1841	Turner, S.C. 2013. (personal communication) Ministry of Forests, Lands and Natural Resource Operations, Provincial Range Operations - Kamloops, 441 Columbia Street Kamloops, BC V2C 2T3.
1842	Tuthill, L.D. 1943. The psyllids of America north of Mexico (Psyllidae: Homoptera). Iowa State College Journal of Science 17: 443-660.
1843	Tyndall, R.W., B. Holt, J., and G. Lam. 1996. *Aeschynomene virginica* (L.) BSP (Fabaceae) in Maryland. Castanea 61(1): 86-89.
1844	Tzean, S.S. 2013. (personal communication) Department of Plant Pathology & Microbiology - National Taiwan University No.1, Sec. 4, Roosevelt Road., Taipei, 10617 Taiwan.
1845	Ung, S.H. and A. Yunus. 1981. The present status of the biological control of *Cordia curassavica* in Malaysia. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 489-498.
1846	Urban, A., D. Simelane, and L. Strathie. 2010. Lantana herringbone leafminer now in Madagascar. Plant Protection News 83: 14.
1847	Urban, A., D. Simelane, and A. Witt. 2010. Lantana herringbone leafminer now in Ethiopia. Plant Protection News 84: 9.
1848	Urban, A.J. 2013. (personal communication) (Retired) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X134, Queenswood, Pretoria 0121 South Africa.
1849	Urban, A.J., D.O. Simelane, E. Retief, F. Heystek, H.E. Williams, and L.G. Madire. 2011. The invasive '*Lantana camara* L.' hybrid complex (Verbenaceae): a review of research into its identity and biological control in South Africa. African Entomology 19(2): 315-348.
1850	Urban, A.J., D.O. Simelane, E. Retielf, F. Heystek, H.E. Williams, and L.G. Madire. 2011. The invasive '*Lantana camara* L.' hybrid complex (Verbenaceae): a review of research into its identity and biological control in South Africa. African Entomology 19(2): 315-348.
1851	US EPA. 1993. Pesticide product label Dr. Biosedge®, a microbial herbicide for the control of yellow nutsedge. University States Environmental Protection Agency, Office of Pesticide Programs. 4 pp.
1852	US EPA. 1999. Pesticide product label, Collego® postemergence herbicide biological weed control agent. United States Environmental Protection Agency, Office of Pesticide Programs. 2 pp.
1853	US EPA. 2002. Biopesticide fact sheet, *Puccinia thlaspeos* strain woad (006489). United States Environmental Protection Agency, Office of Pesticide Programs. 2 pp.
1854	US EPA. 2004. Biopesticide fact sheet, *Chondrostereum purpureum* strain PFC 2139 (081308). United States Environmental Protection Agency, Office of Pesticide Programs. 3 pp.
1855	US EPA. 2005. Biopesticide fact sheet, *Chondrostereum purpureum* strain HQ1 (081309). United States Environmental Protection Agency, Office of Pesticide Programs. 3 pp.
1856	US EPA. 2005. Biopesticide registration action document, *Alternaria destruens* strain 059 (PC Code 028301). United States Environmental Protection Agency, Office of Pesticide Programs. 34 pp.
1857	US EPA. 2006. Pesticide product label, DeVine® biological herbicide. United States Environmental Protection Agency, Office of Pesticide Programs. 4 pp.

Code	Reference
1858	US EPA. 2009. Notice of pesticide registration, LockDown™ Liquid. United States Environmental Protection Agency, Office of Pesticide Programs. 7 pp.
1859	US EPA. 2013. Pesticides: registration review, *Alternaria destruens*. United States Environmental Protection Agency, Office of Pesticide Programs. 1 pp.
1860	USDA NRCS. 2013. The PLANTS Database. National Plant Data Team, Greensboro, NC 27401-4901, USA, http://plants.usda.gov. 17 April 2013.
1861	USDA-FS Unpublished Records. 2012. USDA, Forest Service, Pacific Southwest Research Station, Quarantine Facility, P.O. Box 236, Volcano, Hawaii 96785 USA.
1863	Uyi, O.U. 2011. Discovery of *Pareuchaetes pseudoinsulata* in Edo State, Nigeria. *Chromolaena odorata* Newsletter 18: 1-3.
1862	Uyi, O.U., D.W. David, and Z. Costas. 2009. The impact of *Pareuchaetes pseudoinsulata* (Lepidoptera: Arctiidae), on the growth rate of *Chromolaena odorata* (L.) in southern Ghana. Journal of Applied Sciences and Environmental Management 13(1): 59-65.
1864	Vagalo, M. 1992. (personal communication) Ministry of Agriculture and Fisheries, Dodo Creek Research Station, PO Box G13, Honiara, Solomon Islands.
1865	Valladares, G.R. 1986. The genus *Ophiomyia* Braschnikov (Dipt., Agromyzidae) in Argentina. Entomologist's Monthly Magazine 122: 111-115.
1866	van Epenhuijsen, K.C.W., R.C. Henderson, A. Carpenter, and G.K. Burge. 2000. The rise and fall of manuka blight scale: a review of the distribution of *Eriococcus orariensis* (Hemiptera: Eriococcidae) in New Zealand. New Zealand Entomologist 23: 67-70.
1867	van Goosum, H. 2013. (personal communication) Agentschap voor Natuur en Bos - Cel Fauna & Flora, Beleidsmedewerker Soorten, Koning Albert II-laan 20 te 1000 Brussel.
1868	van Harten, A. 1995. (personal communication) South Pacific Commission - German Biological Control Project, Private Mail Bag, Suva, Fiji.
1869	van Harten, A. 2013. (personal communication) Retired. Vaiamonte, Portugal.
1870	Van Hezewijk, B.H. and R.S. Bourchier. 2012. Impact of *Cyphocleonus achates* on diffuse knapweed and its interaction with *Larinus minutus*. Biological Control 62: 113-119.
1871	Van Hezewijk, B.H., R.S. Bourchier, and R.A. De Clerck-Floate. 2010. Regional-scale impact of the weed biocontrol agent *Mecinus janthinus* on Dalmatian toadflax (*Linaria dalmatica*). Biological Control 55: 197-202.
1872	van Klinken, R.D. 2005. Total annual seed loss on a perennial legume through predation by insects: the importance of within-season seed and seed-feeder dynamics. Austral Ecology 30: 414-425.

Code	Reference
1873	van Klinken, R.D. 2012. *Prosopis* spp. - mesquite. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 477-485.
1874	van Klinken, R.D. 2013. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, 41 Boggo Road, Dutton Park, QLD 4102, Australia.
1875	van Klinken, R.D. and S.D. Campbell. 2009. *Prosopis* L. species. *In* F.D. Panetta, Ed. The Biology of Australian Weeds. Vol. 3. R.G. and F. J. Richardson, Melbourne. pp. 238-273.
1876	van Klinken, R.D., G. Fichera, and H. Cordo. 2003. Targeting biological control across diverse landscapes: the release, establishment, and early success of two insects on mesquite (*Prosopis* spp.) insects in Australian rangelands. Biocontrol 26: 8-20.
1877	van Klinken, R.D. and L. Flack. 2008. What limits predation rates by a specialist seed feeder? Journal of Applied Ecology 456: 1600-1611.
1878	van Klinken, R.D. and T.A. Heard. 2012. *Parkinsonia aculeata* L. - parkinsonia. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 437-447.
1879	van Klinken, R.D., J.H. Hoffmann, H.G. Zimmermann, and A. Roberts. 2009. *Prosopis* species (Leguminosae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 353-377.
1880	van Klinken, R.D. and M.H. Julien. 2003. Learning from past attempts: does classical biological control of noogoora burr (Asteraceae: *Xanthium occidentale*) have a promising future? Biocontrol Science and Technology 13: 139-153.
1881	van Klinken, R.D. and L. Morin. 2012. *Xanthium occidentale* (Asteraceae) - noogoora burr. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 591-600.
1882	Van Klinken, R.D. and A. White. 2008. Optimising management of core mesquite infestations in Australia. Program: Defeating the Weed Menace R & D. Final Report. Project number: CEN23. Product Code: PN22407. Australian Government Land & Water Australia, Canberra, Australia. 39 pp.
1883	van Thielen, R., O. Ajuonu, V. Schade, P. Neuenschwander, A. Adité, and C.J. Lomer. 1994. Importation, releases, and establishment of *Neochetina* spp. (Col.: Curculionidae) for the biological control of water hyacinth, *Eichhornia crassipes* (Lil.: Pontederiaceae), in Benin, West Africa. Entomophaga 39: 179-188.
1884	van Valkenburg, J. 2013. (personal communication) National Reference Centre, National Plant Protection Organization, Geertjesweg 15, 6708 EA Wageningen, The Netherlands.
1885	Vargo, D. 2013. (personal communication) American Samoa Community College, Community and Natural Resources, P.O. Box 5319, Pago Pago, American Samoa 96799-5319.

Code	Reference
1886	Vassiliou, V.A. 2013. (personal communication) Agricultural Research Institute, Plant Protection Section, P.O. Box 22016, 1516 Nicosia, Cyprus.
1887	Vassiliou, V.A. and G. Papadoulis. 2008. First record of *Acanthoscelides macrophthalmus* (Schaeffer) (Coleoptera: Bruchidae) in Cyprus. Entomologia Hellenica 17: 52-55.
1888	Viljanen-Rollinson, S.L.H. and M.G. Cromey. 2002. Pathways of entry and spread of rust pathogens: implications for New Zealand's biosecurity. New Zealand Plant Protection 55: 42-48.
1889	Villaneuva, H.L. and G.O. Faure. 1959. Biological control of St. John's-wort in Chile. FAO Plant Protection Bulletin 7: 144-146.
1890	Villegas, B. 1997. Distribution of the hairy weevil, *Eustenopus villosus*, in California for the biological control of yellow starthistle. *In* D.M. Woods, Ed. Biological Control Program 1996 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry., Sacramento, California. pp. 39.
1891	Villegas, B. 2001. Releases of the flower weevil, *Larinus curtus*, for the biological control of yellow starthistle in California in 2000. *In* D.M. Woods, Ed. Biological Control Program 2000 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 47.
1892	Villegas, B. 2001. Releases of the hairy weevil, *Eustenopus villosus*, in California during 2000. *In* D.M. Woods, Ed. Biological Control Program 2000 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 48.
1893	Villegas, B. 2003. Progress on the biological control program against purple loosestrife in California. *In* D.M. Woods, Ed. Biological Control Program 2002 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 38.
1894	Villegas, B. 2004. Puncturevine, *Tribulus terrestris*. *In* E.M. Coombs, J.K. Clark, G.L. Piper, and A.F. Cofrancesco, Eds. Biological Control of Invasive Plants in the United States. Oregon State University Press, Corvallis, Oregon. pp. 276-280.
1895	Villegas, B. 2010. Leafy spurge, *Euphorbia esula* L. (Euphorbiaceae). *In* D.M. Woods, Ed. Biological Control Program 2009 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 57.
1896	Villegas, B. 2011. Biological control of purple loosestrife in Fresno County. *In* D.M. Woods, Ed. Biological Control Program 2010 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 63.
1897	Villegas, B. 2013. (personal communication) Formerly California Department of Food and Agriculture; Present: 7556 Hickory Avenue, Orangevale, CA 95662 USA.

Code	Reference
1898	Villegas, B., J. Aceves, and M.J. Pitcairn. 2013. Release of Klamath weed inchworm, *Aplocera plagiata* (Lepidoptera: Geometridae), on Klamath weed (*Hypericum perforatum*) in northern California. *In* C. Pickett, H., Ed. Biological Control Program 2011 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. (in press).
1899	Villegas, B., G.W. Brown, and E. Coombs. 2002. Releases of biological control agents onto black and meadow knapweeds in northern California. *In* D.M. Woods, Ed. Biological Control Program 2001 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 44-45.
1900	Villegas, B. and J. Brown. 2007. Release of the chevronated waterhyacinth weevil for the biological control of waterhyacinth in coastal Santa Cruz County, California. *In* B. Villegas, Ed. Biological Control Program 2006 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 25.
1901	Villegas, B., C. Conley, G.W. Brown, and K. Martyn. 2005. Releases of four insects for the biological control of purple loosestrife during 2004 in California. *In* D.M. Woods, Ed. Biological Control Program 2004 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 40-41.
1902	Villegas, B. and E. Coombs. 1999. Releases of the bull thistle gall fly, *Urophora stylata* on bull thistle in California. *In* D.M. Woods, Ed. Biological Control Program 1998 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 49-50.
1903	Villegas, B. and E. Coombs. 2001. Releases of biological control agents for the biological control of purple loosestrife in California. *In* D.M. Woods, Ed. Biological Control Program 2000 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 53.
1904	Villegas, B., E. Coombs, G. Brown, and J. Aceves. 2008. Biological control releases on leafy spurge in Siskiyou County, California. *In* D.M. Woods, Ed. Biological Control Program 2007 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 34-35.
1905	Villegas, B. and C. Gibbs. 2010. Mediterranean sage, *Salvia aethiopis* L., (Lamiaceae). *In* D.M. Woods, Ed. Biological Control Program 2009 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 56.
1906	Villegas, B. and C. Gibbs. 2010. Puncturevine, *Tribulus terrestris* L. (Zygophyllaceae). *In* D.M. Woods, Ed. Biological Control Program 2009 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 54-55.

Code	Reference
1907	Villegas, B., C. Gibbs, and J. Donnelly. 2011. A case of fortuitous biological control of Dalmatian toadflax in Susanville. *In* D.M. Woods, Ed. Biological Control Program 2010 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 65-66.
1908	Villegas, B., C. Gibbs, and K. Haas. 2007. Establishment of the crown weevil, *Phrydiuchus tau,* for the biological control of Mediterranean sage in northeastern California. *In* B. Villegas, Ed. Biological Control Program 2006 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 26-28.
1909	Villegas, B. and D.B. Joley. 2002. Renewed biological control program against purple loosestrife in California. *In* D.M. Woods, Ed. Biological Control Program 2001 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 40-41.
1910	Villegas, B., D.B. Joley, L. Bezark, and E. Coombs. 1999. Releases of two species of *Galerucella* leaf beetles for the biological control of purple loosestrife in California. *In* D.M. Woods, Ed. Biological Control Program 1998 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 45-46.
1911	Villegas, B. and K. Martyn. 2004. Release of *Hylobius* root weevils on purple loosestrife in California. *In* D.M. Woods, Ed. Biological Control Program 2003 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 26.
1912	Villegas, B. and C. Pirosko. 2003. Redistribution of biological control agents of squarrose knapweed in Northern California. *In* D.M. Woods, Ed. Biological Control Program 2002 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 35-37.
1913	Villegas, B. and C. Pirosko. 2004. Release of three insects for the biological control of squarrose knapweed in Northern California in 2003. *In* D. Woods, M., Ed. Biological Control Program 2003 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 29-30.
1914	Vitelli, J.S. 2013. (personal communication) Department of Agriculture, Fisheries & Forestry, Ecosciences Precinct, GPO Box 267, Brisbane, Qld 4001 Australia.
1915	Vitelli, J.S., B.A. Madigan, and K.J. Worsley. 2006. *Mimosa pigra* research. *In* Technical highlights. Weed and pest animal research 2005-06. Queensland Department of Natural Resources and Water, Brisbane, Queensland, Australia. pp. 35-37.
1916	Vitelli, M., P. James, J. Marohasy, R.E. McFadyen, M. Trevino, and M. Hannan-Jones. 1996. Field establishment - how long does it take? Abstract. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 421.
1917	Vitelli, M.P., C. Garcia, C.J. Lockett, G.M. West, and B.W. Willson. 2001. Host specificity and biology of the moth *Psigida walkeri* (Lepidoptera: Citheroniidae), a potential biological control agent for *Mimosa diplotricha* in Australia and the South Pacific. Biological Control 22: 1-8.
1918	Vivian-Smith, G., C.R. Gosper, A. Wilson, and K. Hoad. 2006. *Lantana camara* and the fruit- and seed-damaging fly, *Ophiomyia lantanae* (Agromyzidae): seed predator, recruitment promoter or dispersal disrupter? Biological Control 36(2): 247-257.
1919	Vogel, E. and A.D.J. Oliver. 1969. Evaluation of *Arzama densa* as an aid in the control of water hyacinth in Louisiana. Journal of Economic Entomology 62: 142-145.
1920	Vogel, E. and A.D.J. Oliver. 1969. Life history and some factors affecting the population of *Arzama densa* in Louisiana. Annals of the Entomological Society of America 62: 749-752.
1921	Vogt, G.B., P.C.J. Quimby, and S.H. Kay. 1992. Effects of weather on the biological control of alligatorweed in the lower Mississippi Valley region, 1973-83. Technical Bulletin No. 1766. United States Department of Agriculture, Washington D.C. 143 pp.
1922	Vujnovic, K. and R.W. Wein. 1997. *Linaria dalmatica* (L.) Mill. Canadian Journal of Plant Science 77(3): 483-491.
1923	Vyalkh, A.K. and V.G. Zheryagin. 1977. Factors contributing to the infection of common ragweed (*Ambrosia artemisiifolia*) by the white rust causal agent, *Albugo tragopogonis* Schroet. Mikologiya i Fitopatologiya 11: 135-139.
1924	Wagner, W.L., D.R. Herbst, N. Khan, and T. Flynn. 2012. Hawaiian vascular plant updates: a supplement to the manual of the flowering plants of Hawai'i and Hawai'i's ferns and fern allies. University of Hawaii Press, Honolulu, Hawaii. 126 pp.
1925	Wagner, W.L., R.K. Shannon, and D.R. Herbst. 1997. Contributions to the flora of the Hawai'i. VI. Bishop Museum Occasional Papers 48: 51-65.
1926	Waipara, N.W., J. Barton, L.A. Smith, H.M. Harman, C.J. Winks, B. Massey, J.P. Wilkie, A.F. Gianotti, and M.G. Cripps. 2009. Safety in New Zealand weed biocontrol: a nationwide pathogen survey for impacts on non-target plants. New Zealand Plant Protection 62: 41-49.
1927	Waipara, N.W., E.H.C. McKenzie, H.M. Harman, C.J. Winks, and D. Park. 2006. First record of bridal creeper rust, *Puccinia myrsiphylli*, a classical biocontrol agent of the environmental weed bridal creeper, *Asparagus asparagoides*, in New Zealand. Australian Plant Disease Notes 1: 23-24.

Code	Reference
1928	Waloff, N. 1966. Scotch broom (*Sarothamnus scoparius* (L.) Wimmer) and its insect fauna introduced into the Pacific Northwest of America. Journal of Applied Ecology 3: 293-311.
1929	Walsh, P.G., W.M. Woods, and J. Dood. 1993. Comparison of the life stages and a field guide for *Dialectica scalariella* (Zeller) (Lepidoptera: Gracillariidae) and *Stomopteryx isocelixantha* (Lower) (Lepidoptera: Gracillariidae). Journal of the Australian Entomological Society 32: 29-35.
1930	Walters, M., E. Figueiredo, N.R. Crouch, P.J.D. Winter, G.F. Smith, H.G. Zimmermann, and B.K. Mashope. 2011. Naturalised and invasive succulents of southern Africa. Belgian Development Cooperation. 360 pp.
1931	Walton, C. 2003. *Leucaena leucocephala* (Lamark) de Wit. Plant Protection Quarterly 18(3): 90-98.
1932	Wan, F., R. Wang, and J. Ding. 1995. Biological control of *Ambrosia artemisiifolia* with introduced insect agents, *Zygogramma suturalis* and *Epiblema strenuana*, in China. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand.; DSIR/CSIRO. pp. 193-200.
1933	Wan, F.-H., J. Ma, J.-Y. Guo, and L.-S. You. 2003. Integrated control effects of *Epiblema strenuana* (Lepidoptera: Tortricidae) and *Osrinia orientalis* (Lepidoptera: Pyralidae) against ragweed, *Ambrosia artemisiifolia* (Compositae). Acta Entomologica Sinica 46(4): 473-478.
1934	Wanat, M. 1994. Systematics and phylogeny of the tribe Ceratapiini (Coleoptera: Curculionoidea: Apionidae). Genus: 1-406.
1935	Wang, R. 1989. Biological control of weeds in China: A status report. *In* E.S. Delfosse, Ed. Proceedings of the VII International Symposium on Biological Control of Weeds. 6-11 March 1988, Rome, Italy; Istituto Sperimentale per la Patologia Vegetale. pp. 689-693.
1936	Wapshere, A.J. 1974. An ecological study of an attempt at biological control of noogoora burr (*Xanthium strumarium*). Australian Journal of Agricultural Research 25: 275-292.
1937	Ward, R.H. and R.L. Pienkowski. 1978. Biology of *Cassida rubiginosa,* a thistle-feeding shield beetle. Annals of the Entomological Society of America 71: 585-591.
1938	Watanabe, M. and Y. Hirai. 2004. Host-use pattern of the ragweed beetle *Ophraella communa* LeSage (Coleoptera: Chrysomelidae) for overwintering and reproduction in Tsukuba. Applied Entomology and Zoology 39(2): 249-254.
1939	Waterhouse, D.F. 1994. Biological control of weeds: Southeast Asian prospects. Monograph No. 26. Australian Centre for International Agricultural Research, Canberra, Australia. 302 pp.
1940	Waterhouse, D.F. and K.R. Norris. 1987. Biological Control: Pacific Prospects. Inkata Press, Melbourne. 454 pp.

Code	Reference
1941	Watson, A.K. 2013. Biocontrol. *In* D.M. Joel, J. Gressel, and L.J. Musselman, Eds. Root Parasitic Orobanchaceae: Parasitic Mechanisms and Control Strategies. Springer Publishing, New York. pp. 469-498.
1942	Watson, A.K. and K.L. Bailey. 2013. *Taraxacum officinale* F.H. Wigg, dandelion (Asteraceae). *In* Biological Control Programmes in Canada 2001-2012. Chapter 58. CABI Publishing, Wallingford, U.K. pp. 383-391.
1943	Watson, A.K. and K. Brunetti. 1984. *Puccinia carduorum* on *Carduus tenuiflorus* in California. Plant Disease 68: 1003-1005.
1944	Watson, A.K. and P. Harris. 1984. *Acroptilon repens* (L.) DC., Russian knapweed (Compositae). *In* J.S. Kelleher and M.A. Hulme, Eds. Biological Control Programmes Against Insects and Weeds in Canada 1969-1980. Commonwealth Agricultural Bureaux, London. pp. 105-110.
1945	Watson, M.C., T.M. Withers, and M. Heaphy. 2011. *Cleopus japonicus*: releases and distribution of the buddleia biological control agent in New Zealand. New Zealand Plant Protection 64: 155-159.
1946	Weaver, D.K. 2013. (personal communication) Montana State University, Department of Land Resources & Environmental Sciences, 334 Leon Johnson Hall, Bozeman, MT 59717-3120 USA.
1947	Webb, C.J., W.R. Sykes, and P.J. Garnock-Jones. 1988. Flora of New Zealand Series. Vol. IV: Naturalised Pteridophytes, Gymnosperms, Dicotyledons. Botany Division DSIR, Christchurch. 1364 pp.
1948	Weber, P.W. 1951. Recent liberations of beneficial insects in Hawaii. Proceedings of the Hawaiian Entomological Society 14: 327-330.
1949	Weber, P.W. 1954. Recent liberations of beneficial insects - III. Proceedings of the Hawaiian Entomological Society 15: 369-371.
1950	Weber, P.W. 1955. Recent liberations of beneficial insects in Hawaii - IV. Proceedings of the Hawaiian Entomological Society 15: 635-638.
1951	Weber, P.W. 1956. Recent introductions for biological control in Hawaii - XVI. Proceedings of the Hawaiian Entomological Society 16: 162-164.
1952	Weber, P.W. 1957. Recent introductions for biological control in Hawaii II. Proceedings of the Hawaiian Entomological Society 16(2): 313-314.
1953	Wecker, M.S., T. Alcock, and K. Bennett. 2004. Using GIS to integrate biological control into the integrated weed management program for *Spartina alterniflora* in Willapa Bay, Washington. *In* J.M. Cullen, D.T. Briese, D.J. Kriticos, W.M. Lonsdale, L. Morin, and J.K. Scott, Eds. Proceedings of the XI International Symposium on Biological Control of Weeds. 17 April-2 May 2003, Canberra, Australia; CSIRO Entomology. pp. 457-463.
1967	Weir, B., P. Johnston, and U. Damm. 2012. The *Colletotrichum gloeosporioides* species complex. Studies In Mycology 73: 115-180.
1954	Weiss, J. 1996. Biological control of horehound in South Australia. Keith Turnbull Research Institute, Frankston, Victoria, Australia. 9 pp.
1955	Weiss, J. 2013. (personal communication) La Trobe University, Department of Environment and Primary Industries, CRC for Plant Biosecurity, AgriBio, Centre for AgriBioscience 5 Ring Road, Bundoora, Vic, 3083 Australia.

Code	Reference
1956	Weiss, J. and J.-L. Sagliocco. 2012. *Marrubium vulgare* L. - horehound. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 360-367.
1957	Weiss, J.E.R. Control of horehound, *Marrubium vulgare* L., in Wyperfeld National Park, Victoria. *In* R.C.H. Shepherd, Ed. Proceedings of the 11th Australian Weeds Conference. 30 September-3 October 1996, Melbourne, Victoria, Australia; Weed Science Society of Victoria Inc. pp. 417-419.
1958	Weiss, P.W., R.J. Adair, and P.B. Edwards. 1998. *Chrysanthemoides monilifera* (L.) T. Norl. *In* F.D. Panetta, R.H. Groves, and R.C.H. Shepherd, Eds. The Biology of Australian Weeds. Vol. 2. R.G. and F.J. Richardson, Melbourne. pp. 49-68.
1959	Wester, L.L. and H.B. Wood. 1977. Koster`s curse (*Clidemia hirta*), a weed pest in Hawaiian forests. Environmental Conservation 4: 35-41.
1960	Wheeler, A.G.J. and D.R. Whitehead. 1985. *Larinus planus* (F.) in North America (Coleoptera: Curculionidae: Cleoninae) and comments on biological control of Canadian Thistle. Proceedings of the Entomological Society of Washington 87: 751-758.
1961	Wheeler, G.S. and T.D. Center. 1997. Growth and development of the biological control agent *Bagous hydrillae* as influenced by hydrilla (*Hydrilla verticillata*) stem quality. Biological Control 8: 52-57.
1962	Wheeler, G.S. and T.D. Center. 2001. Impact of the biological control agent *Hydrellia pakistanae* (Diptera: Ephydridae) on the submersed aquatic weed *Hydrilla verticillata* (Hydrocharitaceae). Biological Control 21: 168-181.
1963	Wheeler, G.S. and T.D. Center. 2007. Hydrilla stems and tubers as hosts for three *Bagous* species: two introduced biological control agents (*Bagous hydrillae* and *B. affinis*) and one native species (*B. restrictus*). Environmental Entomology 36(2): 409-415.
1964	Wheeler, G.S., L.M. Massey, and M. Endries. 2001. The Brazilian peppertree drupe feeder *Megastigmus transvaalensis* (Hymenoptera: Torymidae): Florida distribution and impact. Biological Control 22(2): 139-148.
1965	White, I.M. and S.L. Clement. 1987. Systematic notes on *Urophora* (Diptera, Tephritidae) species associated with *Centaurea solstitialis* (Asteraceae, Cardueae) and other Palearctic weeds adventive in North America. Proceedings of the Entomological Society of Washington 89: 571-580.
1966	White, L. 2009. Survey of biocontrol agents of Mexican thorn (*Prosopis juliflora*) on Ascension Island. University of Exeter, Exeter, U.K. 75 pp.
1968	Wiggins, G.J., J.F. Grant, P.L. Lambdin, J.W. Ranney, and J.B. Wilkerson. 2009. First documentation of adult *Trichosirocalus horridus* on several non-target native *Cirsium* species in Tennessee. Biocontrol Science and Technology 19(9): 993-998.
1969	Wild, C.H., R.E. McFadyen, A.J. Tomley, and B.W. Willson. 1992. The biology and host specificity of the stem-boring weevil *Listronotus setosipennis* (Col: Curculionidae), a potential biocontrol agent for *Parthenium hysterophorus* (Asteraceae). Entomophaga 37: 591-598.
1970	Williams, D.J. and A.B. Hamon. 1994. Scientific Note: *Phenacoccus parvus* Morrison, a possible injurious mealybug recorded for the first time from Florida (Homoptera: Coccoidea: Pseudococcidae). Insecta Mundi Paper 299: 16.
1971	Williams, H., S. Neser, and L. Madire. 2008. Candidates for biocontrol of *Macfadyena unguis-cati* in South Africa: biology, host ranges and potential impact of *Carvalhotingis visenda* and *Carvalhotingis hollandi* under quarantine conditions. Biocontrol 53(6): 945-956.
1972	Williams, H.E. 2002. Life history and laboratory host range of *Charidotis auroguttata* (Boheman) (Coleoptera: Chrysomelidae), the first natural enemy released against *Macfadyena unguis-cati* (L.) Gentry (Bignoniaceae) in South Africa. The Coleopterists Bulletin 56(2): 299-307.
1973	Williams, J.R. 1951. The control of the black sage in Mauritius by *Schematiza cordiae* Barb. (Col. Galerucid.). Bulletin of Entomological Research 42: 455-463.
1974	Willis, A.J., P.R. Berentson, and J.E. Ash. 2003. Impacts of a weed biocontrol agent on recovery from water stress in a target and a non-target *Hypericum* species. Journal of Applied Ecology 40: 320-333.
1975	Wills, E. 2000. The release and establishment of two biological control agents of horehound (*Marrubium vulgare* L.) in south-eastern Australia. Plant Protection Quarterly 15(1): 26-28.
1976	Willson, B.W. 1979. The current status of biological control of rangeland weed projects in Australia. *In* Australian Applied Entomological Research Conference, Invited Reviews and Situation Papers. 11-15 June 1979, Lawes, Australia. pp. 214-222.
1977	Willson, B.W. 1985. The biological control of *Acacia nilotica indica* in Australia. *In* E.S. Delfosse, Ed. Proceedings of the VI International Symposium on Biological Control of Weeds. 19-25 August 1984, Vancouver, Canada; Agriculture Canada. pp. 849-853.
1978	Willson, B.W. 1997. (personal communication) Department of Natural Resources, Alan Fletcher Research Station, Sherwood, Queensland 4075, Australia.
1979	Willson, B.W. and C.A. Garcia. 1992. Host specificity and biology of *Heteropsylla spinulosa* (Hom.: Psyllidae) introduced into Australia and Western Samoa for the biological control of *Mimosa invisa.* Entomophaga 37: 293-299.
1980	Wilson, C.G. and G.J. Flanagan. 1991. Establishment of *Acanthoscelides quadridentatus* (Schaeffer) and *A. puniceus* Johnson (Coleoptera: Bruchidae) on *Mimosa pigra* L. in northern Australia. Journal of the Australian Entomological Society 30: 279-280.

Code	Reference
1981	Wilson, C.G. and G.T. Flanagan. 1990. Establishment and spread of *Neurostrota gunniella* on *Mimosa pigra* in the Northern Territory. *In* J.W. Heap, Ed. Proceedings of the 9th Australian Weeds Conference. 6-10 August 1990, Adelaide, South Australia; Crop Science Society of South Australia. pp. 505-507.
1982	Wilson, C.G. and I.W. Forno. 1995. The biological control programme against *Mimosa pigra* in Australia's Northern Territory. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 75-80.
1983	Wilson, C.G. and W.M. Lonsdale. 1995. Biological control of *Sida acuta* in Australia's Northern Territory. *In* E.S. Delfosse, Ed. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand. pp. 451.
1984	Wilson, C.G. and E.B. Widayanto. 2002. The biological control programme against *Chromolaena odorata* in Eastern Indonesia. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 53-57.
1985	Wilson, C.G. and E.B. Widayanto. 2004. Establishment and spread of *Cecidochares connexa* in Eastern Indonesia. *In* M.D. Day and R.E. McFadyen, Eds. Proceedings of the 6th International Workshop on the Biological Control and Management of *Chromolaena*. 6-9 May 2003, Cairns, Queensland, Australia; Australian Centre for International Agricultural Research. pp. 39-44.
1986	Wilson, C.L. 1969. Use of plant pathogens in weed control. Annual Review of Phytopathology 7: 411-434.
1987	Wilson, D. 2013. (personal communication) University of Ghana, Department of Animal Biology & Conservation Sciences, P.O. Box LG 67, Legon-ACCRA, Ghana.
1988	Wilson, F. 1943. The entomological control of St. John's Wort (*Hypericum perforatum*) (L.). with particular reference to the insect enemies of the weed in Southern France. Bulletin, Australian Commonwealth Council of Scientific and Industrial Research 169: 1-87.
1989	Wilson, F. 1960. A review of the biological control of insects and weeds in Australia and Australian New Guinea. Technical Communication, Commonwealth Institute of Biological Control 1: 51-68.
1990	Wilson, J.R.U., O. Ajuonu, T.D. Center, M.P. Hill, M.H. Julien, F.F. Katagira, P. Neuenschwander, S.W. Njoka, J. Ogwang, R.H. Reeder, and T. Van. 2007. The decline of water hyacinth on Lake Victoria was due to biological control by *Neochetina* spp. Aquatic Botany 87: 90-93.

Code	Reference
1991	Wilson, L.M., S.E. Sing, G.L. Piper, R.W. Hansen, R. De Clerck-Floate, D.K. MacKinnon, and C. Randall. 2005. Biology and Biological Control of Dalmatian and Yellow Toadflax. FHTET-05-13. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. 124 pp.
1992	Wilson, R.C., T. Stevenson, and J.B. Knight. 1998. Biological control of invasive range weeds in Nevada. University of Nevada, Reno Cooperative Extension, Reno, Nevada, USA. 11 pp.
1993	Winder, J.A., K.L.S. Harley, and R.C. Kassulke. 1984. *Uroplata lantanae* Buzzi and Winder (Coleoptera: Chrysomelidae: Hispinae), a potential biological control agent of *Lantana camara* in Australia. Bulletin of Entomological Research 74: 327-340.
1994	Winder, J.A., D.P.A. Sands, and R.C. Kassulke. 1988. The life history, host specificity and potential of *Alagoasa parana* Samuelson (Coleoptera: Chrysomelidae) for biological control of *Lantana camara* in Australia. Bulletin of Entomological Research 78: 511-518.
1995	Windham, M.T. 2013. (personal communication) University of Tennessee, Entomology and Plant Pathology Department, 2505 E. J. Chapman Drive, 138 Biotechnology Bldg, Knoxville, TN 37996-4560 USA.
1996	Winotai, A. 1998. (personal communication) 1998. NBCRC, Kasetsart University, PO Box 9-52, Bangkok 10900, Thailand.
1997	Winotai, A. 2013. (personal communication) Biological Control Research Group, Plant Protection Research and Development Office, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand.
1998	Winotai, A. and B. Napompeth. 1997. *Sameodes albiguttalis* (Warren) (Lepidoptera: Pyralidae) for biological control of water hyacinth in Thailand. *In* A. Rajan, Ed. Proceedings of the 16th Asian-Pacific Weed Science Society Conference. September 1997, Kuala Lumpur, Malaysia; Malaysian Plant Protection Society. pp. 352-355.
1999	Winston, R.L. 2010. *Mogulones cruciger* monitoring. ARRA biological control agent development project. Progress Report 2010. MIA Consulting, Shelley, ID, USA. 3-23 pp.
2000	Winston, R.L. 2011. *Mogulones crucifer* monitoring. ARRA Biological control agent development project. Progress Report 2011. MIA Consulting, Shelley, ID, USA. 4-27 pp.
2001	Winston, R.L. 2011. Spotted knapweed biological control assessment in the Clearwater Basin. 2011 Report. MIA Consulting, Shelley, ID, USA. 39 pp.
2002	Winston, R.L., R. Hansen, M. Schwarzländer, E.M. Coombs, C.B. Randall, and R. Lym. 2008. Biology and Biological Control of Exotic True Thistles. FHTET-2007-05. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. 157 pp.
2003	Winston, R.L., C.B. Randall, J. Littlefield, M. Schwarzländer, J. Birdsall, and E.M. Coombs. 2011. Biology and Biological Control of Tansy Ragwort. FHTET-2011-02. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. 122 pp.

Code	Reference
2004	Winston, R.L., M. Schwarzländer, J. Gaskin, and C. Crabtree. 2009. Rush skeletonweed (*Chondrilla juncea*) management plan for the western United States. FHTET-2009-03. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia. 123 pp.
2005	Witt, A. 2013. (personal communication) CABI, ICRAF Complex, United Nations Avenue, Gigiri, P.O. Box 633-00621, Nairobi, Kenya.
2006	Wood, A.R. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag X5017, Stellenbosch 7600 South Africa.
2007	Wood, A.R. and M.J. Morris. 2007. Impact of the gall-forming rust fungus *Uromycladium tepperianum* on the invasive tree *Acacia saligna* in South Africa: 15 years of monitoring. Biological Control 41(1): 68-77.
2008	Wood, A.R. and M. Scholler. 2002. *Puccinia abrupta* var. *partheniicola* on *Parthenium hysterophorus* in southern Africa. Abstract. Plant Disease 86: 327.
2009	Woodburn, T.L. 1993. Host specificity testing, release and establishment of *Urophora solstitialis* (L.) (Diptera: Tephritidae), a potential biological control agent for *Carduus nutans* L., in Australia. Biocontrol Science and Technology 3: 419-426.
2010	Woodburn, T.L. 1996. Interspecific competition between *Rhinocyllus conicus* and *Urophora solstitialis*, two biocontrol agents released in Australia against *Carduus nutans*. *In* V.C. Moran and J.H. Hoffmann, Eds. Proceedings of the IX International Symposium on Biological Control of Weeds. 19-26 January 1996, Stellenbosch, South Africa; University of Cape Town Press. pp. 409-415.
2011	Woodburn, T.L. 1997. Establishment in Australia of *Trichosirocalus horridus* a biological control agent for *Carduus nutans*, and preliminary assessment of its impact on plant growth and reproductive potential. Biocontrol Science and Technology 7: 645-656.
2012	Woodburn, T.L. and D.T. Briese. 1996. The contribution of biological control to the management of thistles. Plant Protection Quarterly 11: 250-253.
2013	Woodburn, T.L. and J.M. Cullen. 1995. Release and establishment of the thistle-head weevil, *Rhinocyllus conicus*, in Australia. *In* E.S. Delfosse and R.R. Scott, Eds. Proceedings of the VIII International Symposium on Biological Control of Weeds. 2-7 February 1992, Canterbury, New Zealand; DSIR/CSIRO. pp. 411-414.
2014	Woodburn, T.L. and J.M. Cullen. 1993. Effectiveness of *Rhinocyllus conicus* as a biological control agent for nodding thistle, *Carduus nutans*, in Australia. *In* J.T. Swarbrick, Ed. Proceedings of the 10th Australian and 14th Asian-Pacific Weed Conference. 6-10 September 1993, Brisbane, Queensland, Australia; Weed Society of Queensland. pp. 99-103.

Code	Reference
2015	Woodburn, T.L. and J.M. Cullen. 1996. Impact of *Rhinocyllus conicus* and *Urophora solstitialis* on achene set in *Carduus nutans* in Australia. *In* D.J.N. Hind, H. Beentje, and P. Caligari, Eds. Proceedings of the International Compositae Conference. 1994, Kew, England; Royal Botanic Gardens. pp. 307-319.
2016	Woods, D. and D.B. Joley. 1996. Biological control of squarrose knapweed, *Centaurea virgata* spp. *squarrosa*: initial release of *Cyphocleonus achates*. *In* L.G. Bezark, Ed. Biological Control Program 1995 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 58.
2017	Woods, D., M. Pitcairn, and B. Villegas. 2009. Biological control of *Centaurea* species by imported biological control agents. *In* D.M. Woods, Ed. Biological Control Program 2008 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 50-51.
2018	Woods, D. and V. Popescu. 2009. Diffuse knapweed biological control in California: 1976-2008. *In* D.M. Woods, Ed. Biological Control Program 2008 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 43-46.
2019	Woods, D. and V. Popescu. 2010. Age structure of spotted and squarrose knapweed populations in California: implications for biological control using seedhead feeders. *In* D.M. Woods, Ed. Biological Control Program 2009 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 39-42.
2020	Woods, D., M., B. Villegas, M. Heuerter, and V. Popescu. 2008. Seedhead insects in meadow knapweed. *In* D.M. Woods, Ed. Biological Control Program 2007 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 29-31.
2021	Woods, D., B. Villegas, and V. Popescu. 2010. Evidence of overwintering and spread of *Mecinus janthinus* in California. *In* D.M. Woods, Ed. Biological Control Program 2009 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 53.
2022	Woods, D.M., W. Bruckart, J. DiTomaso, A.J. Fisher, T. Gordon, M. O'Brien, and V. Pitcairn. 2010. Yellow starthistle rust; summary of release, establishment and biology in California. *In* D.M. Woods, Ed. Biological Control Program 2009 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 43-49.
2023	Woods, D.M., W.L. Bruckart, V. Popescu, and M.J. Pitcairn. 2004. First field release of *Puccinia jaceae* var. *solstitialis*, a natural enemy of yellow starthistle. *In* D.M. Woods, Ed. Biological Control Program 2003 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 31.

Code	Reference
2024	Woods, D.M., J. Goolsby, R. Harrie, D. Spencer, C. Street, B. Villegas, and M. Vernon. 2011. First release of a biological control agent for *Arundo donax* in California. *In* D.M. Woods, Ed. Biological Control Program 2010 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California. pp. 52-54.
2025	Woods, D.M. and D.B. Joley. 1997. An update on the release and establishment of natural enemies for the biological control of spotted knapweed, *Centaurea maculosa* in California. *In* D.M. Woods, Ed. Biological Control Program 1996 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry., Sacramento, California. pp. 34.
2026	Woods, D.M., D.B. Joley, M.J. Pitcairn, and D. Griffin. 1995. Field testing of alternate hosts of *Bangasternus orientalis* (Capiomont). *In* L.G. Bezark, Ed. Biological Control Program 1994 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry, Sacramento, California. pp. 33.
2027	Woods, D.M., D.B. Joley, and V. Popescu. 2003. Establishment and impact of *Terellia virens* on spotted knapweed. *In* D.M. Woods, Ed. Biological Control Program 2002 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 60-61.
2028	Woods, D.M., D.B. Joley, and V. Popescu. 2004. Spotted knapweed seed destruction by seedhead attacking insects. *In* D.M. Woods, Ed. Biological Control Program 2003 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 38-39.
2029	Woods, D.M., M.J. Pitcairn, D.B. Joley, and C.E. Turner. 2008. Seasonal phenology and impact of *Urophora sirunaseva* on yellow starthistle seed production in California. Biological Control 47: 172-179.
2030	Woods, D.M. and V. Popescu. 2001. Establishment of biological control agents on squarrose knapweed in California. *In* L. Smith, Ed. Proceedings of the First International Knapweed Symposium of the Twenty-First Century. 15-16 March 2001, Coeur d'Alene, Idaho, USA; USDA Agricultural Research Service. pp. 58-61.
2031	Woods, D.M. and V. Popescu. 2008. Change in population of weevils attacking squarrose knapweed. *In* D.M. Woods, Ed. Biological Control Program 2007 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 24-25.
2032	Woods, D.M., B. Villegas, and E. Coombs. 1999. Release of knapweed biological control agents on purple starthistle. *In* Biological Control Program 1998 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 46.
2033	Woods, D.M., B. Villegas, and E. Coombs. 1999. Release of knapweed biological control agents on squarrose knapweed, *Centaurea squarrosa*. *In* D.M. Woods, Ed. Biological Control Program 1998 Annual Summary. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, California, USA. pp. 47-48.
2034	Woods, D.M., B. Villegas, and D.B. Joley. 1997. Attempts to establish insects for the biological control of squarrose knapweed, *Centaurea squarrosa*. *In* D.M. Woods, Ed. Biological Control Program 1996 Annual Summary. California Department of Food and Agriculture, Division of Plant Industry., Sacramento, California. pp. 36.
2035	Wooley, S., B. Smith, C. King, T. Seastedt, and D. Knochel. 2011. The lesser of two weevils: physiological response of spotted knapweed (*Centaurea stoebe*) to above-and below ground herbivory by *Larinus minutus* and *Cyphocleonus achates*. Biocontrol Science and Technology 21(2): 153-170.
2036	Woudenberg, J.H.C., M.M. Aveskamp, J. de Gruyter, A.G. Spiers, and P.W. Crous. 2009. Multiple *Didymella* teleomorphs are linked to the *Phoma clematidina* morphotype. Persoonia 22: 59-62.
2037	Wright, A.D. 1981. Biological control of water hyacinth in Australia. *In* E.S. Delfosse, Ed. Proceedings of the V International Symposium on Biological Control of Weeds. 22-29 July 1980, Brisbane, Australia; CSIRO Publishing. pp. 529-535.
2038	Wright, A.D. 1982. Progress towards biological control of water hyacinth in Australia. *In* Regional Workshop on Biological Control of Water Hyacinth. May 1982, Bangalore, India; Commonwealth Scientific Council. pp. 31-33.
2039	Wright, A.D. 1991. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, Long Pocket Laboratories, Private Bag No. 3, Indooroopilly, Queensland 4068, Australia.
2040	Wright, A.D. 1996. An outline of water hyacinth control in Australia. *In* R. Charudattan, R. Labrada, T.D. Center, and C. Kelly-Begazo, Eds. Strategies for Water Hyacinth Control: Report of a Panel of Experts Meeting. 11-14 September 1995, Fort Lauderdale, Florida, USA; FAO. pp. 115-122.
2041	Wu, Z.Y. and P.H. Raven. 1998. *Orobanche cernua* var. *cumana* (Wallroth) Beck. Vol. 18 (Scrophulariaceae through Gesneriaceae). Science Press, Beijing; Missouri Botanical Garden Press, St. Louis, USA. 450 pp.
2042	Yamanaka, T., K. Tanaka, A. Otuka, and O.N. Bjornstad. 2007. Detecting spatial interactions in the ragweed (*Ambrosia artemisiifolia* L.) and the ragweed beetle (*Ophraella communa* LeSage) populations. Ecol Res 22: 185-196.
2043	Yamazaki, K., C. Imai, and Y. Natuhara. 2000. Rapid population growth and food-plant exploitation pattern in an exotic leaf beetle, *Ophraella communa* LeSage (Coleoptera: Chrysomelidae), in western Japan. Applied Entomology and Zoology 35(2): 215-223.

Code	Reference
2044	Yano, K., J.F.G. Clarke, and Y. Yoshiyasu. 1996. Insects of Micronesia Volume 9, no. 3 Lepidoptera: Pterophoridae. Micronesica 28(2): 131-151.
2045	Yano, K. and J.B. Heppner. 1983. Description of Hamakua pamakani plume moth from Hawaii (Lepidoptera: Pterophoridae). Proceedings of the Hawaiian Entomological Society 24: 335-341.
2046	Yeoh, P.B. 2011. (personal communication) Commonwealth Scientific and Industrial Research Organisation, Ecosystem Sciences, Private Bag 5, PO Wembley, Western Australia 6913, Australia.
2047	Yeoh, P.B., M.H. Julien, and J.K. Scott. 2012. *Emex australis* Steinheil - doublegee and *Emex spinosa* (L.) Campdera - lesser jack. *In* M. Julien, R. McFadyen, and J. Cullen, Eds. Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne. pp. 238-255.
2048	Yeoh, P.B., T.L. Woodburn, and J.K. Scott. 2002. Will the red apion (*Apion miniatum*), a potential biocontrol agent for doublegee (*Emex australis*), establish in Australia? *In* J.H. Spafford, J. Dodd, and J.H. Moore, Eds. Proceedings of the 13th Australian Weeds Conference. 8-13 September 2002, Perth, Western Australia; Plant Protection Society of WA. pp. 432-434.
2049	Yoshioka, E.R., M.O. Isherwood, and G.P. Markin. 1991. Progress of biological control of gorse in Hawaii. Western Society of Weed Science 44: 75-78.
2050	Young, R.G. 1982. Recent work on biological control in Papua New Guinea and some suggestions for the future. Tropical Pest Management 28: 107-114.
2051	Yourman, L.F. and D.G. Luster. 2004. Generation of molecular markers for the identification of isolates of *Puccinia jaceae*, a potential biological control agent of yellow starthistle. Biological Control 29: 73-80.
2052	Zachariades, C. 2011. Biological control agents released and established on *Chromolaena odorata* worldwide. *Chromolaena odorata* Newsletter 18: 3-4.
2053	Zachariades, C. 2013. (personal communication) Agricultural Research Council-Plant Protection Research Institute, Weeds Research, P/Bag 6006, Hilton 3245 South Africa.
2054	Zachariades, C., M. Day, R. Muniappan, and G.V.P. Reddy. 2009. *Chromolaena odorata* (L.) King and Robinson (Asteraceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, UK. pp. 130-162.
2055	Zachariades, C., J.H. Hoffmann, and A.P. Roberts. 2011. Biological control of mesquite (*Prosopis* species) (Fabaceae) in South Africa. African Entomology 19(2): 402-414.
2056	Zachariades, C., L.W. Strathie, and R.L. Kluge. 2002. Biology, host-specificity and effectiveness of insects for the biocontrol of *Chromolaena odorata* in South Africa. *In* C. Zachariades, R. Muniappan, and L.W. Strathie, Eds. Proceedings of the 5th International Workshop on Biological Control and Management of *Chromolaena odorata*. 23-25 October 2000, Durban, South Africa; Agricultural Research Council-Plant Protection Research Institute. pp. 160-166.
2057	Zachariades, C., L.W. Strathie, E. Retief, and N. Dube. 2011. Progress towards the biological control of *Chromolaena odorata* (L.) R. M. King & H. Rob. (Asteraceae) in South Africa. African Entomology 19(2): 282-302.
2058	Zachariades, C., L.W. Strathie-Korrûbel, and R.L. Kluge. 1999. The South African programme on the biological control of *Chromolaena odorata* (L.) King & Robinson (Asteraceae) using insects. *In* T. Olckers and M.P. Hill, Eds. Biological Control of Weeds in South Africa (1990-1998). African Entomology Memoir 1: 89-102.
2059	Zahiri, R., I.J. Kitching, J.D. Lafontaine, M. Mutanen, L. Kaila, J.D. Holloway, and N. Wahlberg. 2010. A new molecular phylogeny offers hope for a stable family level classification of the Noctuoidea (Lepidoptera). Zoologica Scripta 40(2): 158-173.
2060	Zebeyou, M. 1998. (personal communication) Ivorian Anti-Pollution Centre (CIAPOL), Ministry of Housing and Environment, Abidjan, Cote d'Ivoire.
2061	Zhang, F. 2005. Water hyacinth *Eichhornia crassipes* (Martius) Solms-Laubach. *In* F.H. Wan, X.B. Zheng, and J.Y. Guo, Eds. Biology and Management of Invasive Alien Species in Agriculture and Forestry. Science Press, Beijing. pp. 693-714.
2062	Zhang, F., W.-X. Liu, F.-H. Wan, and C.A. Ellison. 2008. Sustainable management based on biological control and ecological restoration of an alien invasive weed, *Ageratina adenophora* (Asteraceae) in China. *In* M.H. Julien, R. Sforza, M.C. Bon, H.C. Evans, P.E. Hatcher, H.L. Hinz, and B.G. Rector, Eds. Proceedings of the XII International Symposium on Biological Control of Weeds. 22-27 April 2007, La Grande Motte, France; CAB International. pp. 699-703.
2063	Zhou, Z.S. 2012. (personal communication) Chinese Academy of Agricultural Sciences, Institute of Plant Protection, Biological Invasion Department, Beijing, China.
2064	Zhou, Z.-S., J.-Y. Guo, H.-S. Chen, and F.-H. Wan. 2010. Effect of humidity on the development and fecundity of *Ophraella communa* (Coleoptera: Chrysomelidae). Biocontrol 55: 313-319.
2065	Zhou, Z.-S., J.-Y. Guo, and F.-H. Wan. 2009. Case Study 1: Biological control of *Ambrosia artemisiifolia* with *Epiblema strenuana* and *Ophraella communa*. *In* F.H. Wan, J.Y. Guo, and F. Zhang, Eds. Research on Biological Invasions in China. Science Press, Beijing. pp. 253-258.
2066	Zimmerman, E.C. 1958. Insects of Hawaii. Vol. 7. University of Hawaii Press, Honolulu, Hawaii. 549 pp.

Code	Reference
2067	Zimmerman, E.C. 1958. Insects of Hawaii. Vol. 8. University of Hawaii Press, Honolulu, Hawaii. 458 pp.
2068	Zimmerman, E.C. 1978. Insects of Hawaii. Vol. 9. University of Hawaii Press, Honolulu, Hawaii. 1903 pp.
2069	Zimmerman, E.C. 1994. Australian Weevils. Vol. 2. CSIRO Publications, Melbourne. 755 pp.
2070	Zimmermann, H. 2013. (personal communication) Helmuth Zimmermann & Associates, P.O. Box 974, Faerie Glen 0043, South Africa.
2071	Zimmermann, H., S. Bloem, and H. Klein. 2004. Biology, History, Threat, Surveillance and Control of the Cactus Moth, *Cactoblastis cactorum*. IAEA, Vienna. 47 pp.
2072	Zimmermann, H.G. 1991. Biological control of mesquite, *Prosopis* spp. (Fabaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 175-186.
2073	Zimmermann, H.G. 1991. Biological control of spear thistle, *Cirsium vulgare* (Asteraceae), in South Africa. Agriculture, Ecosystems & Environment 37: 199-205.
2074	Zimmermann, H.G. 1997. (personal communication) Plant Protection Research Institute, Private Bag X134, Pretoria 0001, Republic of South Africa.
2075	Zimmermann, H.G. and V.C. Moran. 1991. Biological control of prickly pear, *Opuntia ficus-indica* (Cactaceae), in South Africa. Agriculture, Ecosystems & Environment 37: 29-35.

Code	Reference
2076	Zimmermann, H.G., V.C. Moran, and J.H. Hoffmann. 2000. The renowned cactus moth, *Cactoblastis cactorum*: its natural history and threat to native *Opuntia floras* in Mexico and the United States of America. Diversity and Distribution 6: 259-269.
2077	Zimmermann, H.G., V.C. Moran, and J.H. Hoffmann. 2009. Invasive cactus species (Cactaceae). *In* R. Muniappan, G.V.P. Reddy, and A. Raman, Eds. Biological Control of Tropical Weeds using Arthropods. Cambridge University Press, Cambridge, U.K. pp. 108-129.
2078	Zimmermann, H.G., M. Pérez, S. Cuen, M.C. Mandujano, and J. Golubov. 2010. The South American mealybug that threatens North American cacti. Cactus and Succulent Journal 82(3): 105-107.
2079	Zimmermann, H.G., M.P. Sandi y Cuen, and A.B. Rivera. 2005. The status of *Cactoblastis cactorum* (Lepidoptera: Pyralidae) in the Caribbean and the likelihood of its spread to Mexico. Report to the International Atomic Energy Agency (IAEA), Joint FAO/IAEA Division of Nuclear Techniques in Food and AGriculture and the Plant Health General Directorate, Mexico (DGSVB/SAGARPA) as part of the TC Project MEX/5/029. 63 pp.
2080	Zwölfer, H. and P. Harris. 1984. Biology and host specificity of *Rhinocyllus conicus* (Froel.) (Col., Curculionidae), a successful agent for biocontrol of the thistle *Carduus nutans* L. Zeitschrift für Angewandte Entomologie 97: 36-62.

SCIENTIFIC NAMES OF WEEDS

INDEXES

O

P

R

S

T

U

V

X

FAMILIES OF WEEDS

SCIENTIFIC NAMES OF AGENTS

A

INDEXES

D

E

INDEXES

S

INDEXES

T

U

V

W

X

Z

AGENT FAMILIES (INSECTS AND MITES) AND ORDERS (FUNGI)