WWF

GREATER MEKONG 2023

NEW SPECIES DISCOVERIES

IN THE GREATER MEKONG

2021 & 2022

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Special thanks to the researchers who contributed to the report by providing quotes and photographs, and for their contributions to expanding our understanding of the species diversity of the region.

We thank Dr Truong Q. Nguyen for providing a foreword. Thanks also to Reuben Houfe for designing the report. WWF-Greater Mekong appreciates WWF-Sweden for funding the production of this report.

- For this report, Greater Mekong region comprises Cambodia, Laos, Myanmar, Thailand and Viet Nam, and does not include Yunnan province and Guangxi Zhuang Autonomous Region of southern China.
- The sum of the numbers for each country on page 3 and 4 does not equal the total number of new species discovered in the Greater Mekong in 2021 and 2022, because some species have a distribution spanning more than one country
- For this report, we consider the new species currently recorded in only one country as endemic to that country; some of these endemic species are likely to occur in multiple countries but have not yet been recorded outside the country's borders.

FOREWORD

Discoveries of new species, like the ones highlighted in this report, help to fill the knowledge gap about what exists in the natural world. They also fill us, the researchers, with wonder and trepidation. Wonder that there are still countless species yet to be found, and trepidation that there isn't enough time to find, understand and conserve them. There are many creatures that have disappeared before we have even named them - some hiding in plain sight and separated from their nearest cousins by just a few physical or genetic characteristics, some in the yet unexplored and hidden corners of our world. This alone is a motivation for scientists like myself to continue conducting biodiversity research. It should also be a wake-up call for everyone - from conservationists to governments to regular people - to take urgent action to ensure these species and their habitats survive into the future.

The Greater Mekong region is recognized as a biodiversity hotspot - also known as the Indo-Burma hotspot. The region exhibits a diversity of natural habitats with a wide range of elevations and complex landforms, resulting in an extremely high level of biological diversity, with scientists discovering numerous new species every year. These taxonomic discoveries are aided by new techniques - like new ways of analysing the sounds made by animals in the field of bioacoustics and advancements in genetic sequencing—that let us see these plants and animals in more detail than ever before.

The outstanding discoveries of new species in the Greater Mekong region show tremendous efforts and fruitful collaboration between scientists from the region and other parts of the world, both in the field and in labs housed in universities and research institutions. These collaborations sometimes span generations, with samples that were collected by naturalists decades ago finally being analysed by up-and-coming researchers working in botanical gardens, natural history museums and zoological societies. For instance, one of the species highlighted in this report is a plant that was collected in the 1930s and only recently confirmed to be a novel species by a new team of researchers.

The biodiversity of the Greater Mekong region is facing tremendous pressures from economic development and human population growth, which drive deforestation, pollution and overexploitation of natural resources, compounded by the effects of climate change. More concerted, science-based and urgent efforts need to be made to reverse the rapid biodiversity loss in the region. To stop what scientists are calling the sixth mass extinction and instead add to our knowledge of the richness of the natural world, more scientific research is needed, including field surveys, analysis of lab samples and advancements in species identification. Conservation measures for ecosystems and wildlife species need more attention from government agencies, NGOs and the general public. Using the critical evidence base that is laid by scientists, we all need to urgently invest time and resources into the best ways to conserve the known and yet unknown species.

Prof Dr Truong Q. Nguyen
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Photo: © Siegfried Werth

2021 AT A GLANCE

131 PLANTS

8 FISHES

14 AMPHIBIANS

22 REPTILES

TOTAL 175

2022 AT A GLANCE

159 PLANTS

11 FISHES

10 AMPHIBIANS

24 REPTILES

1 MAMMAL

TOTAL 205

NEW SPECIES DISCOVERIES IN THE GREATER MEKONG

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	MYANMAR	CAMBODIA	THAILAND	LAOS	VIET NAM
2021	30 (21 ENDEMIC)	3 (1 ENDEMIC)	53 (46 ENDEMIC)	40 (36 ENDEMIC)	62 (57 ENDEMIC)
2022	27 (23 ENDEMIC)	6 (4 ENDEMIC)	74 (66 ENDEMIC)	13 (9 ENDEMIC)	96 (85 ENDEMIC)

INTRODUCTION

An extraordinary 380 new species of vascular plants and vertebrate animals were discovered[i] in the Greater Mekong region in 2021 and 2022 - 175 and 205 species, respectively.

The Greater Mekong region of Southeast Asia - comprising Cambodia, Laos, Myanmar, Thailand and Viet Nam - is part of the larger Indo-Burma biodiversity hotspot. It is home to globally iconic and endangered species, including the tiger, the Asian elephant, the Sunda pangolin and the giant freshwater stingray. New species are discovered here constantly, as researchers continue to explore remote natural habitats and sift through specimens preserved decades back in natural history museums across the world. The 2021 and 2022 discoveries bring the total species of vascular plants, fishes, amphibians, reptiles, birds and mammals described in the region by science since 1997 to 3,389[ii].

In the last two years, researchers have brought some remarkable new species to the world's attention, including a thick-thumbed bat; a new poisonous krait named after a snake goddess from a Chinese myth; a gecko that was discovered near the capital city of Laos; a new cutthroat eel, which is only the third species described in its genus; and a ginger-like plant dispersed by ants.

These new species, painstakingly identified and described by keen naturalists and taxonomists, and compiled here by WWF-Greater Mekong, demonstrate that the region is still a fertile ground for scientific exploration and a hotspot of species diversity. But they also remind us of what we stand to lose if human settlements and development activities in the region continue to destroy the natural habitats. Many species go extinct before they are even discovered, driven by habitat destruction, diseases spread by human activities, competition with invasive species and the devastating wildlife trade.

The discovery of new species every year highlights the importance of the remaining natural ecosystems and the interest of biological explorers in the Greater Mekong. It also drives home the tremendous need for increasing protection of species and habitats. Without substantial conservation action, we will continue to lose the biodiversity that makes our region rich and unique. With active conservation efforts by governments, scientists, NGOs and local communities, we can enable incredible new species, like the ones highlighted here, to continue to persist and be discovered for many years to come.

i Refers to the official process by which a species is described in the peer-reviewed scientific literature once discovered or genetically determined to be distinct from other species and therefore formally determined as 'new' species.

ii This number is compiled from past WWF-Greater Mekong new species research, and includes some species that were discovered in Yunnan and Guangxi before 2014. After 2014, it only includes species discovered in Cambodia, Laos, Myanmar, Thailand and Viet Nam.

CAMBODIA

CLEYERA BOKORENSIS

2021

ALSO FOUND IN VIET NAM

Photos: © Shuichiro Tagane

First collected in Cambodia on Mount Bokor - from which it gets its name - in 1933, this evergreen shrub had been categorized as a variety of *Cleyera japonica* since 1943. Only in 2021 was this species, which is found in Bokor National Park in Cambodia and Binh Dinh in Viet Nam, determined to be a separate species in the genus *Cleyera*. This re-categorization is based on physical differences between *C. bokorensis* and its closest relative *C. obscurinervia*, including longer floral petals and fewer secondary veins in the leaves, as well as the height of mature plants.

Commonly found along bodies of flowing water in forested areas, this species is known from only two isolated populations in Cambodia and Viet Nam. Bokor National Park is a hotspot of plant diversity, with a two-year survey recording at least 24 new plant species and 100 plant species recorded in Cambodia for the first time. Bokor is a popular destination for tourists, and recent plans for developing a casino, dams and residential homes may negatively impact the habitat and survival of the species in Cambodia. Likewise in Viet Nam, the area in Long My Protection Forest where the shrub is found is threatened by human encroachment.

Researchers estimate that there are fewer than 2,500 mature *C. bokorensis* plants in each country, and have recommended that it be assessed as Endangered in the IUCN Red List.

Tagane, S., Phourin, C., Son, H. and Yahara, T. (2021). Flora of Bokor National Park VIII: A new species of *Cleyera* (Pentaphylacaceae), C. *bokorensis*. *Acta Phytotaxonomica et Geobotanica* 72: 145-151. doi.org/10.18942/apg.202011

CALOTES GOETZI

2021

ALSO FOUND IN CHINA, LAOS, MYANMAR AND THAILAND

© Henrik Bringsoe

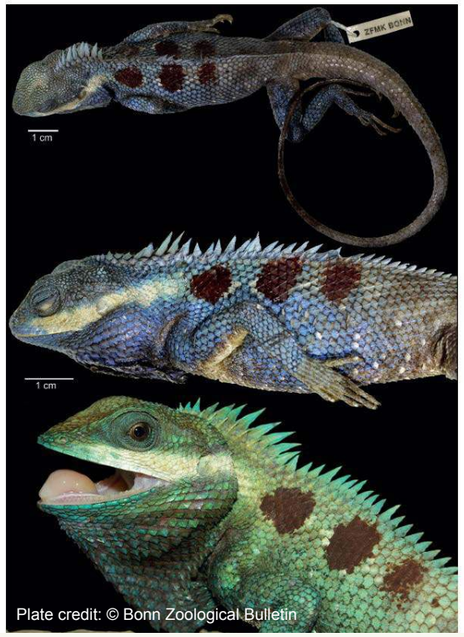

Plate credit: © Bonn Zoological Bulletin

The holotype for the Cambodian blue crested agama was found near the Angkor era archaeological site Kbal Spean, within the Phnom Kulen National Park in Siem Reap province of Cambodia. The dominant males of the species are bright blue, and both males and females have three to five prominent dark brown spots along their back. This species is named after Dr Stephan Goetz in recognition of his contribution to species conservation in Cambodia.

The Cambodian blue crested agama (alternatively known as the Siamese blue crested lizard) is one of three new species in the genus *Calotes* described in the process of resolving the lineage of *Calotes mystaceus*. Previously considered to be the same species, a new study identified four physically and genetically distinct species - *C. goetzi*, *C. geissleri*, *C. mystaceus* and *C. vindumbarbatus* - which span Cambodia, China, Laos, Myanmar, Thailand and India, with the original species now thought to exist only in the Irrawaddy delta region of southern coastal Myanmar.

The genus *Calotes* has 25 species native to Asia but some also have been introduced to Africa and the Americas. Given 25 species, four new species descriptions are very significant for the region. Found in dipterocarp lowland and secondary forests, *C. goetzi* is a strong climber and can easily climb to 10 metres high on a tree. It can also be found in agricultural landscapes, including coconut, banana and durian plantations, and feeds primarily on insects. Something unique for this particular species is that older individuals will change colour as a defence mechanism – particularly males, which are territorial and aggressive, especially when they are guarding a clutch of eggs.

“We came across the new species at our conservation centre in Cambodia, the Angkor Centre for Conservation of Biodiversity, when we recognized that the colouration was different to other similar lizards,” said Dr Philipp Wagner, lead author on the discovery. “We checked images from other countries and realized that what we had been considering a species was in fact a species complex, including this one new individual from Cambodia. It was a great feeling to discover this beautifully coloured new species in a place where we are actively doing conservation; now I love seeing ‘my own’ species running around when I visit the centre.”

Wagner, P., Ihlow, F., Hartmann, T., Flecks, M., Schmitz, A. and Böhme, W. (2021) Integrative approach to resolve the *Calotes mystaceus* Duméril & Bibron, 1837 species complex (Squamata: *Agamidae*). *Bonn Zoological Bulletin* 70(1): 141–171. doi.org/10.20363/BZB-2021.70.1.141

CYRTODACTYLUS KULENENSIS

2021

ENDEMIC TO CAMBODIA

The Phnom Kulen bent-toed gecko has only been found on the sandstone outcroppings in Phnom Kulen National Park in Siem Reap province. Phnom Kulen, which translates as “the mountain of lychees” in Khmer, is a chain of sandstone mountains, part of which was used as a quarry by the Angkorian empire. *C. kulenensis* hides in the crevices in the sandstone rock faces.

This gecko was first collected in 2008, but the holotype is from 2011. Even before the genetic analysis, the morphology of the species showed that it was distinct from other species in this genus, having no large dark blotches on the top of its head, three or four well-defined brown body bands, and a significantly greater number of scales around the mouth and bumps on the skin along its spine.

The genetic analysis of the gecko determined that it is a sister species to a fellow *Cyrtodactylus* from Sa Keao and Sakaerat in eastern Thailand, a long way from Phnom Kulen. Both of these species were formerly considered to be *Cyrtodactylus intermedius*, which was considered to be a distinct species for over 100 years, but which was shown to actually be a number of species in 2015. To date, 12 of these species have been identified, including the one at Phnom Kulen. It shows how many reptile and amphibian species are endemic to very small ranges in this region – from the Salween Basin in Myanmar, through the Chao Phraya and Tonle Sap basins in Thailand and Cambodia, to the Mekong Delta in southern Vietnam – and the urgent need for surveys to discover more species before they are lost.

“Some discoveries take time,” said Peter Geissler of the Museum Natur und Mensch who co-authored the discovery. “We had long suspected that the banded *Cyrtodactylus* geckos on the Phnom Kulen Plateau were a new, undescribed species. But it took almost 10 years of joint research, conducted by Cambodian, American and Russian colleagues, to uncover the evolutionary patterns of this beautiful lizard of the lower Mekong. In the end, morphological as well as molecular data made it clear: Phnom Kulen is home to another unique creature deserving protection.”

Grismer, L.L., Geissler, P., Neang, T., Hartmann, T., Wagner, P. and Poyarkov, N.A. (2021) Molecular phylogenetics, PCA, and MFA recover a new species of *Cyrtodactylus* (Squamata: *Gekkonidae)* from an isolated sandstone massif in northwestern Cambodia. *Zootaxa* 4849: 261-288. doi.org/10.11646/zootaxa.4949.2.3

Photos: © Peter Geissler

MYOTIS HAYESI

2022

ENDEMIC TO CAMBODIA

This new species of bat was discovered from a single specimen found in a garden in Phnom Penh, the capital of Cambodia, in the year 2000. A member of the mouse-eared bat family (*Myotis*), Hayes’ thick-thumbed myotis was named after the Scottish conservation and bat expert Ben Hayes.

The specimen spent two decades in the collection of the Hungarian Natural History Museum before researchers Gábor Csorba and Neil Furey identified it as a new species. As well as its distinctive fleshy thumbs, it has large, smooth soles on its hind feet and a differently shaped skull from other bats in its family.

With just a single specimen having been recorded, the researchers suggest the species should be listed as Data Deficient on the IUCN Red List. But they are concerned about its current status and future survival as Phnom Penh has become more built up and local wetlands and green spaces have been lost in the past two decades.

“This is a specimen from a greener time,” said Csorba. “While we think it is unlikely that the species has become extinct, it is possible that it no longer flies over the city streets and private gardens where the only specimen was originally collected. That is a sobering thought and one that should focus minds on protecting the shrinking habitats that underpin biodiversity in Cambodia.”

Csorba, G. and Furey, N.M. (2022) From greener times: A new species of thick-thumbed Myotis from Phnom Penh, Cambodia. *Acta Zoologica Academiae Scientiarum Hungaricae: An International Journal of Animal Taxonomy and Ecology* 68(1): 85-97. doi.org/10.17109/AZH.68.1.85.2022

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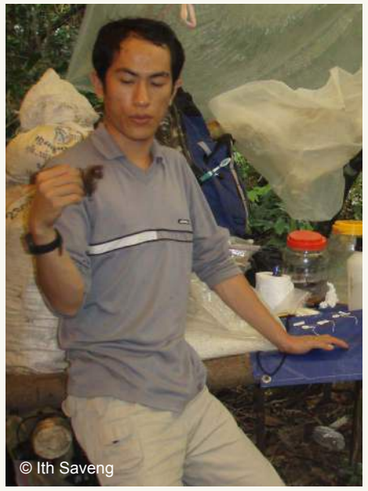

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LAOS

DENDROBIUM FUSCIFAUCIUM

2022

ENDEMIC TO LAOS

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© Keooudone Souvannakhoummane

© Keooudone Souvannakhoummane

© K. Yoganand/WWF-Greater Mekong

© K. Yoganand/WWF-Greater Mekong

This beautiful miniature orchid is an unusual discovery: it was identified as a new species from a nursery collection, but attempts to find it in the wild have so far proved unsuccessful.

The nursery owner bought the plant from a local vendor of wild plants, who claimed to have collected it in the limestone hills of Kasi District in Vientiane province. When it flowered, he sent some photos to Dr Pankaj Kumar, an expert on Asian orchids and currently a visiting scholar at Texas Tech University. Convinced it was an unknown species, Dr Kumar worked with fellow orchid specialist Keooudone Souvannakhoummane of National University of Laos to examine and describe the species. Both have attempted to locate *Dendrobium fuscifaucium* in the wild, but without success.

"This is not the first orchid described from trade in Laos and in fact a few animal species have been also described from the trade in the country in the past decade," says Kumar. "It is a very beautiful miniature orchid with large flowers and hence has a very high potential ornamental value."

The international orchid trade is a huge business, with an estimated 1.1 billion live orchid plants traded in the decade between 1996 and 2015. Although nearly all orchids traded legally are propagated artificially, trafficking and overharvesting from the wild are a threat to many species. The discovery of this new species only underlines the importance of protecting these delicate plants.

Souvannakhoummane, K., Kumar, K. and Phonepaseuth, P. (2022) *Dendrobium fuscifaucium* (Orchidaceae: Epidendroideae: Dendrobieae), a new Laotian species only known in cultivation. *Phytotaxa* 541(3). doi.org/10.11646/phytotaxa.541.3.8

IMPATIENS SUBFALCATA

2021

ENDEMIC TO LAOS

Collected at the Tad Seua waterfall on the Bolaven Plateau in Champasak province, this species of impatiens has only been found on the dripping rocky walls of this waterfall. Known as ຫຽນໃບດຽບ *(thien baidab)* in Lao language, the plant is similar to *I. attopeuensis* and *I. notoptera* with succulent stems, serrate leaf margins and pinkish flowers, but is distinguished from these two by its curved, sickle-like leaves.

The species is also unique in its habitat and elevation, growing on very wet rock walls in an evergreen forest at 1,147m above sea level. This is much more extreme than its close relative *I. attopeuensis*, found in Attepeu province, which grows on rocks or in soil near bodies of water, and is not found at elevations higher than 900m. The other close relative, *I. notoptera* from Stung Treng, Cambodia, has less narrow leaves and smaller lateral petals.

This is the 36th *Impatiens* species to have been discovered in Laos. Since only about 30 individuals were discovered in one location, the species has been preliminarily assessed as Critically Endangered.

Souladeth, P., Tagane, S., Suyama, Y., Ishii, N., Nagahama, A. and Souvannakhoummane, K. (2021). *Impatiens subfalcata (balsaminaceae),* A new species from Laos. *Edinburgh Journal of Botany* 78: 1-10. doi.org/10.24823/EJB.2021.358

Photos: © Shuichiro Tagane

NEMACHEILUS PEZIDION

2022

ENDEMIC TO LAOS

This species of loach was first collected in 1999 in the Xe Kong watershed in Attapeu province in southern Laos. It was originally identified as *Nemacheilus longistriatus*, but in 2022 it was confirmed as a new species. It is distinguished from the nearly 800 other fishes in the stone loach family (*Nemacheilidae*) by its unique colour pattern consisting of a black stripe along its side and 11–15 narrow saddles across its back.

Swiss ichthyologist Maurice Kottelat first came across the species while researching a book on the fishes of Laos. Sampling expeditions in various habitats across the country yielded around 60 new species – but with so many others discovered, this one slipped through the net.

“At first the fish was identified as *N. longistriatus* but it looked somewhat different, and I put it aside to look at it in detail later,” said Kottelat. “It was only recently, when preparing a new edition of my book, that I looked at it in more detail and confirmed it is a distinct species.”

To date, the species has only been recorded in the lower part of the Xe Pian watershed. It is likely to have been affected by the collapse, in 2018, of a major dam on the Xe Pian river, which caused catastrophic flooding. “All the sites where we collected the species seem to have been impacted,” said Kottelat. “As far as I know, nobody has checked which of the native fauna of Xe Pian is still present.”

Kottelat, M. (2022). *Nemacheilus pezidion*, a new species of loach from southern Laos (Teleostei: Nemacheilidae). *Zootaxa* 5129(1): 92-104. doi.org/10.11646/zootaxa.5129.1.5

Photo: © Maurice Kottelat

DIXONIUS SOMCHANHAE

2021

ENDEMIC TO LAOS

This new species of gecko was discovered in Vientiane prefecture, Laos, in a forested area near Huaysorn-Huaysua village, Nasaithong district. Endemic to Laos, *Dixonius somchanhae* is named after Dr Somchanh Bounphanmy, associate professor of the National University of Laos, who supported the authors in their research. The second species of the genus described in the country after *D. lao* was described in 2020, and the 12th to be recognized overall, this species can be distinguished through a number of physical differences, including its colour pattern.

This gecko is a sister species to *D. siamensis*, which occurs in Laos, Thailand and Viet Nam, according to genetic analysis, but is physically most similar to *D. taoi* from Viet Nam. Found at night on sandstone rocks, these geckos live in secondary forests that are being fragmented by construction projects. Given that the only known location for this species is an unprotected habitat near the capital city of Laos, further research to determine its distribution and population is needed in order to determine its conservation status and protect it from threats to its survival.

Nguyen, T.H., Luu, V.Q., Sitthivong, S., Ngo, H.T., Nguyen, T.Q., Le, M.D. and Ziegler, T. (2021) A new species of *Dixonius* (Squamata: *Gekkonidae*) from Vientiane Capital, Laos. *Zootaxa* 4965: 351-362. doi.org/10.11646/zootaxa.4965.2.8

Photos: © Dr Luu Quang Vinh

OLIGODON TEYNIEI

2022

LIKELY TO ALSO OCCUR IN CAMBODIA

Experts struggled to identify this species of *Oligodon* or kukri snake when it was originally collected in 2004 in Xe Pian National Park in southern Laos. Although its bright banded markings were distinct from other closely related species, the original specimen was a newborn, and snakes' patterns can change as they age.

But when another specimen was found dead by the roadside on Không Island, a large island in the Mekong River some 70km away, researchers were able to confirm it was a distinct species. It has fewer plates on its lower surface than the closely related *O. inornatus*, which inhabits the same region, and is a brighter reddish brown colour with conspicuous crossbands on its back.

O. teyniei or Teynié's kukri snake is named in honour of French herpetologist Alexandre Teynié, who has studied the snakes of Laos for 20 years. Although it has only been recorded in Laos, it may also exist in Cambodia, since Không Island is just 8km from the national border.

Xe Pian National Park is a hotspot of snake biodiversity with at least 30 species, including three other species of kukri snake. Its forests and wetlands are home to a rich array of species of various taxa.

David, P., Hauser, S. and Vogel, G. (2022). A new species of the genus *Oligodon* Fitzinger, 1826 (Reptilia: Colubridae) from southern Laos. *Taprobanica* 11(1): 12-24. doi.org/10.47605/tapro.v11i1.273

Photos: © Patrick David. Courtesy of the "Service des collections", Muséum National d'Histoire Naturelle, Paris

MYANMAR

MYANMARANTHUS ROSEIFLORUS

2022

ENDEMIC TO MYANMAR

Found growing by the roadside in the buffer zone of Hkakaborazi National Park in the north of Myanmar, this plant turned out to be not just a new species but an entirely new genus.

Myanmaranthus roseiflorus is a member of the *Marantaceae* family, commonly known as prayer plants for the way they close their leaves at night like praying hands. There are more than 500 species worldwide, of which around 55 are found in Asia. Previously, six genera of *Marantaceae* had been described in Asia, but this specimen's unique features mean it does not fit in any of them. These include a rosulate habit (forming leaves in a rosette pattern), a loose paniculate inflorescence (multi-branched cluster of flowers) growing out of the rhizome, and a fertile bract holding a single pink flower.

Dr Kate Armstrong from the New York Botanical Garden collected the plant as part of an expedition to document the flora of Myanmar's Northern Forest Complex, one of the largest and least-studied areas of unbroken forest in Southeast Asia. Detailed morphological investigation and molecular analyses at Japan's National Museum of Nature and Science confirmed the plant as a new species belonging to a new genus.

"When I first saw this specimen, I thought it was from the genus Indianthus, which has only a single species, *I. virgatus*, from India," said Nobuyuki Tanaka, chief curator for the herbarium in the Department of Botany at the National Museum of Nature and Science, Japan. "But after coming back to my office and carrying out a detailed morphological investigation and molecular analyses, we determined that it could not be assigned to any existing genera of Asian *Marantaceae*, so we described it as a new genus and species."

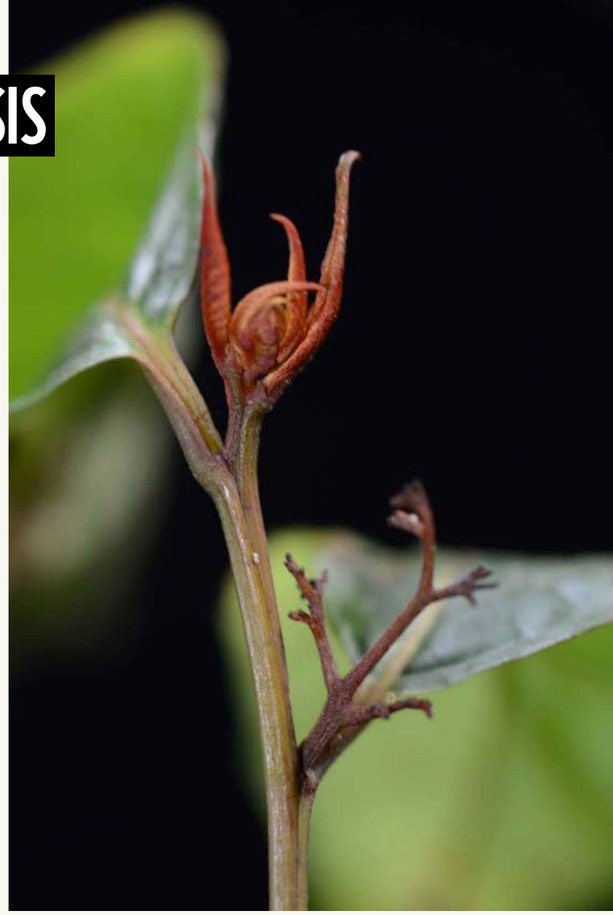
"Myanmar is a major biodiversity hotspot, yet its flora is probably the least studied in the Northern Hemisphere," wrote Dr Armstrong in her institution's blog. "As the country emerges from decades of isolation and political upheaval, the New York Botanical Garden is working to document Myanmar's undiscovered plant life, build the country's capacity to carry out plant research, and promote the sustainable use of its forests."

Tanaka, N., Ohi-Toma, T., Suksathan, P., Aung, M.M., Poulsen, A. D., Mohamad, S. and Armstrong, K.E. (2022). *Myanmaranthus roseiflorus*, a new genus and species of Marantaceae from Myanmar. *Journal of Japanese Botany* 97(4): 187-196. doi.org/10.51033/jjapbot.97_4_11177

PERROTTETIA TARONENSIS

2021

FOUND ALSO IN CHINA



Found in the Babulongtan mountain range in northern Kachin state, Myanmar, and the Dulong Jiang valley in northwestern Yunnan province, China, this new species of flowering shrub is the first species of *Perrottetia* to be reported in Myanmar. Named after the Taron River valley in Myanmar, *P. taronensis* has been found on slopes in subtropical broadleaved evergreen forests, in disturbed secondary forests, and among shrubs near river banks in the Ayeyarwady (Irrawaddy) river basin.

One specimen was collected in Myanmar in the Kachin Hills subtropical rainforest ecosystem, while six were collected in China near Dulong Jiang River, which drains into the Taron River in Myanmar and eventually into the Ayeyarwady River. The specimen from Myanmar is male while the six specimens collected in China are female, leading researchers to posit that this plant is dioecious, meaning male and female reproductive organs are in separate individuals. However, more field studies are needed during the spring when plants are flowering to be certain.

This new species is physically most similar to a species that occurs over 2,500km away in Peninsular Malaysia and Indonesia on Sumatra and Java, as well as a few small islands nearby. Major physical differences between the two species are in its leaf margins, inflorescences and fruit. No other species of this genus occurs in locations in between these two species. The researchers who discovered it recommend it be classified as Endangered in the IUCN Red List, given its small area of occurrence, the degradation of its habitat, and the low number of mature individuals found.

"I collected this plant as part of a large US National Science Foundation funded inventory of the region, where we aimed to document all vascular plant species," said Dr Kate Armstrong of the New York Botanical Garden. "This one was, at first, unremarkable, except that it was collected during a particularly harrowing trip, during a long trek over a mountain in the bucketing monsoon rain. So, I remember the conditions of the trip more than collecting the plant itself!

"Because I couldn't easily identify the genus – it's from a relatively obscure plant family with just 2 genera and 20 species – I asked the advice of colleagues who have also worked on the flora of that region, albeit on the Chinese side of the border. Bruce Bartholomew, from the California Academy of Sciences, recognized the genus immediately, and after going back through collections that he and other colleagues had made in Yunnan about 20 years ago, he realized that we had a new, undescribed species. That is the case with many new taxa – they are hiding in our herbarium collections waiting to be recognized and described."

Bartholomew, B., Armstrong, K.E., Li, R. and Fritsch, P.W. (2021) *Perrottetia taronensis* B.M.Barthol. & K.Armstr., sp. nov. (Dipentodontaceae), a new species from northwestern Yunnan Province, China and northern Kachin State, Myanmar and a re-examination of the Asian and Australasian taxa of Perrottetia. *PhytoKeys* 183: 67-76. doi.org/10.3897/phytokeys.183.71505

DARIO TIGRIS

2022

ENDEMIC TO MYANMAR

© Thadoe Wai / WWF-Myanmar

Although barely 20mm long, this miniature chameleon fish stands out for its striking orange-red stripes – which have earned it the name black tiger badis or dario in the ornamental fish trade.

Researchers first recorded two specimens with this distinct colouration in mountain streams in the Ayeyarwady river basin in northern Myanmar in 2002, among several hundred specimens of *Dario hysginon* – the only species in the *Dario* genus known in Myanmar at the time. Since there were no other clear differences, the researchers concluded that the two striped specimens represented a "colour phase" of *D. hysgnion* rather than a new species. But with the aid of more new specimens and mitochondrial DNA analysis, in 2022 scientists were able to show that it was a distinct species.

At the same time, the research team also described another new *Dario* species, collected from the Chindwin river basin. *D. melanogrammus* has zigzagging dark vertical bars that are unlike any other species in the genus, and has more vertebrae than its fellow Ayeyarwady basin species.

The discoveries bring the total number of species in the *Dario* genus to eight, found in freshwater streams and pools in Myanmar, China's Yunnan province and parts of India. They are among around 30 species belonging to the *Badidae* family, known as chameleon fish for their ability to change colour.

"The small species are exciting because no one has looked at them properly," said researcher Ralph Britz. "Every single species has something extraordinary to offer. Sometimes it's behaviour, sometimes it's anatomy. But every species is really exciting."

"As human beings we are interested, we want to know and we have to know what is around us, especially now that we have started to destroy the wildlife that surrounds us, if only for the sake of keeping a record."

Britz, R., Kullander, S. and Rüber, L. (2022). *Dario tigris* and *Dario melanogrammus*, two new species of miniature chameleon fishes from northern Myanmar (Teleostei: Badidae). *Zootaxa* 5138(1): 1-16. doi.org/10.11646/zootaxa.5138.1.1

GRAMMATONOTUS BIANCHI

2021

POSSIBLY ENDEMIC TO MYANMAR'S COASTAL WATERS

A new species of splendid perch was discovered off the Tanintharyi coast of Myanmar in the Andaman Sea. Two specimens of this fish were collected during a survey conducted in 2018, and a physical examination determined it as a new species. It has a larger head, a different tail-fin shape and a distinct coloration from other splendid perch species.

The designation of "splendid perch" for small brightly coloured fish found near rocks and coral reefs actually describes 17 different species from two genera under the family *Callanthiidae: Callanthias* and *Grammatonotus*. These fish were previously considered a subfamily of another family, but they have different nasal organs, modified scales and unique ornamentation.

Grammatonotus, which also has some distinguishing physical characteristics from *Callanthias*, currently has 10 species, mostly in the western and central Pacific Ocean. This new species is only the second species of *Grammatonotus* to be described from the Indian ocean.

G. bianchi is named after Dr Gabriella Bianchi, a previous senior fisheries researcher at the UN Food and Agriculture Organization and now a research coordinator of the ENS-Nansen Programme, who contributed significantly to the collective knowledge of global marine biodiversity. It is most similar to *G. laysanus* from the Pacific Ocean in appearance, sharing a similar rounded caudal-fin shape and coloration.

Lisher, M.W., Thein, H. and Psomadakis, P.N. (2021) *Grammatonotus bianchi*, a new species of splendid perch (Percoidei: *Callanthiidae*) from Myanmar, northeastern Indian Ocean. *Zootaxa* 4996(3): 513-524. doi.org/10.11646/zootaxa.4996.3.5

Photo: © Peter Psomadakis

Illustration: © Food and Agriculture Organization of the United Nations, Original Scientific Illustrations Archive; reproduced with permission.

PSILORHYNCHUS MAGNAOCULUS

2021

ENDEMIC TO MYANMAR

A new species of torrent minnow of the genus *Psilorhynchus* was collected in the Yu River in the Sagaing region. Fish of this genus are small with arched backs and flat abdominal surfaces and live in fast-flowing, oxygen-rich streams in foothills and high elevation areas of the Himalayan, Indo-Burma and Western Ghats biodiversity hotspots.

This species belongs to the largest of three groups within the genus, the *P. balitora* species group, which comprises 17 species. This novel species has a larger eye diameter and a squarish snout compared to other members of this group, and a wider head than any other *P. balitora* inhabiting the Irrawaddy basin in Myanmar.

Shangningam, B. and Kosygin, L. (2021) *Psilorhynchus magnaoculus*, a new species of torrent minnow (Teleostei: *Psilorhynchidae*) from Myanmar. *Records of the Zoological Survey of India* 121: 319-324. recordsofzsi.com/index.php/zsoi/article/view/158157

Photos: © Bungdon Shangningam

LIMNONECTES BAGOYOMA

2021

ENDEMIC TO MYANMAR

The bamboo forest Bago Yoma frog is one of two new stream frogs discovered in the Bago region of Myanmar. These frogs, like their name implies, live in and around the streams of tropical forests. They are usually brown and blend into the leaf litter. They make mating calls at night during the rainy season.

Distinct from the Bago stream frog, *L. bagoensis*, which was described at the same time, the bamboo forest Bago Yoma frog is smaller and lacks a black stripe that the other species has running from the tip of its nose to the side of its ear. The bamboo forest Bago Yoma frog is most closely genetically related to *L. limborgi*, which occurs in eastern Myanmar and northwestern Thailand.

Discovered and described by a consortium of scientists from Thailand's Chulalongkorn University's Faculty of Science, East Yangon University of Myanmar and Germany's Senckenberg Forschungs Institut und Naturmuseum, these two amphibian discoveries took place over the course of two years, during which time specimens were collected, analysed and catalogued, vocal variations recorded, and samples taken for DNA analysis.

Köhler, G., Zwitzers, B., Than, N.L., Gupta, D.K., Janke, A., Pauls, S.U. and Thammachoti, P. (2021) Bioacoustics reveal hidden diversity in frogs: Two new species of the genus *Limnonectes* from Myanmar (Amphibia, Anura, Dicroglossidae). *Diversity* 13(9): 399. doi.org/10.3390/d13090399

Photos: © Gunther Köhler

BUNGARUS SUZHENAE

2021

ALSO FOUND IN CHINA

The Suzhen's krait is an extremely venomous snake, found in rice fields and streams in the forests of Kachin state, Myanmar, and Yingjiang county, Yunnan province, China. It was previously thought to be a many-banded krait (*Bungarus multicinctus*), but DNA sequencing of specimens collected in 2016 and 2019 has led researchers to determine that it is a new species. In addition to the genetic differences, this species has other distinct physical characteristics, including the number of bands, variations in teeth, and the shape of the male reproductive organ.

This distinction is critical for developing effective antivenom, since the treatment would be different depending on which snake species delivered the bite. A herpetologist, Joseph B Slowinski, died after being bitten by a krait in Myanmar in 2001, and the researchers who described this new species think it may have been the one the delivered the lethal venom.

The snake is named after Bai Su Zhen, a snake goddess from a Chinese myth. In this story, Bai Su Zhen is a white snake that is transformed into a woman by the Dragon King of the East China Sea after undergoing a thousand years of Taoist training. She devotes herself to doing good deeds and healing the sick. However, she falls in love with a young man and is ultimately imprisoned for her forbidden love. The name of this mythical figure who devoted herself to helping people was chosen to reflect the importance that this new species could play in providing effective treatment for krait bites.

"It is very dangerous," Gernot Vogel of the Society for Southeast Asian Herpetology in Germany, one of the researchers, told Live Science. "Krait species are active at night and they often enter houses in search for food. So often sleeping people are bitten while touching the snake during their sleep. Because kraits are highly venomous, understanding their species diversity and geographic distribution is vital for saving human lives."

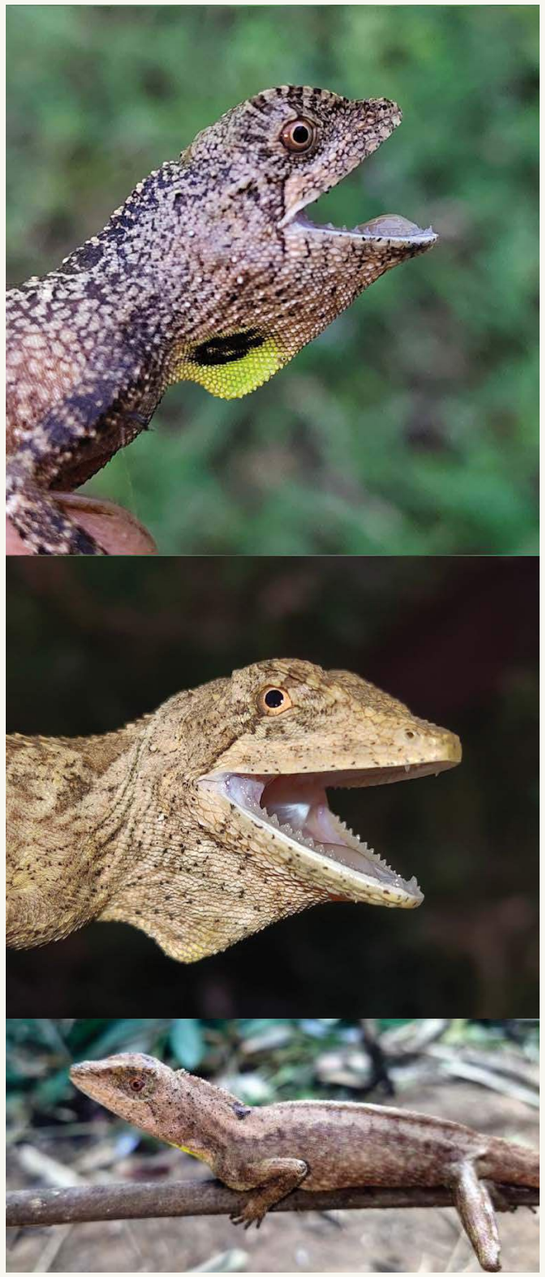
Chen, Z.N., Shi, S.C., Vogel, G., Ding, L. and Shi, J.S. (2021) Multiple lines of evidence reveal a new species of Krait (Squamata, Elapidae, *Bungarus*) from Southwestern China and Northern Myanmar. *ZooKeys* 1025: 35-71. doi.org/10.3897/zookeys.1025.62305

Photos: © Dr. Li Ding

PTYCTOLAEMUS CHINDWINENSIS

2021

ENDEMIC TO MYANMAR



This new species of lizard was described in the Htamanthi Wildlife Sanctuary, Sagaing division, and named after the Chindwin River. Inhabiting primary and secondary forests, it is only the third species of this genus to be described, with the first having been identified in 1864 and the other in 2004.

The new species differs from the other two by having longer limbs and a different colouration on the skin around its throat. It also is genetically distinct from the two species by about 24%. All three species occur in Myanmar, one in Chin state and the others in Kachin state and neighbouring parts of China and India.

Four specimens were collected at night in the forest in 2019, found on withered leaves, sleeping. Although the lizard is named after the Chindwin River, the specimens were collected far away from any body of water. This species can change its body colour; when they are sleeping on leaves at night, they are pale with almost no stripes or patches, but during the day, their bodies become darker and patterned.

Liu, S., Hou, M., Lwin, Y.H. and Rao, D. (2021) A new species of the genus *Ptyctolaemus* Peters, 1864 (Squamata, Agamidae) from Sagaing, Myanmar. *Evolutionary Systematics* 5(2): 347-357. doi.org/10.3897/evolsyst.5.75305

Photos: © Shuo Liu

THAILAND

CURCUMA RANGSIMAE

2021

ENDEMIC TO THAILAND

Described at the same time as five other species in this genus, the classification of *Curcuma rangsimae* as a new species brings the total number in this genus present in Thailand to 63 species. The genus is one of the largest in its family, and is found in India, south China, Southeast Asia and northern Australia. All six new species described in 2021 are endemic to Thailand.

Very similar to *C. vetellina*, *C. rangsimae* has more narrowly elliptic leaves, a longer and thicker spike, and conical spurs instead of filamentous ones. It is found in Nakhon Nayok, Saraburi , Prachin Buri, Chachoengsao and Nakhon Ratchasima provinces. Its common name in Thai languages means “yellow sapphire” in reference to its yellow flowers. These flowers can be seen in the rainy season between June and September in deciduous forests where it occurs.

It is also popularly used as a sacred ornamental plant, with the flowers and sometimes whole plants being preserved in sandalwood oil to bring the collector beauty, charisma, popularity and a good reputation. Unfortunately, due to this market demand, it is often illegally harvested from the forest. In combination with the impact of habitat loss and natural drought, this led the researchers to suggest an IUCN classification of Vulnerable, but with a warning that without proper protection, it could easily become critically endangered or even extinct.

Its scientific name comes from Rungsima Tantalakha, an important plant taxonomist in Thailand.

Saensouk, S., Boonma, T. and Saensouk, P. (2021). Six new species and a new record of *Curcuma* L. (Zingiberaceae) from Thailand. *Biodiversitas, Journal of Biological Diversity* 22: 1658-1685. doi. org/10.13057/biodiv/d220410

Photos: © Thawatphong Boonma

CURCUMA STAHLIANTHOIDES

2022

ENDEMIC TO THAILAND

This new species of ginger was recorded during a field survey with local people in Nakhon province in northeast Thailand. A large population was found growing near a shallow swamp in a shaded area of mixed scrub and bamboo forest.

Local people already knew the species, which is known as *bussarin,* meaning “lotus of Indra”, a deity in Hinduism and Buddhism. It is sometimes sold as an ornamental plant in local markets, and the flowers are used as religious offerings. But for scientists, its discovery offers new insights.

“The discovery of this species is interesting because we were able to document that the seeds were dispersed by ants, a phenomenon that we think is very much under-reported in gingers,” said Dr Jana Skornickova, an expert on gingers of the region. The team photographed many ants attempting to carry the seeds away from the flowers. Better understanding of relationships like these helps shed light on the ecological services that plants like gingers play in their ecosystems.

The species also provides a missing link within the *Curcuma* genus, one of around 60 genera within the ginger family. “The flowers closely resemble those in a subgroup of gingers that used to be considered a separate genus, *Stahlianthus*. On the other hand, the number of bracts which enclose these flowers, and how they are arranged on the stem resemble species in the genus *Curcuma,*” explained Dr Skornickova. “*Stahlianthus* was only merged with *Curcuma* due to genetic testing,

but this species bridges the morphological gap between two groups.”

The researchers recommend that the species should be classified as Vulnerable. Although the population that was recorded included more than 1,000 mature individuals, the area is not under any legal protection and is close to agricultural land. There is also a danger of the plant being targeted by collectors.

Soonthornkalump, S., Kongphapa, J., Vianmana, S., Kunlapa, N. and Leong-Škorničková, J., 2022. *Curcuma stahlianthoides* (Zingiberaceae), a new species from northeastern Thailand dispersed by ants. *Blumea-Biodiversity, Evolution and Biogeography of Plants* 67(1): 71-75. doi. org/10.3767/blumea.2022.67.01.09

Photos: © Sutthinut Soonthornkalump

NEPENTHES BRACTEOSA & NEPENTHES HIRTELLA

2022

BOTH ENDEMIC TO THAILAND

These two new species of pitcher plant (*Nepenthes* spp.), discovered in the hills of southern Thailand, have immediately been classified as Critically Endangered. Each is found at only a single hilltop site – *N. bracteosa* on the summit of Khao Wang Hip in Nakhon Si Thammarat province and *N. hirtella* on Khao Shawaplab, Krabi province. This means that any significant disturbance or deterioration in their habitat could put them at risk of extinction.

This is a concern, because both sites are easily accessible. In fact, *N. bracteosa* was first discovered from a photo taken by a tourist, while *N. hirtella* was discovered by a pitcher plant collector.

Pitcher plants – which all belong to a single genus – are carnivorous plants, with tendrils that form into a tube or globe-shaped trap to capture insects. Around 180 species have been recognized, and the number is increasing all the time. But while there's been a lot of research into their diversity, their evolution is poorly understood, and their genome has not been fully sequenced.

As well as noting distinguishing characteristics in the shape of the leaves and pitcher shape, hairs and bracts, the researchers who described the new species used a technique called AFLP to examine genetic differences. AFLP (amplified fragment length polymorphism) uses selected fragments of DNA to create a genetic "fingerprint". Researchers compared the new species with five other *Nepenthes* from Thailand; this helped to clarify the differences and relationships between them, and suggested that all pitcher plants in Thailand share a common ancestor.

Nuanlaong, S., Mekanawakul, M. and Suraninpong, P. (2022). Descriptions of two new species of Nepenthes (Nepenthaceae) from Thailand and their phylogenetic analysis based on AFLP technique species confirmation. *Kew Bulletin* 77(1): 105-120. doi.org/10.1007/s12225-021-09997-6

Photos: © Potjamarn Suraninpong

AKYSIS PATRATOR

2022

ENDEMIC TO THAILAND

This small sisoroid catfish was collected during a survey along with the Karen people in the Roh Kee River in western Thailand, which eventually flows in the Mae Klong River. It is the first fish in the *Akysis* genus to be recorded in the Mae Klong basin.

"When the first *Akysis* was collected I knew this was new to science and a new record for this river," said researcher Parinya Pawangkhanant. "We thank so much the local Karen youth for helping us collect fish in their home river."

He shared the finding with catfish specialist Dr Heok Hee Ng, who helped confirm that it was a new species. *A. patrator* can be distinguished from its relatives by a long, low ridge between the last dorsal fin ray and the adipose fin, and its colour pattern of a light brown body with a chocolate-brown reticulate (net-like) pattern on its sides. To date, it is thought to be endemic to the Roh Kee River.

The discovery brings the total number of species in the *Akysis* genus to 25. The fishes of this genus are one of the smallest of catfishes, measuring up to just 60mm.

Ng, H.H., Pawangkhanant, P. and Suwannapoom, C. (2022). Plugging the gap: description of a new Akysis species represents a new record of the genus from the Mae Klong drainage in western Thailand (Teleostei: Siluriformes: Akysidae). *Ichthyological Exploration of Freshwaters* 1186: 1-9. doi.org/10.23788/IEF-1186

Photos: © Parinya Pawangkhanant

ANSONIA KAREN

2021

ENDEMIC TO THAILAND

This new species of endemic stream toad was found around Khao Laem in the Tennaserim mountains, in Ratchaburi province, western Thailand. The Karen stream toad – named for the local Karen people, who supported the researchers during field surveys – is genetically and physically different from other species in its genus. Compared to its sister species, the *A. thinthinae* from Tanintharyi division, Myanmar, it has a significantly shorter and wider head, a shorter snout, smaller eyes, shorter hind limbs and a different coloration. Prior to this discovery, the distance between this sister species and the next closest species from this genus - *A. kraensis* from Ranong province, Thailand – was 350km.

This endemic and range-restricted steam toad is one of many that have been recently discovered in the Dawna Tenasserim mountain range. Just from this genus, there are 10 distinct species of stream toad that live in eastern Myanmar and western and southern Thailand. This illustrates the importance of continued biological surveys, and more importantly, conservation of this important landscape.

Suwannapoom, C., Grismer, L., Pawangkhanant, P., Naiduangchan, M., Yushchenko, P., Arkhipov, D., Wilkinson, J. and Poyarkov, N. (2021). Hidden tribe: A new species of stream toad of the genus *Ansonia* Stoliczka, 1870 (Anura: Bufonidae) from the poorly explored mountainous borderlands of western Thailand. *Vertebrate Zoology* 71: 763-779. doi.org/10.3897/vz.71.e73529

Photo: © Parinya Pawangkhanant

ANSONIA INFERNALIS

2022

ENDEMIC TO THAILAND

The Thai-Malay peninsula contains a range of “sky islands” – isolated mountain habitats rising from a sea of very different lowland environments. These sky islands are rich in endemic species – like this species of stream toad, found on the lower slopes of the Nakhon Si Thammarat mountain range.

It has been named *A. infernalis* – infernal stream toad – for the bright reddish orange coloration of its limbs and flanks, said to resemble the flames of hell. The Latin adjective *infernalis* also means “lower”, referencing the lower elevations at which the species is found, between 300m and 900m above sea level.

The tiny toad – females are just 29mm long and males less than 25mm – was recorded at two locations 15km apart, in small, fast-flowing streams within evergreen forest. During the evening, the toads were observed slowly moving along the stream, or calling while perched on stones and leaves near the water. In the daytime, they could be seen sitting on rocks near the stream. Little is known about their natural history, but like some other stream toad species their behaviour appears to be seasonal.

As well as noting differences in anatomy and colouration, researchers used molecular evidence to confirm that *A. infernalis* is a distinct species from other stream toads in the region. They described its discovery as “more of an expectation than a surprise” because of the rich diversity of range-restricted endemic amphibians and reptiles in this sky island archipelago. The discovery further underscores the rich unexplored biodiversity of the region and the need for conservation.

Suwannapoom, C., Grismer, L.L., Pawangkhanant, P. and Poyarkov, N.A. (2022). A new species of stream toad of the genus *Ansonia* Stoliczka, 1870 (Anura: Bufonidae) from Nakhon Si Thammarat Range in southern Thailand. *Zootaxa* 5168(2): 119-136. doi.org/10.11646/zootaxa.5168.2.2

Photo: © Parinya Pawangkhanant

CYRTODACTYLUS RUKHADEVA

2021

ENDEMIC TO THAILAND

A new species of bent-toed gecko was discovered in the Tenasserim mountains in Suan Phueng district, Ratchaburi province. An arboreal species, *Cyrtodactylus rukhadeva* takes its name from the Rukha Deva, mythical tree nymphs that protect the forest in Thai mythology. While this species is physically and genetically distinct from related species from the *Brevipalmatus* group, most of the species within this group look quite similar, given that they evolved alongside one another in similar habitats.

Found in the mountainous evergreen tropical forests of the Tenasserim mountains, primarily in bamboo and dry dipterocarp forests, these lizards are usually seen near large tree holes or hiding around the roots of strangler fig trees. Most were found around two metres above the ground, but at least one was found at six metres above the ground, leading researchers to conclude that this species usually prefers the upper canopy, but might be forced to move further down in the presence of rain or strong winds.

This gecko is very aggressive, opening its mouth and waving its tail side to side when threatened. This discovery again highlights the biodiversity and range-restricted endemism in the Dawna Tenasserim landscape on the border of Thailand and Myanmar which has yet to be fully explored or the species there fully described.

Grismer, L.L., Suwannapoom, C., Pawangkhanant, P., Nazarov, R.A., Yushchenko, P.V., Naiduangchan, M., Le, M.D., Luu, V.Q. and Poyarkov, N.A. (2021) A new cryptic arboreal species of the *Cyrtodactylus brevipalmatus* group (Squamata: Gekkonidae) from the uplands of western Thailand. *Vertebrate Zoology* 71: 723-746. doi.org/10.3897/vz.71.e76069

HEBIUS TERRAKARENORUM

2022

MAY ALSO OCCUR IN MYANMAR

Found in the northern part of the Tenasserim mountain range along the border with Myanmar, this slender, semiaquatic snake reaches a length of 650mm. Although largely brown with a pale pinkish venter (belly), the colouration varies significantly between different specimens, which is unusual in snake species in the region.

Its discovery was unconventional, since it wasn't based on a living specimen but on roadkill and photos. Researchers examined more than 70 specimens of *Hebius* species found dead on roads in northern Thailand between 2010 and 2020, supplemented by a dozen photos of living specimens that were not collected. H*ebius* species are often misidentified because of both similarities between species and differences within them.

While most of the specimens could be assigned to one of five *Hebius* species (out of the eight known in Thailand), around 20 could not. Close analysis of the snakes' markings and anatomy revealed them to belong to a previously unrecorded species.

Nearly all the specimens of this species were found close to fast-flowing mountain streams in the provinces of Chiang Mai, Mae Hong Son, Tak and Kanchanaburi. One of the authors later captured and handled a living specimen which, like other *Hebius* species, was docile and did not strike or bite.

The Dawna–Tenasserim landscape in northwest Thailand and Myanmar is a rich area for scientific discovery, containing large areas of pristine forest that have been little explored. Snake fauna in particular remains understudied, with discoveries like this one promising more to come.

Hauser, S., Smits, T. and David, P. (2022). On the distribution of the species of the genus *Hebius* Thompson, 1913 (Squamata: Natricidae) in northern Thailand, including the description of a new species and a discussion on snake diversity of this region. *Zootaxa* 5116(1): 1-39. doi.org/10.11646/zootaxa.5116.1.1

VIET NAM

BEGONIA CATBENSIS

2021

ENDEMIC TO VIET NAM

This species of begonia was discovered in the karst islands of Cat Ba National Park during a field visit in 2019. It belongs to a group within the genus found on limestone karst formations, which currently has 21 accepted species in Viet Nam, compared to just four described until 2007. Although similar to other species within this group, it is distinguished by having hairs on the slender stems that support the leaves, truncated leaves and leaf-like structures found near the base of these stems, and dense conical blister-like structures on the upper surface of the leaf blade, as well as some differences in the flower structure.

Named after the park in which it was found, the population recorded in 2019 is the only one currently known. With fewer than 200 mature individuals and a very limited distribution range, this species is considered rare, and the researchers who described it have assessed its conservation status as Endangered. Luckily, being within the national park offers protection, so the population is thought to have been stable for at least two decades. It flowers and fruits in August, and can be found on semi-shady tops of small rocks and steep slopes under the broad-leaved evergreen forest in lowlands of the karst hills.

“The discovery of this beautiful begonia is the result of a rich collaboration between many organizations for which I am very grateful,” said Lina Dong of the Guangxi Institute of Botany, Guangxi Zhuang Autonomous Region and Chinese Academy of Sciences, who worked with researchers from several Vietnamese institutions. “It was a great experience working together and I hope the friendships that developed during our field work will continue well into the future.”

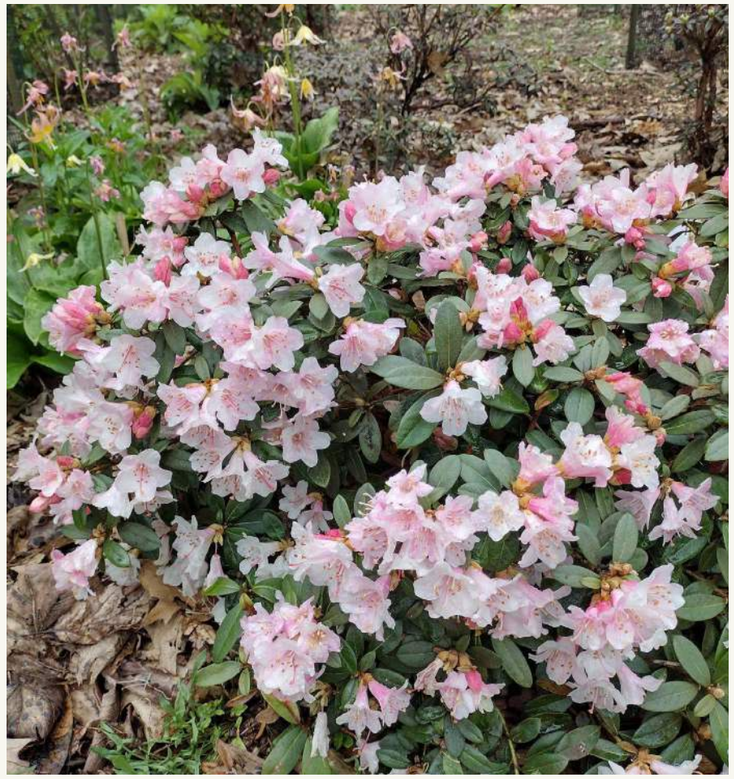
Dong, L.N., Nguyen, K.S., Shui, Y.M., Nguyen, H.Q., Xu, W.B. and Nguyen, X.K. (2021) *Begonia catbensis* (sect. Coelocentrum, Begoniaceae), a new species from northern Vietnam. *PhytoKeys* 179: 1-12. doi.org/10.3897/phytokeys.179.65812

Photos: © Dr Khang Sinh Nguyen

RHODODENDRON TEPHROPEPLOIDES

2021

ENDEMIC TO VIET NAM



Photos: © Richard Baines (top), © John Grimshaw (bottom)

This recently named new species of rhododendron with pretty white flowers was found on Phan Xi Păng of the Hoang Lien Son mountain range in Viet Nam, near the border with China, in 2014. Phan Xi Păng is the highest peak in the country, and its species diversity is little studied. The habitat is characterized as temperate montane cloud forest.

The team that discovered this plant was made up of researchers from the Vietnamese Institute of Ecology and Biological Resources, the Royal Botanic Garden Edinburgh, Royal Botanic Gardens, Kew, Longwood Gardens, and the University of British Columbia. Seeds were collected and planted at Logan, Kew and the Yorkshire Arboretum, which flowered in 2016. Similar to another species that occurs in northeast India, northern Myanmar and southwest China, this new rhododendron has scales on surfaces of its lower leaves and has a larger funnel shaped petal that is smooth on the outside.

Many species in this area are threatened by deforestation driven by agricultural expansion, and although this species is currently classified as Data Deficient, researchers suspect it may be threatened by soil erosion.

“In a world where plant species are disappearing at an alarming rate, now more than ever it is imperative that we know what species exist so that we can conserve and cultivate them, to secure their long-term survival,” said Richard Baines of the Royal Botanic Garden Edinburgh. “Plant exploration can be gruelling, exhausting and dangerous but these are nothing compared to the satisfaction of discovering a new species. We really must do all we can to protect the world’s threatened flora!”

Baines, R.A., Chamberlain, D.F., Nguyen V.D. and Quang, B.H. (2021) Two new taxa of *Rhododendron* (Ericaceae) from Vietnam. *Edinburgh Journal of Botany* 78: 363. doi.org/10.24823/EJB.2021.363

NEPHOANTHUS NUBIGENUS

2022
NEW GENUS
ENDEMIC TO VIET NAM

During a field investigation in southern Viet Nam, researchers came across a remarkable herbaceous species of *Melastomataceae* in a cloud forest on the Langbiang Plateau in Khanh Hoa province.

Detailed morphological studies (looking at the structural features of a species) revealed that it was closely related to *Phyllagathis prostrata*, a species found in Viet Nam and Hainan Island, China, whose attractive foliage has made it a popular greenhouse plant among indoor plant enthusiasts around the world.

However, phylogenetic analysis (which looks at species through their evolutionary development and common ancestry) showed the newly collected specimens and *P. prostrata* to be only distantly related to other members of the *Phyllagathis* genus. Nor could they be placed in any of the other 175 genera in the *Melastomataceae* family.

The two species have now been recognized as a new genus, *Nephoanthus* – derived from the Greek *nephos* (cloud) and *anthus* (flower) for the cloud forest habitat where they grow. The new species was named *N. nubigenus* (cloud-born).

“Over the years, our team has explored and published many new species of *Begonia* and *Orchidaceae* in Viet Nam,” said lead researcher Che Wei Lin. “This demonstrates that there are still many new discoveries waiting to be made in the country.”

Lin, C.W., Hsu, T.C., Luu, H.T., Yang, T.Y.A. and Li, C.W. (2022). *Nephoanthus* (Melastomataceae: Sonerileae), a new genus segregated from *Phyllagathis* s.l., with a new species from Southern Vietnam. *Phytotaxa* 547(1): 66-76. doi.org/10.11646/phytotaxa.547.1.6

MEADIA MINOR

2021

FOUND IN THE COASTAL WATERS OF VIET NAM

A new species of the cutthroat eel family was discovered off the coast of Quy Nhon in central Viet Nam. The small arrowtooth eel, so named because it is smaller than the two other species in this genus, is also different in that it has a trunk that is longer than its head, a relatively small gill opening and a pale complexion.

"I had returned to my hometown to celebrate Viet Nam's independence in September of 2019, and went to a fishing port in Quy Nhon city for three days," said Dr Vo Van Quang, Head of Department of Marine Vertebrates at the Institute of Oceanography in Viet Nam. "The goal of the trip was to collect marine eels and a few other fish species. It was a very fruitful trip, in which I found 10 individuals of a species of eel that seemed to belong to a new group.

"I brought these back to the laboratory, and tried to determine what family they belonged to based on their characteristics. At first, I thought they belonged to the family *Chlopsidae* (known as false morays), but then we talked to Dr Ho from the National Museum of Marine Biology and sent him specimens to compare with those in the museum's collection. The results showed that these 10 specimens belong to the genus *Meadia* of the family *Synaphobranchidae* – cutthroat eels. It's exciting because this is only the third species in this genus that has ever been discovered."

While the species is similar to members of the *Ilyophis* genus, its pectoral fin is set low on its body and its gill opening is lower still, marking it out as related to *M. abyssalis* and *M. roseni*. It has a short blunt snout, is scaleless and is only about 300mm long.

Vo, V.Q., Ho, H.C., Dao, H.V. and Tran, H.H.T. (2021) A new arrowtooth eel of genus *Meadia* (Synaphobranchidae: Ilyophinae) from Vietnam, South China Sea. *Zootaxa* 4952(1). doi.org/10.11646/zootaxa.4952.1.11

Photo: © Vo Van Quang

QUASIPAA TAOI

2022

ALSO FOUND IN LAOS

This new species of frog was recorded on Mount Ngoc Linh, the highest peak in central Vietnam at 2,598m. It was found in the headwaters of rocky streams in secondary evergreen forest at around 1,500m above mean sea level. It is a large frog – the male's body measures up to 85mm, with the females some 15mm shorter.

Researchers observed several morphological differences compared to other species in the *Quasipaa* genus, which are often known as spiny frogs, and genetic testing confirmed it as a separate species. The genetic data also matched it with a specimen recorded in neighbouring Xekong province in Laos. *Quasipaa taoi* represents the thirteenth known species of *Quasipaa* and the sixth in Viet Nam.

Recent research has highlighted the extraordinary levels of endemic amphibians in Viet Nam's Central Annamite mountains. Mount Ngoc Linh itself has been the site of discovery of several new amphibian species.

Like other endemic species with restricted distribution, *Q. taoi* is at risk from habitat loss, with major threats including agricultural expansion for medicinal plants, illegal logging and tourism development. The species is also collected by local people for food. Because of this, the researchers suggest it should be assessed as Near Threatened on the IUCN Red List. Its continued survival depends on its habitat being protected and well managed.

Van Hoang, C., Phan, T.Q., Nguyen, T.Q. and Ziegler, T. (2022). Hidden in the jungle of Vietnam: a new species of *Quasipaa* (Amphibia, Anura, Dicroglossidae) from Ngoc Linh Mountain. *ZooKeys* 1124: 23-42. doi.org/10.3897/zookeys.1124.89282

Photo: © Chung Van Hoang

THELODERMA KHOII

2022
ENDEMIC TO VIET NAM

Viet Nam has more species of mossy frogs (*Theloderma*) than any other country and the discovery of Khoi's mossy frog (*T. khoii*) brings the total to 17.

The species was discovered during field work in Ha Giang province in northeast Viet Nam, in deep narrow valleys within the forested limestone mountains. Around 5-6cm long, it's a mossy green in colour and has irregular ridges and warts on its skin that enable it to blend in with its surroundings.

Morphological and molecular studies showed that Khoi's mossy frog – named in honour of Professor Dr Le Vu Khoi from the Hanoi University of Science – is a unique species. Its closest relative, *T. bicolor,* is found on the far side of the Red River, which is thought to be a barrier for species dispersal and gene flow.

The exact range of the new species is unknown, though it may extend to Yunnan province in China. However, border road construction, expanding agriculture and illegal logging all threaten the rich biodiversity of the region's karst forests, and researchers believe the species should be classified as Endangered. None of its likely area of habitat is currently protected.

Thomas Ziegler, one of the researchers who described the species, said that greater protection is urgently needed for these range-restricted "micro-endemic" species in Viet Nam. "Alarmingly, a recent study revealed 13 endemic amphibian species, including two threatened species, have been recorded exclusively from unprotected areas," he explained. "For two-thirds of Viet Nam's endemic amphibians, there is no conservation data available, as their IUCN Red List status is either missing or outdated.

"Viet Nam is classified as a biodiversity hotspot, and the rate of discovering new amphibian species remains relatively high. Thirty-five per cent of the amphibian species are endemic to the country, with more than half of them reported exclusively from a single locality, which makes them especially vulnerable to extinction. There is an urgent need for more studies that identify the gaps in species conservation so that proper action can take place."

Ninh, H.T., Nguyen, T.T., Nguyen, H.Q., Van Hoang, N., Siliyavong, S., Van Nguyen, T. ... and Ziegler, T. (2022). A new species of mossy frog (Anura: Rhacophoridae) from Northeastern Vietnam. *European Journal of Taxonomy* 794: 72-90. doi.org/10.5852/ejt.2022.794.1655

Photo: © Nguyen Thien Tao

TYLOTOTRITON THAIORUM

2021

LIKELY TO ALSO OCCUR IN LAOS

Figure 3. Holotype of *Tylototriton thaiorum* sp. nov. male in life (collected, ZMMU A-7577). Photo ©: Nikolay A. Poyarkov.

It has taken a while for this crocodile newt, found in the evergreen tropical forests of Pu Hoat Nature Reserve in Nghe An province, central Viet Nam, to be recognized as its own species. Originally reported in 2005, it was misidentified as *T. vietnamensis*, based solely on the location. Then in 2010, the specimen was reclassified as a new species, *T. notialis*, which had just been identified in Nakai-Nam Theun National Protected Area in Khammouan province, Laos. The researchers noted that there were physical differences between the species in Laos and the one in Pu Hoat, but their genetic proximity was very close, so they were classified as one species. Finally, in May 2019, six specimens of the Pu Hoat newt were collected to re-examine its classification – and in 2021 it was described as a distinct species, *Tylototriton thaiorum*, based on genetic and physiological differences.

Called the Thai crocodile newt after the Thai ethnic group that inhabits the new species' locality, this novel species lacks the orange glands on the back, neck and shoulders that characterize *T. notialis*. It also has a darker brown coloration on its rib nodules, a broader head and shorter limbs. The genetic analysis shows that it is indeed a sister species of *T. notialis* but its range is distinct and separated by the Ca River.

"The Ca River is a very important boundary separating *T. thaiorum* from its sister species, *T. notialis*," said Tan Van Nguyen, one of the researchers who described the new species. "Even though they are closely related, the barrier is enough to have split the two into different species."

Currently, 31 species of crocodile newt are recognized across monsoon climatic Asia. Given that it is only known from the one location that is suffering habitat loss due to agricultural expansion and logging, and because it is collected by local communities as a traditional cure for abdominal pain and parasitic infection, the researchers suggest the Thai crocodile newt be classified as Endangered.

Poyarkov, N., Nguyen, T. and Arkhipov, D. (2021). New species of vertebrate animals and vascular plants discovered/described in the Greater Mekong region in peer-reviewed articles published in 2021 and 2022. *Taprobanica, The Journal of Asian Biodiversity* 10: 4–22. doi.org/10.47605/tapro.v10i1.244

Plate credit: Taprobanica

SUBDOLUSEPS VIETNAMENSIS

2021

ENDEMIC TO VIET NAM

A new skink was discovered in Ba Ria Vung Tao and Bin Thuan provinces in southern Viet Nam, inhabiting acacia and rubber plantations in addition to secondary dipterocarp forest. First collected in 2017, and then again in 2020, the Vietnamese agile skink is different from related members of the *Subdoluseps* genus by having just a single scale behind the eyes instead of two, and is smaller than many other *Subdoluseps* species. In addition, it has a tail that is about the same length as its body, which is different from its two closest relatives whose tails are proportionally longer.

The males and females of this species also look quite different from each other. Males have yellow chests and bellies, orange around the ears and bright spots on their sides, while females have cream-coloured bellies and are dark around the ears and on the sides.

These skinks were found on sandy ground under cover of rotting leaves. Already well hidden by the leaf cover, they will dive under the loose sand to avoid being caught, hence the name Vietnamese agile skink.

"We described this new species when I was conducting my master's programme research on lizards along the southern coast of Viet Nam," said researcher Manh Van Le. "This is an endemic species that only has a very narrow distribution in the coastal lowlands of Binh Thuan and Ba Ria Vung Tau provinces. Its ability to burrow under the sand helps them evade predators and escape from fires, which is quite unique."

Le, M.V., Nguyen, V.D.H., Phan, H.T., Rujirawan, A., Aowphol, A., Vo, T.D., Murphy, R.W. and Nguyen, S.N. (2021) A new skink of the genus *Subdoluseps* Freitas, Datta-Roy, Karanth, Grismer & Siler, 2019 (Squamata: Scincidae) from southern Vietnam. *Zootaxa* 4952(2). doi.org/10.11646/zootaxa.4952.2.3

Photos: © Manh Van Le

XENOPELTIS INTERMEDIUS

2022

ENDEMIC TO VIET NAM

Sunbeam snakes (*Xenopeltidae*), named for their iridescent scales, are widely distributed across Southeast Asia. But this new addition to the family is known from just one locality in the Central Annamites of Viet Nam. It is only the third species of *Xenopeltis*, the only genus in the family, joining the widespread common sunbeam snake (*X. unicolour*), and *X. hainanensis*, found in southeastern China and northern Viet Nam.

Researchers collected several specimens back in 2006 from evergreen forests in a mountainous region of Kon Tum province, at between 1,500m and 2,500m above mean sea level. Originally, they were thought to be *X. hainanensis*, but subsequent morphological and molecular analyses showed that the specimens clearly belonged to a separate species, with a number of differences in their scale patterns and skeletons.

The new species has been given the name *X. intermedius* because the shape and elongation of its head and the size of its eye are intermediate between its two sister species. Sunbeam snakes are fossorial – meaning they spend most of their time below ground – and this one's body shape makes it better adapted to a burrowing way of life than *X. unicolour* but less so than *X. hainanensis*. Like all sunbeam snakes, it has a highly iridescent scale surface but is well camouflaged, being an even light brown colour on top and a paler creamy yellow underneath.

Sunbeam snakes feed on frogs and smaller snakes, and kill their prey through constriction. The researchers observed the new species doing the same.

The Central Highlands of Viet Nam is known for its high diversity of amphibians and reptiles, including many cryptic (morphologically indistinguishable but genetically distinct) species. Recent studies have revealed numerous species new to science in this region.

Orlov, N., Snetkov, P., Ermakov, O., Nguyen, T. and Ananjeva, N. (2022). Integrative taxonomy reveals a new cryptic species of *Xenopeltis* Gray, 1831 (Ophidia: Macrostomata: Pythonoidea: Xenopeltidae) from Central Highlands, Vietnam. *Russian Journal of Herpetology* 29: 237-249. doi.org/10.30906/1026-2296-2022-29-4-237-249

Photo: © Natalia Ananjeva

NEW SPECIES OF VERTEBRATE ANIMALS AND VASCULAR PLANTS DISCOVERED/DESCRIBED IN THE GREATER MEKONG REGION IN PEER-REVIEWED ARTICLES PUBLISHED IN 2021 AND 2022.

2021 APPENDIX

SPECIES	RESEARCHERS	COUNTRY
PLANT		
PERROTTETIA TARONENSIS	Bartholomew, B., Armstrong, K. E., Li, R., & Fritsch, P. W.	Myanmar & China
DIDYMOCARPUS VICKIFUNKIAE	Prasanna, N. S., & Gowda, V.	Myanmar & India
CLEYERA BOKORENSIS	Tagane, S., Nagamasu, H., Chhang, P., Son, H. T., Toyama, H., & Yahara, T.	Cambodia & Viet Nam
BEILSCHMIEDIA BOLAVENENSIS	Tagane, S., Phetlasy, S., & Yahara, T.	Laos
MACHILUS CHAMPASAKENSIS	Tagane, S., Phetlasy, S., & Yahara, T.	Laos
SONERILA ERECTIFOLIA	Phonepaseuth, P., Souladeth, P., Souvannakhoummane, K., Vongthavone, T., & Tagane, S.	Laos
SONERILA SOUVANNII	Phonepaseuth, P., Souladeth, P., Souvannakhoummane, K., Vongthavone, T., & Tagane, S.	Laos
STERCULIA BOLAVENENSIS	Tagane, S., Souladeth, P., Kongxaysavath, D., Rueangruea, S., Suddee, S., Suyama, Y., Suzuki, E. & Yahara, T.	Laos
WIKSTROEMIA BOLAVENENSIS	Tagane, S., Souladeth, P., Kongxaysavath, D., Rueangruea, S., Suddee, S., Suyama, Y., Suzuki, E. & Yahara, T.	Laos
ASPIDISTRA PARTITA	Ding, H. B., Xiong, K. C., Yang, B., Yin, J. T., Bouamanivong, S., & Tan, Y. H.	Laos
SONERILA BOLAVENENSIS	Souladeth, P., Tagane, S., Suddee, S., Kongxaysavath, D., & Rueangruea, S.	Laos
CEROPEGIA LONGICAUDATA	Phonepaseuth, P., & Rodda, M.	Laos
PARABOEA KHOTAMIAE	Phonepaseuth, P., Souvannakhoummane, K., Tagane, S., Souladeth, P., & Yahara, T.	Laos
BEGONIA GLABRITEPALA	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA HETEROCANTHA	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA LANXANGENSIS	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA PARVIGLANDULOSA	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA PSEUDOBRANDISIANA	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA TRIPARTIFOLIA	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA VIRIDITENEBRIS	Keooudone, S., & Soulivanh, L.	Laos
BEGONIA CATARACTA	Lanorsavanh, S., Souvannakhoummane, K., Lamxay, V., & Chanthavongsa, K.	Laos
BEGONIA VOLUPTUARIA	Lanorsavanh, S., Souvannakhoummane, K., Lamxay, V., & Chanthavongsa, K.	Laos
STROBILANTHES BOLAVENENSIS	Yamazaki, K., Souladeth, P., & Tagane, S.	Laos
IMPATIENS ROSTRATA	Souvannakhoummane, K., Newman, M. F., Lanorsavanh, S., & Suksathan, P.	Laos
DIDYMOCARPUS ANGUSTIFLORUS	Souvannakhoummane, K., Lanorsavanh, S., Tagane, S., Souladeth, P., Phonepaseuth, P., Pongamornkul, W., & Lamxay, V.	Laos
DIDYMOCARPUS BOLAVENENSIS	Souvannakhoummane, K., Lanorsavanh, S., Tagane, S., Souladeth, P., Phonepaseuth, P., Pongamornkul, W., & Lamxay, V.	Laos

DIDYMOCARPUS LAOTICUS	Souvannakhoummane, K., Lanorsavanh, S., Tagane, S., Souladeth, P., Phonepaseuth, P., Pongamornkul, W., & Lamxay, V.	Laos
DIDYMOCARPUS TRILOBUS	Souvannakhoummane, K., Lanorsavanh, S., Tagane, S., Souladeth, P., Phonepaseuth, P., Pongamornkul, W., & Lamxay, V.	Laos
HEMIBOEA OLIVIFOLIA	Souvannakhoummane, K., Lanorsavanh, S., Tagane, S., Souladeth, P., Phonepaseuth, P., Pongamornkul, W., & Lamxay, V.	Laos
PARABOEA PLANIFLORA	Souvannakhoummane, K., Lanorsavanh, S., Tagane, S., Souladeth, P., Phonepaseuth, P., Pongamornkul, W., & Lamxay, V.	Laos
OPHIOPOGON ROBUSTUS	Averyanov, L. V., Tanaka, N., Nguyen, K. S., Maisak, T. V., Nuraliev, M. S., Vislobokov, N. A., Romanov, M., S. & Son, H. T.	Laos
PELIOSANTHES RUBRA	Averyanov, L. V., Tanaka, N., Nguyen, K. S., Maisak, T. V., Nuraliev, M. S., Vislobokov, N. A., Romanov, M., S. & Son, H. T.	Laos
PHANERA LAOTICA	Mattapha, S., Lanorsavanh, S., Lamxay, V., & Chanthavongsa, K.	Laos
PHANERA RUBRA	Mattapha, S., Lanorsavanh, S., Lamxay, V., & Chanthavongsa, K.	Laos
ASPIDISTRA NITENS	Averyanov, L. V., Nguyen, K. S., Tillich, H. J., Krupkina, L. I., Maisak, T. V., & Sokolova, I. V.	Laos
CYMBILABIA SOURIOUDONGII	Souvannakhoummane, K., Lanorsavanh, S., Rakthai, P., Kumar, P., & Gale, S. W.	Laos
IMPATIENS SUBFALCATA	Souladeth, P., Tagane, S., Suyama, Y., Ishii, N., Nagahama, A., & Souvannakhoummane, K.	Laos
BEGONIA CASSEABRI	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
BEGONIA PERSISTENS	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
BEGONIA LATIBRACTEATA	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
BEGONIA NATMATAUNGENSIS	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
BEGONIA AMNICOLA	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
BEGONIA SAGAINGENSIS	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
BEGONIA CHINDWINENSIS	Maw, M. B., Hong-Bo, D. I. N. G., Bin, Y. A. N. G., Win, P. P., & Yun-Hong, T. A. N.	Myanmar
ARTABOTRYS CHITKOKOI	Hein, K. Z., Naive, M. A. K., & Chen, J.	Myanmar
PETROCOSMEA VILLOSA	Middleton, D. J., Shin, T., & Baba, Y.	Myanmar
PREMNA CARIDANTHA	Tan, Y. H., Min, D. Z., Ding, H. B., Yang, B., Maw, M. B., & Li, B.	Myanmar
ERIOBOTRYA SHANENSE	Kang, D. H., Ong, H. G., Lee, J. H., Jung, E. K., Kyaw, N. O., Fan, Q., & Kim, Y. D.	Myanmar
CANTHIUM OBSCURUM	De Wilde, W. J. J. O., & Duyfjes, B. E. E.	Myanmar, Thailand, Laos, Viet Nam & China
CURCUMA CHANTARANOTHAI	Saensouk, S., Boonma, T., & Saensouik, P.	Thailand
CURCUMA RANGSIMAE	Saensouk, S., Boonma, T., & Saensouik, P.	Thailand
CURCUMA CHARANII	Saensouk, S., Boonma, T., & Saensouik, P.	Thailand
CURCUMA PHRAYAWAN	Saensouk, S., Boonma, T., & Saensouik, P.	Thailand
CURCUMA PUANGPENIAE	Saensouk, S., Boonma, T., & Saensouik, P.	Thailand
CURCUMA PURPURATA	Saensouk, S., Boonma, T., & Saensouik, P.	Thailand

CURCUMA WANENLUEANGA	Saensouk, S., Boonma, T., Thomudtha, A., Thomudtha, P., & Saensouk, P.	Thailand
ARTABOTRYS ANGUSTIPETALUS	Photikwan, E., Damthongdee, A., Jongsook, H., & Chaowasku, T.	Thailand
OROPHEA SICHAIKHANII	Damthongdee, A., Aongyong, K., & Chaowasku, T.	Thailand
GONIOTHALAMUS ROSEIPETALUS	Leeratiwong, C., Chalermglin, P., & Saunders, R. M.	Thailand
GONIOTHALAMUS SUKHIRINENSIS	Leeratiwong, C., Chalermglin, P., & Saunders, R. M.	Thailand
ANTHEROPORUM PUUDJAAE	Mattapha, S., & Tetsana, N.	Thailand
PHAEANTHUS PIYAE	Wiya, C., Aongyong, K., Damthongdee, A., Baka, A., & Chaowasku, T.	Thailand
ASPLENIUM APPRESSIFOLIUM	Petchsri, S., & Boonkerd, T.	Thailand
CURCUMA RANGJUED	Saensouk, S., Boonma, T., & Saensouk, P.	Thailand
HEMIBOEA CHANII	Nguyen, C. H., Van Nguyen, L., Nguyen, K. S., Egorov, A. A., & Averyanov, L. V.	Thailand
KAEMPFERIA UNIFOLIA	Saensouk, P., & Saensouk, S.	Thailand
KAEMPFERIA ISANENSIS	Saensouk, P., & Saensouk, S.	Thailand
PARABOEA KHAOYAICA	Kaitongsuk, S., Triboun, P., Suddee, S., Ue-Aree, P., & Sungkaew, S.	Thailand
CURCUMA ARUNA	Maknoi, C., Saensouk, S., Saensouk, P., Rakarcha, S., & Thammarong, W.	Thailand
CURCUMA PITUKII	Maknoi, C., Saensouk, S., Saensouk, P., Rakarcha, S., & Thammarong, W.	Thailand
KAEMPFERIA UTTARADITENSIS	Meechonkit, P., & Picheansoonthon, C.	Thailand
KAEMPFERIA KAMTHORNII	Meechonkit, P., & Picheansoonthon, C.	Thailand
CURCUMA SIAMENSIS	Saensouk, P., Boonma, T., & Saensouk, S.	Thailand
STEMONA NAMKHUNENSIS	Promprom, W., & Chatan, W.	Thailand
CORYBAS PAPILLATUS	Inuthai, J., Chantanaorrapint, S., Poopath, M., Tetsana, N., Kiewbang, W., & Suddee, S.	Thailand
CAUSONIS SESSILIFOLIA	Trias-Blasi, A., Poopath, M., Lu, L. M., & Parmar, G.	Thailand
RHYNCHOGLOSSUM AUSCULUM	Pattharahirantricin, N., & Poopath, M.	Thailand
CURCUMA LITHOPHILA	Soonthornkalump, S., Pungpairote, T., Niwesrat, S., & Leong-Skornickova, J.	Thailand
CURCUMA RUFOSTRIATA	Soonthornkalump, S., Pungpairote, T., Niwesrat, S., & Leong-Skornickova, J.	Thailand
GYMNEMA WIYADAE	Kidyoo, A.	Thailand
ALPHONSEA ANNULATA	Leeratiwong, C., Chalermglin, P., & Johnson, D. M.	Thailand
KAEMPFERIA JENJITTIKULIAE	Nopporncharoenkul, N., Somnoo, T., Tanming, W., & Maknoi, C.	Thailand
SARACA THAILANDICA	Pongamornkul, W., Panyadee, P., Muangyen, N., & Inta, A.	Thailand
THUNBERGIA AMPHAII	Suwanphakdee, C., Khammonkol, K., Middleton, D., & Suddee, S.	Thailand
POLYALTHIA CHALERMGLINII	Bunchalee, P. A. S. A. K. O. R. N., Johnson, D. M., Murray, N. A., & Chalermglin, P. I. Y. A.	Thailand
POLYALTHIA CHAYAMARITANA	Bunchalee, P. A. S. A. K. O. R. N., Johnson, D. M., Murray, N. A., & Chalermglin, P. I. Y. A.	Thailand
ERANTHEMUM DECUMBENS	Kladwong, P., & Chantaranothai, P.	Thailand & Laos
POLYALTHIA CHANTARANOTHAII	Bunchalee, P. A. S. A. K. O. R. N., Johnson, D. M., Murray, N. A., & Chalermglin, P. I. Y. A.	Thailand & Laos
TYPHONIUM PHUOCBINHENSE	Croat, T.	Viet Nam
ASPIDISTRA PELTATA	Averyanov, L. V., Truong, B. V., Trinh, B. N., Dang, S. V., Bui, V. H., Le, T. A., Nguyen, T. H. A., Do, T. T. H., Nguyen, C. V.., Maisak, T. V., Nguyen, K. S. & Tillich, H. J.	Viet Nam
ARISTOLOCHIA VUQUANGENSIS	Van Do, T., Nguyen, H. V., & Le, K. D.	Viet Nam

ARACHNIODES VIETNAMENSIS	Lu, N. T., Nguyen, L. P., Le, C. T., Nguyen, T. T., & Zhang, L.	Viet Nam
ASPIDISTRA LILIIFLORA	Averyanov, L. V., Wynn-Jones, B., Nguyen, T. H., Nguyen, K. S., Tillich, H. J., Nguyen, V. D., Maisak, T. V. & Chu, C. X.	Viet Nam
ASPIDISTRA SESSILISTIGMA	Averyanov, L. V., Wynn-Jones, B., Nguyen, T. H., Nguyen, K. S., Tillich, H. J., Nguyen, V. D., Maisak, T. V. & Chu, C. X.	Viet Nam
PETROCODON VIETNAMENSIS	Xin, Z. B., Do, T. V., Fu, L. F., Huang, Z. J., Maciejewski, S., & Wen, F.	Viet Nam
BAMBUSA NGHIANA	Tran, V. T.	Viet Nam
ASPLENIUM UANGBINHENSE	Xu, K. W., Lu, N. T., Zhou, X. M., Zhang, L., & Zhang, L. B.	Viet Nam
PSEUDOCHIRITA TRIFOLIATA	Wen, F.	Viet Nam
ZINGIBER MAGANG	Ngọc-Sâm, L. Ý., Đăng-Giáp, Đ. Ỗ., Ngọc-Giang, C. A. O., Trương, B. V., Nguyễn, V. T., & Leong-Škorničková, J.	Viet Nam
ZINGIBER TAMII	Ngọc-Sâm, L. Ý., Đăng-Giáp, Đ. Ỗ., Ngọc-Giang, C. A. O., Trương, B. V., Nguyễn, V. T., & Leong-Škorničková, J.	Viet Nam
ARISTOLOCHIA LUUDAMCUI	Phan, L. K., Wanke, S., Neinhuis, C., & Van Do, T. R. U. O. N. G.	Viet Nam
LITHOCARPUS BIDOUPENSIS	Van Ngoc, N., Binh, H. T., Nagahama, A., Tagane, S., Toyama, H., Matsuo, A.,Suyama, Y. & Yahara, T.	Viet Nam
LITHOCARPUS CONGTROIENSIS	Van Ngoc, N., Binh, H. T., Nagahama, A., Tagane, S., Toyama, H., Matsuo, A.,Suyama, Y. & Yahara, T.	Viet Nam
LITHOCARPUS HONGIAOENSIS	Van Ngoc, N., Binh, H. T., Nagahama, A., Tagane, S., Toyama, H., Matsuo, A.,Suyama, Y. & Yahara, T.	Viet Nam
ASPIDISTRA MAGNIFICA	Lý, N. S., Nguyen, K. S., Hoàng, T. S., Đỗ, V. N., & Tillich, H. J.	Viet Nam
RAPHIOCARPUS AXILLARIS	Middleton, D. J., Nguyễn, Q. B., Trần, H. Đ., & Leong-Škorničková, J.	Viet Nam
ARISTOLOCHIA QUANGNAMENSIS	Van Do, T., Lai, H. V., & Le, K. D.	Viet Nam
PRIMULINA SCUTELLIFOLIA	Vu, N. L., Nguyen, T. Q. T., Tran, G., Nguyen, Q. D., & Luu, H. T.	Viet Nam
BULBOPHYLLUM VULINHAE	Duong, M. T. T. N., Son Dang, V., Averyanov, L. V., Tam Truong, Q., Amsler, R., & Vuong Truong, B.	Viet Nam
BEGONIA CATBENSIS	Dong, L. N., Nguyen, K. S., Shui, Y. M., Nguyen, H. Q., Xu, W. B., & Nguyen, X. K.	Viet Nam
CHIMONOCALAMUS BIDOUPENSIS	Vinh, T. T., Nguyen, H. N., Duy, N. V., & Tran, V. T.	Viet Nam
DENDROBIUM PARAHENDERSONII	Van Canh Nguyen, L. V., Maisak, T. V., Nguyen, T. L. T., & Van Khuong Nguyen, B. V. T.	Viet Nam
CYNANCHUM QUANGBINHENSE	Nuraliev, M. S.	Viet Nam
PELIOSANTHES CONVALLARIOIDES	Averyanov, L. V., Tanaka, N., Nguyen, K. S., Maisak, T. V., Nuraliev, M. S., Vislobokov, N. A., Romanov, M., S. & Son, H. T.	Viet Nam
TYPHONIUM VIETNAMENSE	Van, H. T., Van Son, L. E., Nguyen-Phi, N., Nguyen, Q. D., Nguyen, T. Q. T., Nguyen, H. C., & Luu, H. T.	Viet Nam
CAMELLIA PROENSIS	Hoi, Q. V., Dung, L. V., Doudkin, R. V., Averyanov, L. V., Thinh, B. B., Lieu, N. T., & Truong, L. H.	Viet Nam
BEGONIA MANGDENENSIS	Hoang, T. S., Lin, C. W., & Vu, A. T.	Viet Nam
RHODODENDRON TEPHROPEPLOIDES	Baines, R. A., Chamberlain, D. F., Nguyen, V. D., & Quang, B. H.	Viet Nam
BEILSCHMIEDIA DANHKYII	Quang, B. H., Tagane, S., Viet, H. N., & Canh, T. T.	Viet Nam
THOTTEA AROANGENSIS	Le, T. A., Dinh, D., Doan, Q. T., Nguyen, Q. H. A., & Tagane, S.	Viet Nam
CHAYAMARITIA VIETNAMENSIS	Xin, Z. B., Fu, L. F., Maciejewski, S., Huang, Z. J., Van Do, T., & Wen, F.	Viet Nam
CAMELLIA FLOSCULORA	Le, V. S., Curry, A. S., Truong, Q. C., Luong, V. D., & Nguyen, T. L.	Viet Nam
CLAOXYLON LANGBIANGENSE	Nagahama, A., Tagane, S., Zhang, M., Van Ngoc, N., Binh, H. T., Cuong, T. Q., Nagamasu, H., Toyama, M., Tsuchiya, K. & Yahara, T.	Viet Nam
ARDISIA PATENTIRADIOSA	Nuraliev, M. S., Kuznetsov, A. N., Kuznetsova, S. P., & Hu, C. M.	Viet Nam
ROHDEA DANGII	Nguyen, K. S., Nguyen, P. H., Tran, D. B., Tanaka, N., & Averyanov, L. V.	Viet Nam
QUERCUS NGOCHOAENSIS	Binh, H. T., Van Ngoc, N., Son, H. T., Tagane, S., & Yahara, T.	Viet Nam
BEGONIA VILLOSULA	Hoang, T. S., & Lin, C. W.	Viet Nam
BEGONIA LOPHURA	Hoang, T. S., & Lin, C. W.	Viet Nam
BULBOPHYLLUM XUANSONII	Nguyen, D. H., Averyanov, L. V., Van Son, D. A. N. G., Pham, P. D., Maisak, T., Van Huong, B. U. I., ... & Truong, B. V.	Viet Nam
LITOSTIGMA NAPOENSE	You-Sheng, C., Huang, Y. F., Xu, L. S., & Wang, B. M.	Viet Nam & China
LOMARIOPSIS LONGINI	Wu, Y. H., Sun, C. Y., Ebihara, A., Lu, N. T., Rouhan, G., & Kuo, L. Y.	Viet Nam & China

FISH

GRAMMATONOTUS BIANCHI	Lisher, M. W., Thein, H. T. U. N., & Psomadakis, P. N.	Myanmar
PSILORHYNCHUS MAGNAOCULUS	Shangningam, B., & Kosygin, L.	Myanmar
BLEEKERIA ALBICAUDA	Psomadakis, P. N., Yoshinaga, T., Wah, Z., & Ida, H.	Myanmar
CHELIDOPERCA MYATHANTUNI	Psomadakis, P. N., Gon, O., & Htut, T.	Myanmar
CHELIDOPERCA FLAVIMACULA	Psomadakis, P. N., Gon, O., & Htut, T.	Myanmar
MUSTELUS ANDAMANENSIS	White, W. T., Arunrugstichai, S., & Naylor, G. J.	Thailand & Myanmar
BLEEKERIA NIGRILINEA	Psomadakis, P. N., Yoshinaga, T., Wah, Z., & Ida, H.	Thailand & Myanmar
MEADIA MINOR	Vo, V. Q., Ho, H. C., Dao, H. V., & Tran, H. H. T.	Viet Nam

AMPHIBIAN

GEKKO KHUNKHAMENSIS	Sitthivong, S., Van Lo, O., Nguyen, T. Q., Ngo, H. T., Khotpathoom, T., Le, M. D., ... & Luu, V. Q.	Laos
LIMNONECTES BAGOYOMA	Köhler, G., Zwitzers, B., Than, N. L., Gupta, D. K., Janke, A., Pauls, S. U., & Thammachoti, P.	Myanmar
LIMNONECTES BAGOENSIS	Köhler, G., Zwitzers, B., Than, N. L., Gupta, D. K., Janke, A., Pauls, S. U., & Thammachoti, P.	Myanmar
TYLOTOTRITON UMPHANGENSIS	Pomchote, P., Peerachidacho, P., Hernandez, A., Sapewisut, P., Khonsue, W., Thammachoti, P., & Nishikawa, K.	Thailand
LIMNONECTES PSEUDODORIAE	Yodthong, S., Rujirawan, A., Stuart, B. L., & Aowphol, A.	Thailand
ANSONIA KAREN	Suwannapoom, C., Grismer, L. L., Pawangkhanant, P., Naiduangchan, M., Yushchenko, P. V., Arkhipov, D. V., ... & Poyarkov, N. A.	Thailand
VIETNAMOPHRYNE VUQUANGENSIS	Jiang, J., Nguyen, Q. H., Orlov, N., Nguyen, V. H., Nguyen, V. T., Nguyen, T. T., & Ziegler, T.	Viet Nam
MICRYLETTA MELANOPS	Poyarkov, N. A., Van Nguyen, T., Yang, J. H., & Gorin, V. A.	Viet Nam
CYRTODACTYLUS CHUNGI	Ostrowski, S., Le, M. D., Ngo, H. T., Phung, T. M., Nguyen, T. Q., & Ziegler, T.	Viet Nam
CYRTODACTYLUS ORLOVI	Do, Q. H., Phung, T. M., Ngo, H. T., Ziegler, T., Pham, C. T., & Nguyen, T. Q.	Viet Nam
MICROHYLA DAKLAKENSIS	Van Hoang, C., Nguyen, T. T., Ninh, H. T., Luong, A. M., Pham, C. T., Nguyen, T. Q., Orlov, N. L., Chen, Y., Wang, B., Ziegler, T. & Jiang, J.	Viet Nam
MICROHYLA NINHTHUANENSIS	Van Hoang, C., Nguyen, T. T., Ninh, H. T., Luong, A. M., Pham, C. T., Nguyen, T. Q., Orlov, N. L., Chen, Y., Wang, B., Ziegler, T. & Jiang, J.	Viet Nam
HEMIPHYLLODACTYLUS DALATENSIS	Nguyen, K. V., Pham, C. T., Ziegler, T., & Nguyen, T. Q.	Viet Nam
VIETNAMOPHRYNE CUONGI	Nguyen, T. V., Van Hoang, C., Jianping, J., Orlov, N. L., Ninh, H. T., Nguyen, H. Q., Nguyen, T. T. & Ziegler, T.	Viet Nam

REPTILE		
BUNGARUS SUZHENAE	Chen, Z. N., Shi, S. C., Vogel, G., Ding, L., & Shi, J. S.	Myanmar & China
TRIMERESURUS GUOI	Chen, Z., Shi, S., Gao, J., Vogel, G., Song, Z., Ding, L., & Dai, R.	China, Viet Nam, Thailand & Myanmar
CYRTODACTYLUS KULENENSIS	Poyarkov, N. A.	Cambodia
CALOTES GOETZI	Wagner, P., Ihlow, F., Hartmann, T., Flecks, M., Schmitz, A., & Böhme, W.	Cambodia, Laos, Thailand, China & Myanmar
DIXONIUS SOMCHANHAE	Nguyen, T. H., Luu, V. Q., Sitthivong, S., Ngo, H. T., Nguyen, T. Q., Le, M. D., & Ziegler, T.	Laos
MYANOPHIS THANLYINENSIS	Koehler, G., Khaing, K. P. P., Than, N. L., Baranski, D., Schell, T., Greve, C., Janke, A. & Pauls, S. U.	Myanmar
PTYCTOLAEMUS CHINDWINENSIS	Liu, S., Hou, M., Lwin, Y. H., & Rao, D.	Myanmar
CALOTES VINDUMBARBATUS	Wagner, P., Ihlow, F., Hartmann, T., Flecks, M., Schmitz, A., & Böhme, W.	Myanmar
CALOTES GEISSLERI	Wagner, P., Ihlow, F., Hartmann, T., Flecks, M., Schmitz, A., & Böhme, W.	Myanmar&India
LEPTOBRACHELLA MURPHYI	Chen, J. M., Suwannapoom, C., Wu, Y. H., Poyarkov, N. A., Xu, K., Pawangkhanant, P., & Che, J.	Thailand
OLIGODON PHANGAN	Pauwels, O. S., Thongyai, K., Chantong, P., & Sumontha, M.	Thailand
OLIGODON PROMSOMBUTI	Pauwels, O. S., Thongyai, K., Chantong, P., & Sumontha, M.	Thailand
CYRTODACTYLUS RUKHADEVA	Grismer, L. L., Suwannapoom, C., Pawangkhanant, P., Nazarov, R. A., Yushchenko, P. V., Naiduangchan, M., ... & Poyarkov, N. A.	Thailand
CYRTODACTYLUS STELLATUS	Termprayoon, K., Rujirawan, A., Ampai, N., Wood Jr, P. L., & Aowphol, A.	Thailand
TRIMERESURUS KUIBURI	Ngkhanant, N. C., Iamwiriyakul, P., & Chanhome, L.	Thailand
PAREAS TEMPORALIS	Le, D. T., Tran, T. G., Hoang, H. D., & Stuart, B. L.	Viet Nam
CYRTODACTYLUS NGATI	Le, D. T., Sitthivong, S., Tran, T. T., Grismer, L. L., Nguyen, T. Q., Le, M. D., Ziegler, T. & Luu, V. Q.	Viet Nam
AHAETULLA RUFUSOCULARA	Lam, N. Q., Thu, T. T. A., Nguyen, L. T., Murphy, R. W., & Nguyen, S. N.	Viet Nam
GEKKO PHUYENENSIS	Nguyen, V. D. H., Nguyen, S. N., Nguyen, L. T., Orlov, N. L., & Murphy, R. W.	Viet Nam
TYLOTOTRITON THAIORUM	Poyarkov, N. A., Nguyen, T. V., & Arkhipov, D. V.	Viet Nam
CYRTODACTYLUS RAGLAI	Nguyen, A. T., Duong, T. V., Grismer, L. L., & Poyarkov, N. A.	Viet Nam
SUBDOLUSEPS VIETNAMENSIS	Le, M.v., Nguyen, V.d.h., Phan, H.t., Rujirawan, A., Aowphol, A., Vo, T.d., Murphy, R.w. And Nguyen, S.n.	Viet Nam

2022 APPENDIX

PLANT		
ERIOCAULON BOKORENSE	Souladeth, P., Newman, M. F., & Prajaksood, A.	Cambodia
ERIOCAULON CAMBODIANUM	Souladeth, P., Newman, M. F., & Prajaksood, A.	Cambodia
UROPHYLLUM PULCHRISTIPULUM	Yooprasert, S., Culham, A., Tagane, S., Yahara, T., Nguyen, K. S., & Utteridge, T. M.	Cambodia
BREDIA BULLATA	Dai, J. H., Nong, S. Y., Guo, X. B., Van Do, T., Liu, Y., Zhou, R. C., & Liu, Y.	China, Viet Nam
PTERIS PSEUDOAMOENA	Guo, R., Wang, J. M., Zhang, W., He, D., Yu, J., & Yang, D. M.	China, Viet Nam
BEGONIA XENOS	Lin, C. W., Phonepaseuth, P., & Rahm, P.	Laos
CAMCHAYA BOLAVENENSIS	Noyori, W., Komada, N., Souladeth, P., & Tagane, S.	Laos
CAPPARIS PHATADKE	Fici, S., Lanorsavanh, S., Lamxay, V., & Souvannakhoummane, K.,	Laos
CROTON NAGAOI	Tagane, S., Souvannakhoummane, K., & Souldeth, P.	Laos
MILLETTIA DENSIFLORA	Mattapha, S., Sungkaew, S., Pongamornkul, W., Lanorsavanh, S., Lamxay, V., & Hein, K. Z.	Laos
DENDROBIUM FUSCIFAUCIUM	Souvannakhoummane, K., Kumar, P., & Phonepaseuth, P.	Laos
AGAPETES OLIGODONTA	Tong, Y. H., Fritsch, P. W., Tan, Y. H., Aung, M. M., Yang, B., & Armstrong, K. E.	Myanmar
ALOCASIA EPILITHICA	Hein, K. Z., Naive, M. A. K., & Serebryanyi, M. M.	Myanmar, Thailand
AMORPHOPHALLUS WASA	Naive, M. A. K., Hein, K. Z., & Hetterscheid, W.	Myanmar
DENDROBIUM POPAENSE	Yukawa, T., Takamiya, T., Aung, M. M., Htwe, K. M., & Tanaka, N.	Myanmar
GARCINIA YAATAPSAP	Sweeney, P. W., Nwe, T. Y., & Armstrong, K. E.	Myanmar
IMPATIENS KATJAE	Tanaka, N., Aung, M. M., & Vermeulen, J. J.	Myanmar
LEPISORUS MEDIOXIMUS T	Fujiwara, T., Khine, P. K., Hori, K., Shin, T., Murakami, N., & Schneider, H.	Myanmar
LIPARIS CASSEABRIA	Wang, Y. Q., Wu, X. F., Li, J. L., Zhou, S. S., Li, R., Liu, Q., & Li, L.	Myanmar
MARSDENIA BURMANICA	Wen-Bin, X. U., Yan-Ling, L. I. U., Jing-Jing, Y. A. N., & Jian-Yong, S. H. E. N.	Myanmar
MYANMARANTHUS ROSEIFLORUS	Tanaka, N., Ohi-Toma, T., Suksathan, P., Aung, M. M., Poulsen, A. D., Mohamad, S., & Armstrong, K. E.	Myanmar
RHIZOMNIUM MIEHEANUM	Müller, F., & Koponen, T.	Myanmar
STAUROGYNE FILISEPALA	Wood, J. R., Nwe, T. Y., & Armstrong, K. E.	Myanmar
STAUROGYNE YAMOKMEHONG	Wood, J. R., Nwe, T. Y., & Armstrong, K. E.	Myanmar
STROBILANTHES HIANS	Wood, J.r.i., Aung, M.m., Wells, T. Et Al.	Myanmar
THYLACOPTERIS MINUTA	Hori, K., Khine, P. K., Fujiwara, T., Shin, T., & Schneider, H.	Myanmar
ZINGIBER PROCUMBENS	Tanaka, N., Miyake, K., & Aung, M. M.	Myanmar
EULOPHIA MYANMARICA	Naive, M. A. K., Hein, K. Z., Kumar, P., & Ormerod, P.	Myanmar
SONERILA LOBBII	Wai, J. S., & Hu, J. M.	Myanmar
ACILEPIS NAKHONPHANOMENSIS	Promprom, W., & Chatan, W.	Thailand
CANTHIUM FLAVOVIRENS	De Wilde, W. J., & Duyfjes, B.	Thailand, Laos
CANTHIUM GRANDIFLORUM	De Wilde, W. J., & Duyfjes, B.	Thailand
CANTHIUM ROTUNDUM	De Wilde, W. J., & Duyfjes, B.	Thailand
CORNUKAEMPFERIA SRISUMONIAE	Saensouk, P., Boonma, T., & Saensouk, S.	Thailand
CURCUMA LAMPANGENSIS	Rakarcha, S., Saensouk, S., Maknoi, C., Wongnak, M., Thammarong, W., & Saensouk, P.	Thailand
CURCUMA LINDSTROMII	Leong-Škorničková, J., Soonthornkalump, S., Niwesrat, S., & Lim, S. Q.	Thailand
CURCUMA NAKHONPHANOMENSIS	Saensouk, S., Boonma, T., & Saensouk, P.	Thailand
CURCUMA PULCHERRIMA	Saensouk, P., Boonma, T., & Saensouk, S.	Thailand
CURCUMA ROSEA	Saensouk, P., Boonma, T., Rakarcha, S., Maknoi, C., Wongnak, M. & Saensouk, S.	Thailand
CURCUMA SABHASRII	Rakarcha, S., Saensouk, S., Maknoi, C., Wongnak, M., Thammarong, W., & Saensouk, P.	Thailand
CURCUMA STAHLIANTHOIDES	Soonthornkalump, S., Kongphapa, J., Vianmana, S., Kunlapa, N. And Leong-Škorničková, J.	Thailand
CURCUMA SUPHANENSIS	Saensouk, P., Boonma, T., Rakarcha, S., Maknoi, C., Wongnak, M. And Saensouk, S.	Thailand
ELATOSTEMA KAWEESAKII	Pauwels, O. S., Meesook, W., Kunya, K., Donbundit, N., & Sumontha, M.	Thailand
ELATOSTEMA RUBRICAULE	Triyutthachai, N., Fu, L. F., Triboun, P., Wei, Y. G., & Pornpongrungrueng, P.	Thailand

ELATOSTEMA SAXATILE	Triyutthachai, N., Fu, L. F., Triboun, P., Wei, Y. G., & Pornpongrungrueng, P.	Thailand
GARCINIA SANTISUKIANA	Ngernsaengsaruay, C., & Suddee, S.	Thailand
GARCINIA SIRIPATANADILOKII	Ngernsaengsaruay, C., Meeprom, N., Boonthasak, W., Chamchumroon, V., Sinbumroong, A., Wessapak, P., & Duangjai, S.	Thailand
GOMPHOSTEMMA PHETCHABURIENSE	Bongcheewin, B., Poopath, M., & Paton, A.	Thailand
GREWIA SCABRIFOLIA	Chantaranothai, P., & Nualngam, S.	Thailand
GREWIA THAILANDICA	Chantaranothai, P., & Nualngam, S.	Thailand
KAEMPFERIA NAPAVARNIAE	Saensouk, P., Saensouk, S., & Boonma, T.	Thailand
KAEMPFERIA SAKONENSIS	Saensouk, P., Saensouk, S., & Boonma, T.	Thailand
KAEMPFERIA SIPRAIANA	Boonma, T., Saensouk, S., & Saensouk, P.	Thailand
LEIODONTIUM GEMINOSERRATUM	He, S., Senayai, A., & Chantanaorrapint, S.	Thailand
LITHOCARPUS EIADTHONGII	Sinbumroong, A., Rueangruea, S., Teerawatananon, A., & Sungkaew, S.	Thailand
MADHUCA KANCHANABURIENSIS	Chantaranothai, P., Kunasit, P., & Kladwong, P.	Thailand
MICROCOS BIFURCATA	Chantaranothai, P., Kladwong, P., & Kunasit, P.	Thailand, Cambodia
MILIUSA MICROPHYLLA	Damthongdee, A., Sinbumroong, A., Rueangruea, S., Kaitongsuk, S., Ue-Aree, P., Jongsook, H. And Chaowasku, T.	Thailand
MILLETTIA SIRINDHORNIANA	Mattapha, S., Suddee, S., Tetsana, N., Thananthaisong, T., & Kaewmuan, A.	Thailand
MILLETTIA TOMENTOSA	Mattapha, S., Suddee, S., Tetsana, N., Thananthaisong, T., & Kaewmuan, A.	Thailand
MONOON ORNITHOCEPHALUM	Bunchalee, P., Johnson, D. M., & Murray, N.	Thailand
MONOON PHUKRADUENGENSE	Bunchalee, P., Johnson, D. M., & Murray, N.	Thailand
MONOON PHULUANGENSE	Bunchalee, P., Johnson, D. M., & Murray, N.	Thailand
MONOON ROSEUM	Bunchalee, P., Johnson, D. M., & Murray, N.	Thailand
NEPENTHES BRACTEOSA	Nuanlaong, S., Mekanawakul, M., & Suraninpong, P.	Thailand
NEPENTHES HIRTELLA	Nuanlaong, S., Mekanawakul, M., & Suraninpong, P.	Thailand
NERVILIA HEMRATII	Gale, S. W., Tetsana, N., & Suddee, S.	Thailand
OPHIOGLOSSUM ISANENSE	Petchsri, S., Zhang, L. B., & Jaruwattanaphan, T.	Thailand
PEPEROMIA RANONGENSIS	Suwanphakdee, C., Hodkinson, T. R., & Chantaranothai, P.	Thailand
PHANERA MEKONGENSIS	Mattapha, S., Suddee, S., Duangjai, S., & Kiewbang, W.	Thailand
SAGITTARIA SIAMAGINASHI	Shiga, T., Kato, S., Suzuki, K., Tsubota, K., Zungsontiporn, S., Jongrukthai, T., ... & Itoh, K.	Thailand, Myanmar
THRIXSPERMUM OBYRNEANUM	Toolmal, N., Teck, O. P., & Schuiteman, A.	Thailand, Malaysia
TOXOCARPUS INCARNATUS	Kidyoo, A.	Thailand
WURFBAINIA ELLIPTICARPA	Kaewsri, W., & Sangvirotjanapat, S.	Thailand
WURFBAINIA GEOSTACHYOIDES	Kaewsri, W., & Sangvirotjanapat, S.	Thailand
WURFBAINIA GLOBOSA	Kaewsri, W., & Sangvirotjanapat, S.	Thailand
WURFBAINIA LONGIFLORA	Kaewsri, W., & Sangvirotjanapat, S.	Thailand
WURFBAINIA PARVIFLORA	Kaewsri, W., & Sangvirotjanapat, S.	Thailand
WURFBAINIA YINGYONGII	Kaewsri, W., & Sangvirotjanapat, S.	Thailand
APHYLLORCHIS PERIACTINANTHA	Chantanaorrapint, A., & Chantanaorrapint, S.	Thailand
CURCUMA ACHRAE	Saensouk, S., Boonma, T., & Saensouk, P.	Thailand
CLERODENDRUM PENINSULARE	Satthaphorn, J., Paton, A. J., & Leeratiwong, C.	Thailand
ARGOSTEMMA TORTILOBUM	Fang, K. Y., Tong, Y. H., Vu, T. C., Nguyen, K. S., & Xia, N. H.	Viet Nam
ARISAEMA VIETNAMENSE	Luu, H.t., Nguyen, H.c., Nguyen, T.q.t. And Nguyen, Q.b.	Viet Nam
ARISTOLOCHIA THOTTEAEFORMIS	Luu, H. T., Nguyen, T. Q. T., Nguyen, Q. D., Nguyen, T. T., & Van Do, T. R. U. O. N. G.	Viet Nam
ASPIDISTRA HETEROTEPALA	Tian-Chuan, H. S. U., Luu, H. T., & Chia-Wei, L. I.	Viet Nam
BEGONIA DIEUANHIAE	Hoang, T.s. And Lin, C.w.	Viet Nam
BEGONIA KHAUCAENSIS	Luu, H. T., Duong, Q. H., Le, K. Q., & Lin, C. W.	Viet Nam
BEGONIA KIMLONGII	Nguyen, V.c.,Hoang, T.s., Lin C.w., & Nguyen, V.k.	Viet Nam
BEGONIA MINHANIAE	Hoang, T.s. And Lin, C.w.	Viet Nam
BEGONIA NGOCBONII	Son, H. T., Lin, C. W., & Bon, T. N.	Viet Nam
BEGONIA TUANII	Hoang, T. S., & Lin, C. W.	Viet Nam
BEGONIA YENTUENSIS	Luu, H. T., Duong, Q. H., Le, K. Q., & Lin, C. W.	Viet Nam
BEILSCHMIEDIA BIDOUPENSIS	Komada, N., Tagane, S., Matsuo, A., Van Ngoc, N., Binh, H. T., Nagahama, A., ... & Yahara, T.	Viet Nam
BULBOPHYLLUM MAMILLATUM	Van Huong, B.u.i. And Van Canh Nguyen, B.v.t.	Viet Nam
BULBOPHYLLUM PHANQUYETII	Dang, M. Q., Averyanov, L. V., Van Son, D. A. N. G., Maisak, T., Van Huong, B. U. I., Tu, B. N., ... & Truong, B. V.	Viet Nam
BULBOPHYLLUM TRUONGTAMII	Dang, M.q., Averyanov, L.v., Van Son, D.a.n.g., Maisak, T., Van Huong, B.u.i., Tu, B.n. And Truong, B.v.	Viet Nam
BULBOPHYLLUM XUANDANGII	Nguyen, V.c., Hoang, T.s., Lin, C.w., & Nguyen, V.k.	Viet Nam
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CAMELLIA PHUONGCHIANA	Quach, V. H., Hoang, T. T., Truong, Q. C., Le, V. H., Luong, V. D., Võ, Q. T., ... & Curry, A. S.	Viet Nam
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CLEISOSTOMA FURCATUM	Averyanov, L.v., Thai, T.h., Truong, B.v., Van Canh, N.g.u.y.e.n., Nguyen, T.h., Maisak, T.v. And Nguyen, K.s.	Viet Nam
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COLOCASIA SPONGIFOLIA	Matthews, P. J., Fang, Q., & Long, C. L.	Viet Nam and China
CONAMOMUM VIETNAMENSE	Newman, F.	Viet Nam
COSMIANTHEMUM MELINHENSE	Van Hai, D., Nguyen The, C., Choudhary, R., Lin, Z., & Deng, Y.	Viet Nam
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CURCUMA VINHLINHENSIS	Nguyen, D.d., Le, T.a., Hoang, Q.h., Le, Q.t. And Nguyen, E.	Viet Nam
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LASIANTHUS CHII	Dang, V.s. And Naiki, A.	Viet Nam
LASIANTHUS GIALAIENSIS	Dang, V. S., Truong, B. V., Hoang, N. S., Le, V. T., Dang, M. Q., Nguyen, M. H., & Naiki, A.	Viet Nam
LASIANTHUS KBANGENSIS	Nguyen, D., Dang, Q., Le, N., Quach, V., Pham, V., Le, V., Truong, V., Naiki, A., & Dang, S.	Viet Nam
LASIANTHUS NAIKII	Dang, M. Q., Nguyen, M. H., Hoang, N. S., Le, V. T., Nguyen, T. M. H., Ho, N. Q. C., Truong, B. V., & Dang, V. S.	Viet Nam
LASIANTHUS SONLANGENSIS	Dang, M. Q., Nguyen, M. H., Hoang, N. S., Le, V. T., Nguyen, T. M. H., Ho, N. Q. C., Truong, B. V., & Dang, V. S.	Viet Nam
LASIANTHUS YERSINII	Dang, V.s. And Naiki, A.	Viet Nam
LEPTOMISCHUS MULTIFLORUS	Nuraliev, M. S., Nguyen, K. S., Pham, T. K. T., Nguyen, C. H., Quang, B. H., Lyskov, D. F., ... & Wu, L.	Viet Nam
LITHOCARPUS CADAMENSIS	Ngoc, N.v. Son, H.t., Binh, H.t., Tagane, S., Suyama, Y., & Yahara, T.	Viet Nam
LITHOCARPUS PACOENSIS	Ngoc, N. V., Son, T. H., & Binh, T. H.	Viet Nam
LYSIONOTUS HAGIANGENSIS	Nguyen, H. C., Averyanov, L. V., Maisak, T. V., & Nguyen, S. K.	Viet Nam
MEIOGYNE RUBRA	Jaikhamseub, T., Le, T. A., Damthongdee, A., Huong, T. T. T., Kuznetsov, A. N., Kuznetsova, S. P., ... & Chaowasku, T.	Viet Nam
MEIOGYNE VIETNAMICA	Jaikhamseub, T., Le, T. A., Damthongdee, A., Huong, T. T. T., Kuznetsov, A. N., Kuznetsova, S. P., ... & Chaowasku, T.	Viet Nam
MICROCHIRITA MINOR	Xin, Z. B., Li, R. F., Maciejewski, S., Fu, L. F., Van Do, T., & Wen, F.	Viet Nam
NEPHOANTHUS NUBIGENUS	Lin, C. W., Hsu, T. C., Luu, H. T., Yang, T. Y. A., & Li, C. W.	Viet Nam
OREOCHARIS PHUONGII	Le, K. D., Nguyen, T. T., Nguyen, P. T., Hoang, T. T., Wen, F., & Van Do, T.	Viet Nam
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QUERCUS MANGDENENSIS	Van Ngoc, N., & Binh, H. T.	Viet Nam
QUERCUS SONTRAENSIS	Van Ngoc, N., Binh, H. T., Son, H. T., Suyama, Y., & Yahara, T.	Viet Nam
RAPHIOCARPUS SINOVIETNAMICUS	Xin, Z. B., Yuan, L. X., Zhang, Z. Y., Dinh, Q. D., Lu, G., Maciejewski, S., & Do, T. V.	Viet Nam and China
SARCOGLYPHIS HIEPII	Averyanov, L.v., Thai, T.h., Van Canh, N.g.u.y.e.n., Truong, B.v., Maisak, T.v., Doan, N.t. And Nguyen, K.s.	Viet Nam
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SPOROXEIA VIETNAMENSIS	Thuy, N. T., Zeng, S., Do Van, H. A. I., Hoan, D. T., Lin, Z., & Deng, Y.	Viet Nam
TECTARIA DANANGENSIS	Li, S. H., & Dong, S. Y.	Viet Nam
TECTARIA FUNGII	Dong, S.y., Li, S.h., Huang, L., Tan, S.s. And Zuo, Z.y.	Viet Nam and China
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UROPHYLLUM BIDOUPENSE	Yooprasert, S., Culham, A., Tagane, S., Yahara, T., Nguyen, K. S., & Utteridge, T. M.	Viet Nam
UROPHYLLUM BROCHIDODROMUM	Yooprasert, S., Culham, A., Tagane, S., Yahara, T., Nguyen, K. S., & Utteridge, T. M.	Viet Nam
UROPHYLLUM PSEUDOSCHMIDTII	Yooprasert, S., Culham, A., Tagane, S., Yahara, T., Nguyen, K. S., & Utteridge, T. M.	Viet Nam
VANILLA CARDINALIS	Averyanov, L. V., Nuraliev, M. S., Thai, T. H., Maisak, T. V., Popov, E. S., Lyskov, D. F., ... & Kuznetsova, S. P.	Viet Nam
MALLEOLA MICRANTHA	Averyanov, L.v., Thai, T.h., Truong, B.v., Van Canh, N.g.u.y.e.n., Nguyen, T.h., Maisak, T.v. And Nguyen, K.s.	Viet Nam
CHILOSCHISTA GLABRISEPALA	Pham, P. D., Averyanov, L. V., Nguyen, D. H., Maisak, T., Van Canh, N. G. U. Y. E. N., Dang, M. Q., ... & Van Son, D. A. N. G.	Viet Nam
ISOTREMA PUTALENGENSE	Nguyen, Q. B., Nguyen, H. C., Tran, D. B., Nguyen, P. H., & Luu, H. T.	Viet Nam

FISH

NEMACHEILUS CACAO	Bohlen, J., Kottelat, M., & Šlechtová, V.	Laos
NEMACHEILUS PEZIDION	Kottelat, M.	Laos
DARIO MELANOGRAMMUS	Britz, R., Kullander, S., & Rber, L.	Myanmar
DARIO TIGRIS	Britz, R., Kullander, S., & Rber, L.	Myanmar
DEVARIO AHLANDERI	Kullander, S., & Norén, M.	Myanmar
GLARIDOGLANIS RAMOSA	Ng, H. H., & Kottelat, M.	Myanmar
GLYPTOTHORAX YUENSIS	Shangningam, B., & Kosygin, L.	Myanmar
MUSTURA YANGI	Qin, T., Kottelat, M., Kyaw, Y. M. M., & Chen, X.	Myanmar
PARACANTHOCOBITIS EPIMEKES	Dvořák, T., Bohlen, J., Kottelat, M., & Šlechtová, V.	Myanmar, Thailand
AKYSIS PATRATOR	Ng, H. H., Pawangkhanant, P., & Suwannapoom, C.	Thailand
NEMIPTERUS BIENDONGENSIS	Prokofiev, A. M.	Viet Nam

AMPHIBIAN

AMOLOPS SHIHAITAOI	Wang, J., Li, J., Du, L., Hou, M., & Yu, G.	China, Viet Nam
THELODERMA HEKOUENSE	Du, L., Wang, J., Liu, S., & Yu, G.	Viet Nam, China
ANSONIA INFERNALIS	Suwannapoom, C., Grismer, L. L., Pawangkhanant, P., & Poyarkov, N. A.	Thailand
HOPLOBATRACHUS SALWEEN	Thongproh, P., Chunskul, J., Sringurngam, Y., Waiprom, L., Makchai, S., Cota, M., ... & Chuaynkern, Y.	Thailand
MICROHYLA HMONGORUM	Van Hoang, C., Nguyen, T. T., Phan, T. Q., Ninh, H. T., Wang, B., Jiang, J., ... & Nguyen, T. Q.	Viet Nam, Laos, Myanmar
MICROHYLA XODANGORUM	Van Hoang, C., Nguyen, T. T., Phan, T. Q., Ninh, H. T., Wang, B., Jiang, J., ... & Nguyen, T. Q.	Viet Nam
QUASIPAA TAOI	Van Hoang, C., Phan, T. Q., Nguyen, T. Q., & Ziegler, T.	Viet Nam, Laos
RHACOPHORUS TRANGDINHENSIS	Kropachev, I. I., Evsyunin, A. A., Orlov, N. L., & Nguyen, T. T.	Viet Nam
THELODERMA KHOII	Ninh, H. T., Nguyen, T. T., Nguyen, H. Q., Van Hoang, N., Siliyavong, S., Van Nguyen, T., ... & Ziegler, T.	Viet Nam
XENOPHRYS TRUONGSONENSIS	Luong Am, Van Hoang C, Pham Ct, Et Al.	Viet Nam

REPTILE

HYPSISCOPUS MURPHYI	Bernstein, J. M., Voris, H. K., Stuart, B. L., Phimmachak, S., Seateun, S., Sivongxay, N., ... & Ruane, S.	Laos, Thailand, Vietnam, Cambodia, Taiwan, China
OLIGODON TEYNIEI	David, P., Hauser, S., & Vogel, G.	Laos (maybe cambodia)
GEKKO HULK	Grismer, L. L., Del Pinto, L., Quah, E. S., Anuar, S., Cota, M., Mcguire, J. A., ... & Grismer, J. L.	Malaysia, Thailand
ACANTHOSAURA MERIDIONA	Trivalairat, P., Sumontha, M., Kunya, K., & Chiangkul, K.	Thailand

CNEMASPIS AURIVENTRALIS	Rujirawan, A., Yodthong, S., Ampai, N., Termprayoon, K., Aksornneam, A., Stuart, B. L., & Aowphol, A.	Thailand
CNEMASPIS SAMUI	Ampai, N., Rujirawan, A., Yodthong, S., Termprayoon, K., Stuart, B. L., Wood Jr, P. L., & Aowphol, A.	Thailand
CNEMASPIS SIMILAN	Ampai, N., Rujirawan, A., Yodthong, S., Termprayoon, K., Stuart, B. L., Wood Jr, P. L., & Aowphol, A.	Thailand
CYRTODACTYLUS FLUVICAVUS	Grismer Ll, Aowphol A, Yodthong S, Ampai N, Termprayoon K, Aksornneam A, Rujirawan A	Thailand
CYRTODACTYLUS KOCHANGENSIS	Grismer Ll, Aowphol A, Yodthong S, Ampai N, Termprayoon K, Aksornneam A, Rujirawan A	Thailand
CYRTODACTYLUS MONILATUS	Yodthong, S., Rujirawan, A., Stuart, B. L., Grismer, L. L., Aksornneam, A., Termprayoon, K., ... & Aowphol, A.	Thailand
CYRTODACTYLUS PHUKHAENSIS	Chomdej, S., Pradit, W., Pawangkhanant, P., Kuensaen, C., Phupanbai, A., Naiduangchan, M., ... & Suwannapoom, C.	Thailand
CYRTODACTYLUS RIVULARIS	Grismer Ll, Aowphol A, Yodthong S, Ampai N, Termprayoon K, Aksornneam A, Rujirawan A	Thailand
CYRTODACTYLUS UTHAIENSIS	Grismer Ll, Aowphol A, Yodthong S, Ampai N, Termprayoon K, Aksornneam A, Rujirawan A	Thailand
CYRTODACTYLUS KOCHANGENSIS	Grismer, L. L., Aowphol, A., Yodthong, S., Ampai, N., Termprayoon, K., Aksornneam, A., & Rujirawan, A.	Thailand
CYRTODACTYLUS RIVULARIS	Grismer, L. L., Aowphol, A., Yodthong, S., Ampai, N., Termprayoon, K., Aksornneam, A., & Rujirawan, A.	Thailand
GEHYRA WONGCHAN	Pauwels, O. S., Meesook, W., Kunya, K., Donbundit, N., & Sumontha, M.	Thailand
HEBIUS TERRAKARENORUM	Hauser, S., Smits, T. And David, P.	Thailand (maybe Myanmar)
ACHALINUS VANHOENSIS	Luu, V. Q., Ziegler, T., Van Ha, N., Van Lo, O., Hoang, T. T., Ngo, H. T., ... & Nguyen, T. Q.	Viet Nam
LYCODON ANAKRADAYA	Nguyen, A. T., Duong, T. V., Wood Jr, P. L., & Grismer, L. L.	Viet Nam
LYCODON TRUONGI	Nguyen, A. T., Duong, T. V., Wood Jr, P. L., & Grismer, L. L.	Viet Nam
OLIGODON TUANI	Nguyen, S. N., Van Le, M. A. N. H., Thi-Dieu-Hien, V. O., & Murphy, R. W.	Viet Nam
PAREAS ABROS	Poyarkov, N. A., Van Nguyen, T., Pawangkhanant, P., Yushchenko, P. V., Brakels, P., Nguyen, L. H., ... & Vogel, G.	Viet Nam
PAREAS KUZNETSOVORUM	Poyarkov, N. A., Van Nguyen, T., Pawangkhanant, P., Yushchenko, P. V., Brakels, P., Nguyen, L. H., ... & Vogel, G.	Viet Nam
XENOPELTIS INTERMEDIUS	Orlov, N., Snetkov, P., Ermakov, O., Nguyen, T., Ananjeva, N.	Viet Nam
MAMMAL		
MYOTIS HAYESI	Csorba, G., & Furey, N. M.	Cambodia

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A Khoi's mossy frog (*T. khoii*) in Ha Giang province in northeast Viet Nam.

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