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THE INTERNATIONAL PALM SOCIETY, INC.

The International Palm Society

Founder: Dent Smith

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FRONT COVER

Brahea sarukhanii Quero, a newly-described species from Mexico. See article p. 109. Photo by Scott Zona.

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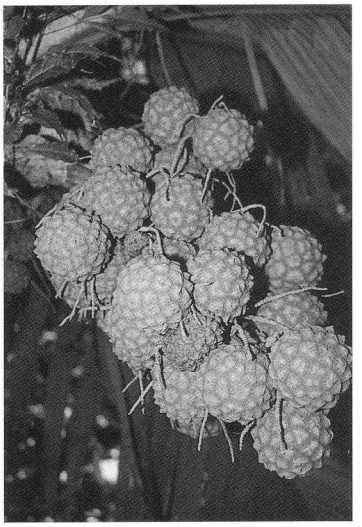
Mature *Pritchardia limahuliensis*, in Kauai, Hawaii, 1997. Forest destruction was caused by a hurricane in November, 1992. See accompanying article p. 121. Photo by David H. Lorence.

Features



The corky fruits of *Pelagodoxa henryana* are distinctive. This photograph was taken at the National Tropical Botanical Garden. See related article p. 121. Photo by J. Dransfield.

The next issue of PALMS will feature the palms of New Guinea and will include descriptions of a new *Licuala*, a new *Caryota* and much more!

President's Message

This is the last Message of my tenure as IPS President. It seems normal for me to reflect upon what I wanted to achieve when I took office, and whether or not it happened. I am quite proud of the accomplishments of our Society during the past four years, and I am pleased to tell you why.

My primary concern was our journal. I heard complaints that it was too technical and did not meet the needs of our Members, so Directors and the Editors worked long and hard to create a more user-friendly publication. We now have nothing short of a world-class journal filled with great articles. Our long-awaited Horticulture Issue became a reality last year. We added more articles on growing and have even included a regular horticulture column. We created the Supplement and expanded chapter news. And these last few issues of PALMS have been knockouts! The issue on the palms of Cuba comes to mind. What else could a palm lover want? Also, the format of our journal has changed, making it easier to read. And yes, the name change from Principes to PALMS was difficult, but this, too, has been part of our evolution in giving the reader what he wants. I hope these innovations are evident and enjoyable to all of you.

I also pushed hard to continue our efforts to become a truly international society. We have made administrative changes that facilitate memberships worldwide. Since I took office, we have had seven new Chapters and Affiliated Societies join the IPS. There might even be one more before this issue is published. Each of the groups brings something unique to our Society. For example, both Association Chambeyronia in New Caledonia and the Far North Queensland Palm and Cycad Association in Australia became affiliated quite recently. Our New Caledonian friends will host the Biennial 2000, and the FNQPACA will host the Post Tour 2000. These many chapters around the world help unite all of us in our keen interest in palms from all areas.

And what of the Biennial Meetings? Southern California in 1996, Thailand in 1998 and now New Caledonia in 2000 will prove to be unforgettable experiences. For those of you who have been to one of these events, you will understand exactly what I mean. For others, it may be a goal for the future, but I hope that all of you will be able to experience one of these magical and rewarding events.

Another achievement of the past four years is our greatly expanded Internet presence with a truly state of the art website. Originally pioneered by our previous President, Jim Cain, and with the present guidance of Lynn McKamey and Jana Meiser, our site <www.palms.org> has blossomed into the best source for palm information on the Internet.

All of us on the Board of Directors continue to look for ways to keep the dues stable and the membership rates affordable, despite rising costs. I am proud to say that during my tenure dues have not increased, and we are more fiscally sound than when I took office. Our Endowment Fund has actually grown, and we have continued to support much-needed research and education on palms throughout the world.

I must add that being President has not come without its difficulties. I wish that members and Chapters always coexisted as complacently as the palms in my garden. It seems that, when we add the human element, problems can arise. These problems are typically related to communication or, more commonly, the lack of good communication. At the time of this writing, I am working with other Directors to improve communication within the Society, among its Chapters and all the members.

I thank various people who have contributed greatly to our Society during the past four years. First and foremost, I thank our Editors, Jim Cain, John Dransfield, Scott Zona and especially our beloved Natalie Uhl, who contributed many decades of hard work for all of us. I thank Lynn McKamey and Ross Wagner, both retiring this year, for their years of contributions as Officers. Thanks go out to Pauleen Sullivan for her decades of serving as Bookstore Officer and Director. My thanks also go to Martin Gibbons, Lester Pancoast and Richard Woo, who are also retiring Directors. For our unforgettable Biennial 1998 in Thailand, I thank Kampon Tansacha and his fabulous staff at Nong Nooch Tropical Garden. I send a special thanks to all our Directors who have spent countless hours this year finding a better path for our Society to follow.

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Brahea sarukhanii, a New Species of Palm from Mexico

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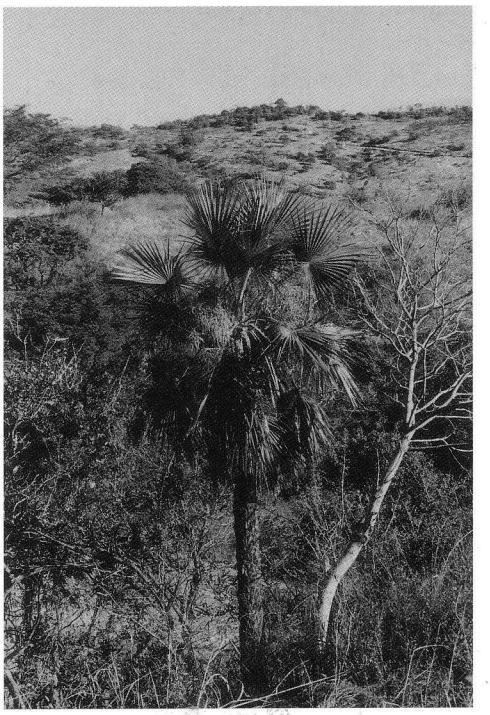


1. *Brahea sarukhanii* growing in a disturbed Median Dry Forest of Jalisco.

The genus *Brahea* was described by Martius in 1837 while *Erythea* was described by S. Watson in 1880. The latter genus has been considered by many authors as synonymous with *Brahea*. However, I have maintained the two genera because *Erythea* has ternately glomerate flowers, big subglobose fruits with blunt subapical stigmatic scars and always grows on igneous or neutral soils, while *Brahea* has solitary flowers, small ellipsoid or falcoid fruits with apiculate stigmatic scars and always grows on limestone soils.

During recent intensive field exploration in order to collect specimens of *Brahea* and *Erythea*, I observed populations of *Erythea pimo* growing on limestone and igneous soils while populations of *Brahea dulcis* and *Brahea nitida* were found growing on both types of soils. On the other hand, *Brahea decumbens* which grows in limestone soils has big subglobose fruits. As the elements that I used to separate both genera are insufficient to distinguish the two genera, I now use *Brahea* as the valid genus which includes two subgenera and 12 species, all of them growing in Mexico, although three of them extend to Central America.

Upon studying the numerous collections and field observations made for my monograph of *Brahea*, I realized that the palms growing in the states of Nayarit and Jalisco did not correspond to populations of other species of *Brahea* occurring in the surrounding regions, nor with any other species known. I concluded that there are remarkable differences sufficient to consider the palms from Nayarit and Jalisco as belonging to a new species.

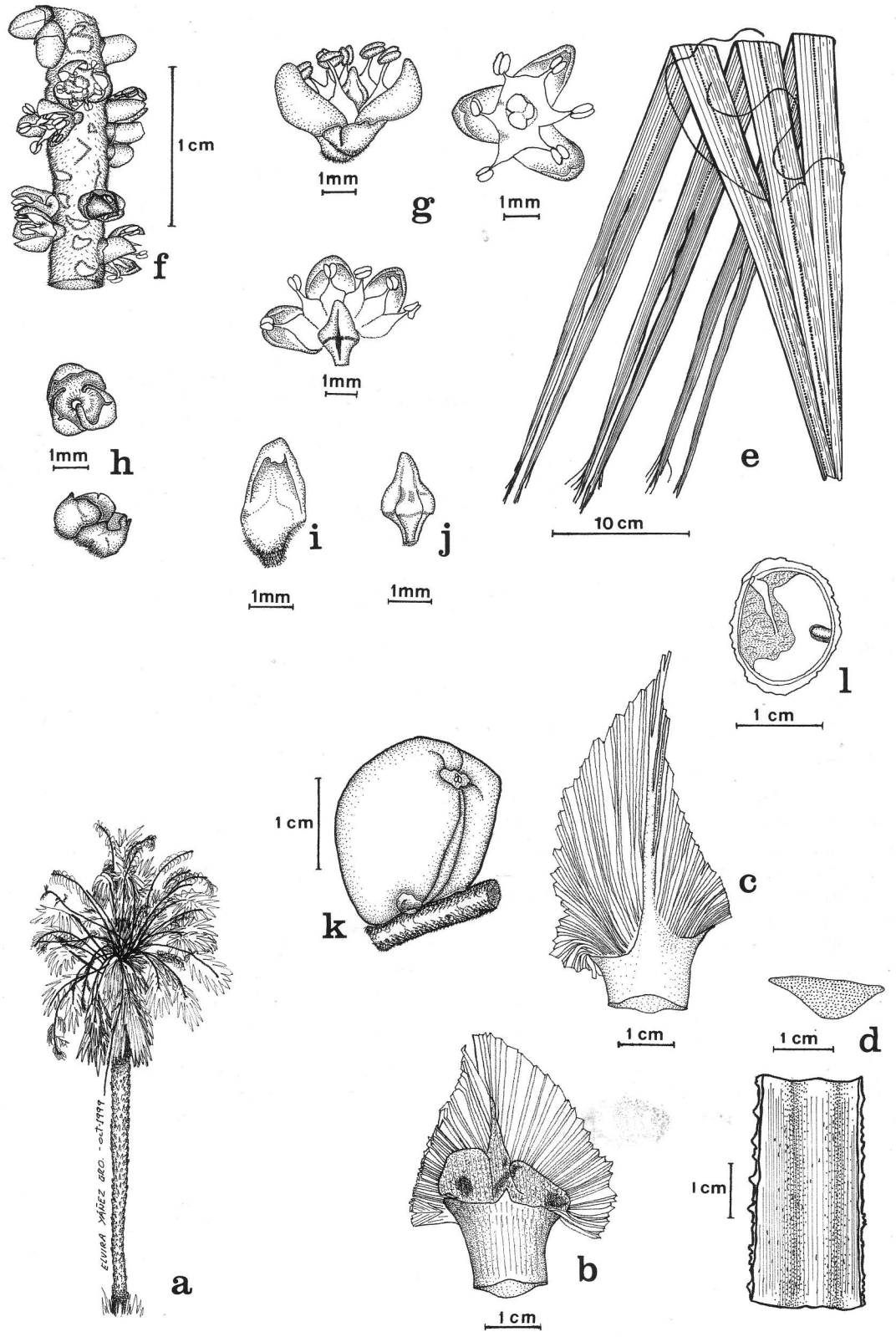
Brahea sarukhanii Quero, **sp. nov.** Figs. 1–4.

Palma mediocris, usque ad 5 m alta, trunco simplici, erecto, 10–15 cm diametro. Folia mediocria, lamina usque ad 80 cm lata, ambitu orbiculari; petiolis denticulatis, apice 10–12 mm, base 15–22 mm latis; lamina in 52–67 segmentis divisa, centralibus usque ad 80 cm longis, 20–40 mm latis, supra sinus persaepe bifurcatis, palman longitudine 1/4–1/3 laminae. Inflorescentiae ascendentes vel diffusae. Flores solitarii in rachilla conferti; calyce in indumento impresso, ca 1.2–1.5 mm longo, petala 2.6–3.0 mm longa per 1/3 longitudine connata; pistillum ca 2.0 mm longum, ovariis 3 discretis, stipitatis, stylo communi unico. Fructus ellipsoideus vel oblongus, 18–20 x 12–16 mm, glaber. Semen oblongum 14–16 x 12–13 mm.

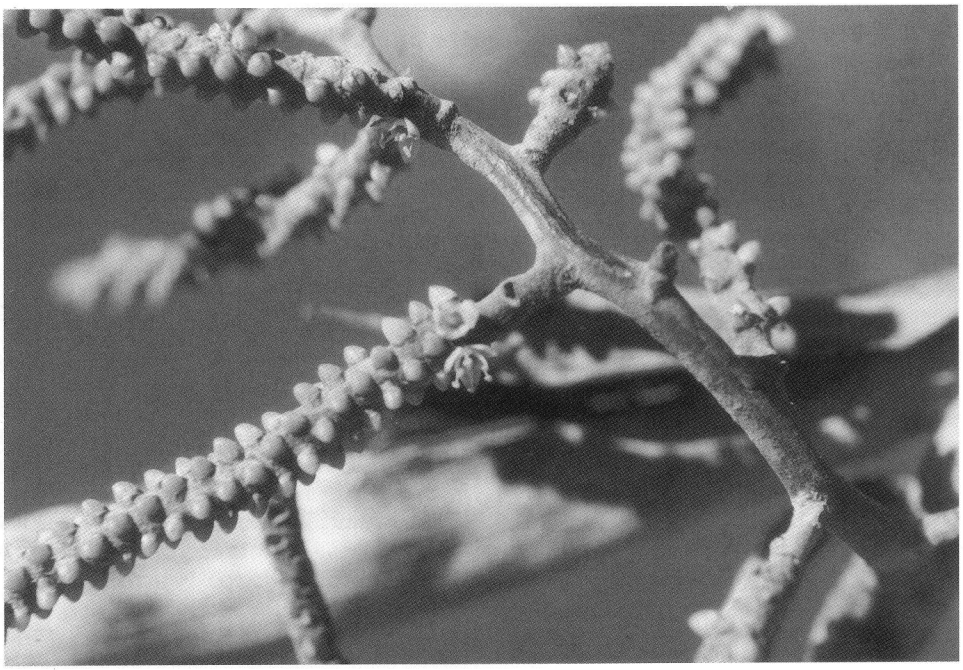
Typus: Mexico, Nayarit: 20 km SE of Ixtlan del Rio on road to Guadalajara, *Quero 3791* (Holotypus MEXU; isotypi BH, NY, US).

Palms to 5 m tall. Trunk solitary, 10–15 cm diam. with persistent sheaths and petiole bases through almost all its length. Crown with ca. 12-18 leaves. Leaf to 1.60 m long; petioles glabrous, 45–90 cm long, 15–22 mm wide at the base, 10–12 mm wide at the apex, armed with small teeth ca. 1.2 mm long at least toward the base, usually flat above convex below, abaxially projected in a small costa 5–9 cm long, hastula triangular with short membranaceous point; blade scarcely costapalmate, circular in general outline, 80–115 cm diam., with 52–67 segments and a palman of 30–50% of the radius of the blade, at least in the middle; central segments 60–80 cm long, 1.8–4.0 cm wide, the free portion deeply bifurcate, each portion with entire apex, and prominent, numerous closely spaced secondary nerves with connecting cross veinlets visible underneath. Inflorescence arching, equal to or slightly exceeding the leaves, 120–150 cm long; prophyll bicarinate with triangular apex, opening apically, ca. 20 cm long, 35–40 mm wide; peduncular bracts 2; rachis bracts with triangular apices; peduncle less than 1/3 the length of the inflorescence; primary branches 7 (–9), rachillae 8.0–14 cm long, 3.0–3.5 mm diam., densely woolly-tomentose. Flowers solitary,creamy-white, 3.5 mm long; floral bracts and the base of calyx sunken in the tomentum; calyx 1.2–1.5 mm high, sepals canescent in the upper inner surface, free and imbricate; corolla at least twice the length of the calyx, petals triangular ascendent, imbricate and connate at base, valvate above, 2.5–3.0 mm long, strongly costate when dry, canescent at the outer base; stamens shorter than the petals, anthers 1.5 mm long; pistil ca. 2.0 mm long with connate styles, ovary pyramidal, lightly stipitate with free carpels, canescent at the base, shorter than the style, stigma punctiform. Fruit ellipsoid to nearly oblong, sometimes slightly falcoid, 18–20 x 12–16 mm with blunt subapical ventral stigmatic remnant and a median ventral groove, creamy and canescent when young, black and glabrous at maturity; epicarp smooth, mesocarp fleshy and fibrous to 2.5 mm thick, endocarp cartaceous. Seed oblong, smooth, 14–16 x 12–13 mm, endosperm homogeneous intruded by a horny ventral postament; embryo subbasal.

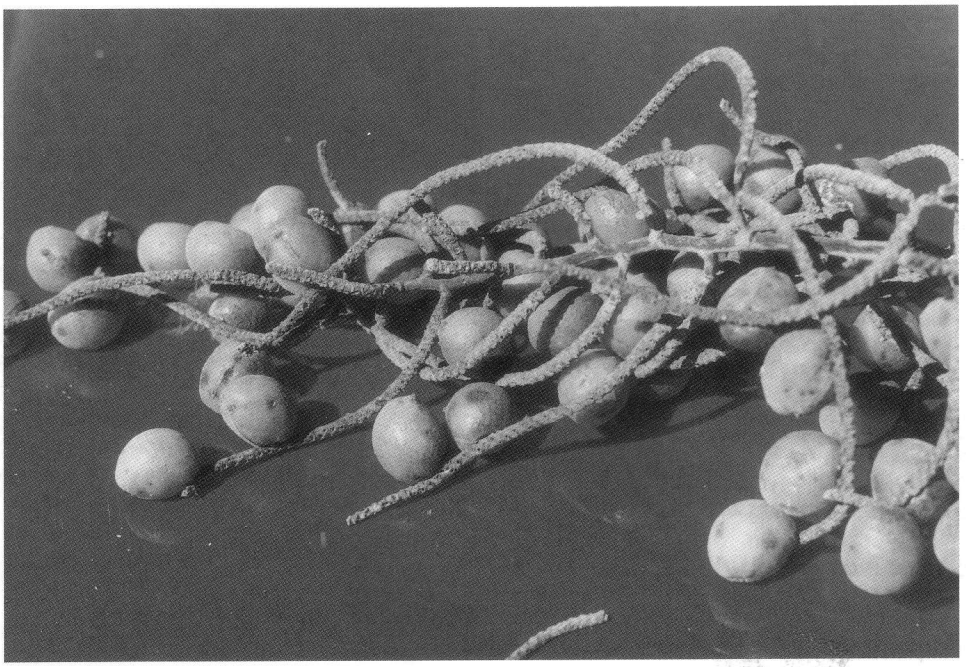
SPECIMENS EXAMINED: MEXICO: NAYARIT: 20 km SE of Ixtlan del Rio on road to Guadalajara, *Quero 3791* (Holotype MEXU, isotypes BH, NY, US); 19.5 km SE of Ixtlan del Rio, *Quero 3792* (MEXU); 19 km S of Ixtlan del Rio, *Quero 3567* (MEXU). JALISCO: 120 km SE of Tepic, along highway 15, *F. C. Boutin 2092* (BH); Km 800 on highway from Guadalajara to Tepic, near the border between Jalisco and Nayarit, *H. E. Moore & V. Cetto 6043* (BH, NY); Municipio Hostotipaquillo, 2 km W of Plan de Barrancas, *Ornelas 1544* (IBUG); 13 km NW of Ameca, beyond the Realito on road to Guachinango, *Gonzalez Villarreal 653* (IBUG); 3 km from Nayarit border along road from Tepic to Guadalajara; *S. Zona, O. Dorado, O. Tellez 246* (FTG); 2.5 Km E of the border between Nayarit and Jalisco, *Quero 3701, 3702* (MEXU); 3 Km E of the border between Nayarit and Jalisco, *Quero 3766, 3767* (MEXU); 7 km NW of tollbooth Plan de Barrancas, on the tollroad Guadalajara–Tepic, *Quero 3624* (MEXU); Platanal bridge, 5 km SE the border between Nayarit and Jalisco, on the



2. *Brahea sarukhani*. a) general appearance of the palm; b) adaxial part of the leaf; c) abaxial part of the leaf; d) cross section and basal part of petiole; e) central segments of the leaf; f) rachilla with open and bud flowers; g) open flowers; h) calyx; i) petal; j) pistil; k) fruit; l) cross section of seed.



3. *Brahea sarukhanii:* close up of rachilla with mature and unopened flowers.



4. *Brahea sarukhanii:* primary branch with fruits.

tollroad, *Quero 3678* (MEXU); Km 85.5 on the tollroad Guadalajara–Tepic, *Quero 3774* (MEXU); 27.8 km W of Ameca on road to Mascota, *Quero 3775* (MEXU); 29 km W of Ameca on road to Guachinango and Mascota, *Quero 3732, 3733* (MEXU); 30 km W of Ameca on road to Guachinango and Mascota, *Quero 3731* (MEXU). In addition, numerous observations and measurements were made from randomly distributed plants in each population.

DISTRIBUTION AND ECOLOGY. This new species is known only from the mountain regions of Ameca, Jalisco and near the border between the states of Nayarit and Jalisco (Fig. 5), on hillsides with abundant basaltic rocks. It is an important element of the physiognomy of the Dry Tropical Forest and Pine-Oak Forest of that region where it grows at an elevation between 1100 and 1650 m.

The most similar species to the new one are *Brahea aculeata, B. dulcis* and *B. pimo;* however, *B.*

5. Distribution of *Brahea sarukhanii*.

sarukhanii differs from *B. aculeata* in its smaller oblong fruits and the scarce, small teeth of petioles. From *B. dulcis* it differs in that the fruits are nearly double the size and the rachillae are shorter. In contrast with *B. pimo*, it has thicker rachillae, larger fruit and more sparsely armed petioles.

Key to the Brahea *species from western Mexico*

1. Petioles strongly armed with teeth 4–5 mm long at least at the base; rachillae less than 3 mm diam.

   2. Leaves lepidote-tomentose at least at the apex of petiole and base of blade, fruits less than 15 mm diam. ..... *Brahea pimo*

   2. Leaves almost always glabrous, never lepidote-tomentose, fruits more than 20 mm diam. ..... *Brahea aculeata*

1. Petioles sparsely armed, but teeth never more than 3 mm long; rachillae thick, more than 3 mm diam.

   3. Trunk with remains of sheaths and petioles on the upper third; petals more or less deltoid, fruit apiculate, less than 12 mm long and less than 10 mm diam. ..... *Brahea dulcis*

   3. Trunks with remains of sheaths and petioles along most of their length; petals triangular, fruit not apiculate, more than 18 mm long and 15 mm diam. ..... *Brahea sarukhanii*

This species is named in honor of Dr. José Sarukhán, eminent Mexican botanist and ecologist, General Coordinator of the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) and former director of Instituto de Biología de la Universidad Nacional Autónoma de México.

Acknowledgments

I wish to express my appreciation to the CONABIO (grant L216) who made possible the field work to collect the *Brahea* palms. I extend special thanks to Elvira Yanez from the Jardín Botánico UNAM for her assistance during the realization of this work. Thanks also to Dr. Fernando Chiang from Instituto de Biología, UNAM for his assistance with the Latin description, and to Dr. Javier Caballero and Dr. Robert E. Bye from the Jardín Botánico, UNAM for critically reviewing the manuscript. Biol. Jorge Saldivar helped in the computer assisted processing of the photographs.

The Effects of Vitamin B_1 on Palm Seedling Growth

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Palm roots appear to grow very slowly and are subject to considerable damage when injured or broken during transplant. Accordingly, palm growers have long sought treatments that can be applied during the transplant process that will both mitigate damage and promote rapid recovery. Such treatments could be used in transplanting field grown palms into the landscape, in moving plants up to larger pots or separating community pots of seedlings

In the last few years, numerous products described by their manufacturers as "biostimulants" have become commercially available. These products include a wide variety of fertilizers, vitamins, and other unknown substances. One product – Ecosane 5000 ®, an "enzyme activated stabilized biologic catalyst" with undisclosed ingredients – has been the subject of controversy in the South Florida palm horticulture community (Hull 1996, Romney 1998, Waddell 1998) with widely divergent claims of its usefulness. While there is some evidence to suggest the effectiveness of such products in annuals and woody dicots (Kelting et al. 1998a, 1998b; Sanders et al. 1990), their effect on palms – long-lived tropical monocots – is largely anecdotal.

Vitamin B_1 (thiamine) is found in all these products at varying concentrations. It is thought to promote root initiation and establishment. Because B_1's role is unclear, this experiment investigated the effect of B_1 on root initiation and growth during the early life of transplanted palm seedlings.

Material and Methods

This experiment was set up to test the effects of B_1 on the root and shoot biomass of two palm species. Six separate control and experimental groups of 12 seedlings each were monitored weekly for the two species over a 4-month period during the summer of 1999 (7 May–18 August).

Two horticulturally common palm species were selected for this experiment. Six-month old seedlings of *Ptychosperma lineare*, a fast-growing clustering palm, were dug from a self-sown population in the author's garden. Dr. Jack Fisher, of Fairchild Tropical Garden (FTG), supplied year-

Tab. 1. Summary for *Ptychosperma lineare*.

	Mean total mass (g)	Standard deviation
Water: Initial drench	0.2773	0.00508
Water: Weekly drench	0.2667	0.00375
Water: Weekly foliar	0.2782	0.00397
B_1: Initial drench	0.2580	0.00719
B_1: Weekly drench	0.3150	0.00792
B_1: Weekly foliar	0.2610	0.00453

old, nursery-grown seedlings of the slow-growing clustering palm *Acoelorraphe wrightii*. Twelve seedlings of similar size were selected for each treatment. All soil or potting mix was washed and hand picked from each seedling prior to planting in standard nursery mix.

Horticultural conditions at the FTG nursery were typical of many commercial production nurseries that grow seedling palms. Seedlings were grown in a sterile, soil-less potting mix, at moderate light levels, with high temperature and humidity and daily irrigation. Plastic rose pots (57 mm square x 127 mm deep) were chosen to ensure excellent drainage.

The B_1 experimental group received a 0.01% solution, freshly prepared each week, and the control group received only tap water. This solution duplicates the concentration of B_1 found in Ortho Up-Start®, a commercially-available plant growth promoter. The six treatments for each species were as follows:

Control (water only) / initial drench
Control (water only) / weekly drench
Control (water only) / weekly foliar spray
Experimental (B_1) / initial drench
Experimental (B_1) / weekly drench
Experimental (B_1) / weekly foliar spray

Drench treatments (either B_1 or water) were applied so that water ran through each pot. Foliar spray treatments of B_1 or water were applied by a hand held pump sprayer with enough liquid to wet the leaves thoroughly until run off occurred.

At the end of the experiment, each plant was removed from its pot, and all potting mix was gently washed and hand picked from its root mass. Each treatment group was dried for 6 days at 45°C. Total mass of each plant was recorded. Each plant's roots were then cut off, and both root and shoot masses were determined separately.

The data were analyzed with SPSS 9.0 software and a General Linear Model was run. Significance at the 0.05 level was applied as the standard.

Results and Discussion

Despite four months of treatment, there was no obvious discernible difference observed between the control and experimental groups of either species (Tab. 1 and 3). Both control and experimental groups looked equally vigorous and had grown at similar rates.

For *Ptychosperma lineare*, there was a statistically significant difference in shoot mass between the B_1 weekly drench group and the B_1 initial drench group (Tab. 2). There was also a significant difference in shoot mass between the B_1 weekly

Tab. 2. Post hoc tests for significance: *Ptychosperma lineare*. Shoot mass comparisons given above the diagonal; root mass comparisons given below the diagonal. Asterisk indicates significant value.

Treatment	Water: Initial drench	Water: Weekly drench	Water: Weekly foliar	B_1: Initial drench	B_1: Weekly drench	B_1: Weekly foliar
Water: Initial drench		0.983	0.945	0.538	0.154	0.364
Water: Weekly drench	0.344		0.931	0.544	0.184	0.376
Water: Weekly foliar	0.802	0.477		0.583	0.135	0.400
B_1: Initial drench	0.241	0.848	0.352		0.046*	0.773
B_1: Weekly drench	0.255	0.044*	0.165	0.023*		0.023*
B_1: Weekly foliar	0.566	0.702	0.742	0.555	0.093	

Tab. 3. Summary for *Acoelorrahe wrightii*.

	Mean total mass (g)	Standard deviation
Water: Initial drench	0.4908	0.01206
Water: Weekly drench	0.6942	0.17392
Water: Weekly foliar	0.5673	0.00000
B_1: Initial drench	0.7242	0.16443
B_1: Weekly drench	0.5900	0.34000
B_1: Weekly foliar	0.5717	0.18341

drench group and the B_1 weekly foliar spray group. In comparing root mass for this species, there was a significant difference in effect between the weekly water drench and weekly B_1 drench, as well as between the B_1 weekly and initial drenches.

For *Acoelorraphe wrightii* shoot and root masses, the only difference in effect was between the water initial drench and B_1 initial drench.

Statistical differences between two B_1 treatment groups, rather than between treatments and controls (e.g., shoot mass in *P. lineare* B_1 weekly drench vs. B_1 foliar spray), imply that one treatment suppressed growth relative to the other. Treatment with B_1 may, in some circumstances, hinder growth.

It is important to note that because the *Ptychosperma lineare* seedlings were dug from the ground, they may have been inoculated with mycorrhizae. This was not true in the case of the *Acoelorraphe wrightii* which were grown from seed in a sterile medium. Even if the *Ptychosperma* were inoculated, establishment of mycorrhizal colonies in palm roots is an extremely slow and uncertain process and was unlikely to affect the experiment one way or the other (J. Fisher, pers. comm.).

Although 6% of the seedlings (1 of 72 *Acoelorraphe* and 8 of 72 *Ptychosperma*) died, such mortality is normal for small palm seedlings. No control or experimental group lost more than two seedlings. The larger percentage of *Ptychosperma* deaths were attributed to the fact that the seedlings were dug from the ground and suffered greater initial root disturbance.

Conclusions

It is important to emphasize that there were no observable differences between the control and experimental treatment groups. Significant

Tab. 4. Post hoc tests for significance: *Acoelorraphe wrightii*. Shoot mass comparisons given above the diagonal; root mass comparisons given below the diagonal. Asterisk indicates significant value.

Treatment	Water: Initial drench	Water: Weekly drench	Water: Weekly foliar	B_1: Initial drench	B_1: Weekly drench	B_1: Weekly foliar
Water: Initial drench		0.20	0.198	0.012*	0.559	0.314
Water: Weekly drench	0.064		0.302	0.857	0.076	0.173
Water: Weekly foliar	0.755	0.131		0.228	0.470	0.760
B_1: Initial drench	0.038*	0.820	0.840		0.051	0.124
B_1: Weekly drench	0.184	0.589	0.321	0.443		0.669
B_1: Weekly foliar	0.495	0.235	0.722	0.158	0.514	

differences between control and experimental groups were revealed only by statistical analysis.

The differences between control (i.e. standard nursery treatment) and B_1-treated palm seedlings, while statistically significant, are slight. They do not warrant the extra time and expense needed to perform the treatment. Instead, a well-balanced and regular fertilizer program would work equally well, if not better.

It is possible that four months is too short a time to see results of B_1 treatments. However, for the commercial grower who wants to move nursery stock up to marketable size as soon as possible, long-term B_1 treatments are not commercially feasible.

Acknowledgments

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PALM RESEARCH IN 1999

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Developing a Tropical Botanical Garden Palm Collection

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1. The Lawai palmetum at the National Tropical Botanical Garden on Kauai, developed in the 1970s (Photo by Blaine Michioka).

The National Tropical Botanical Garden (NTBG), Kauai, Hawaii began developing a palm collection from its inception in 1970. Some of its original palm plantings remain as majestic reminders of its humble beginnings to collect and develop this third most important plant group. Recent collecting expeditions have enhanced this collection with palms from New Caledonia, Kosrae, Pohnpei, Palau and the Marquesas. NTBG is developing a conservation collection of the native genus *Pritchardia*. The living palm collections are actively used for research, conservation, education, and pleasure. Future plans include adding species that are now under-represented or not represented at all.

Palms are synonymous with the tropics, yet in Hawaii only one genus, *Pritchardia*, is native to this archipelago, with about 22 species endemic to Hawaii. Fortunately, the tropical climate of Hawaii allows a great majority of palm species from all over the world to be grown. Hawaii thus provides the best situation in the USA for the development of an extensive palm collection that will be protected for future generations. The National Tropical Botanical Garden (NTBG) was chartered by Congress in 1964 as a privately supported research and education institution. It encompasses more than 1,600 acres in four gardens: Lawai, Allerton's, Limahuli and Kahanu (Maui), and three preserves in Hawaii and one garden in Florida, the Kampong. NTBG began developing its palm collections from its inception in 1970 with *Roystonea regia* , *Veitchia* spp., *Latania loddigesii*, and *Dypsis madagascariensis*. The first palm plantings were made in a site designated as the Lawai Palmetum at the garden's headquarters on Kauai. Half of this hillside area is planted with fan palms, whereas the other side includes feather palms (Fig. 1). Today the NTBG palm collection includes over 200 species of palms and these original majestic trees remain as reminders of NTBG's humble beginnings.

Over the years NTBG has included the acquisition of palm species as an important part of developing its collections. In recent years several expeditions to Micronesia, New Caledonia, and the Marquesas have added very unusual, rare and interesting palms to NTBG's collections. NTBG obtains the necessary botanical collecting permits from local and regional authorities and strictly complies with all national and international phytosanitary regulations.

2. *Metroxylon amicarum* is endemic to Pohnpei, where its leaves are used for thatch and the ivory-like seeds are used for carving (Photo by Jim Wiseman).

3. Leaves of the mangrove palm, *Nypa fruticans,* are harvested for thatch on Kosrae (Photo by David Lorence).

In relation to NTBG's interest in the Micronesian flora several collecting trips have been made to Kosrae and Pohnpei in the Federated States of Micronesia (FSM) and one to the Republic of Palau (Belau). Micronesian palms collected on these trips from Kosrae and Pohnpei include *Metroxylon amicarum* (Fig. 2), *Nypa fruticans* (Fig. 3), *Clinostigma ponapense* (Fig. 4), and *Ptychococcus lepidotus* var. *lepidotus* (Fig. 5). Palms from Palau include *Gulubia palauensis*, restricted to the upraised coral rock islands, *Heterospathe elata* var. *palauensis*, *Pinanga insignis* (Fig. 6), and *Ptycho-sperma palauense*. Although still abundant on some rock islands, *Gulubia palauensis* is threatened by introduced cockatoos which eat the palm's heart, killing the trees.

New Caledonia is well known for its unique and diverse palm flora (Moore & Uhl 1984; Hodel & Pintaud 1998). There, we were permitted to collect certain taxa for our research and conservation collections, including *Actinokentia divaricata*, *Basselinia gracilis* and *B. pancheri*, *Burretiokentia vieillardii*, *Campecarpus fulcitus*, *Cyphokentia macrostachya*, and *Cyphosperma balansae*.

4. (top) Emerging from the forest canopy on Pohnpei, the majestic *Clinostigma ponapense* reaches over 60 feet tall (Photo by Diane Ragone). 5 (bottom). *Ptychococcus ledermannianus* growing with *Cyathea* in wet forest on Kosrae (Photo by David Lorence).

Collaboration with the Ministry of the Environment in French Polynesia has resulted in several joint collecting trips to the remote Marquesas Islands. In 1997 seed collections were made from nine of the ten individuals of the only known population of the rare *Pelagodoxa henryana* in Taipivai Valley on Nuku Hiva island.

The Hawaiian archipelago is a hot spot for rare and endangered plants and has the world's highest level of endemism, about 89% at the species level. Named in honor of William T. Pritchard, a 19th century British consul in the Fiji Islands (Wagner et. al. 1990), *Pritchardia* is a genus of 27 known species found in Hawaii, Fiji, Cook Islands, Tonga, and the Tuamotus. There are now thought to be 22 species in the Hawaiian Archipelago, and each species is confined to a single island (Gemmill et al. 1993). Although the method of arrival on this isolated archipelago is still uncertain, Corner suggests that pigeons may have been responsible for the presence of *Pritchardia* in Hawaii by transporting seeds from Fiji, or vice versa (Corner 1966). Others speculate that the seeds may have floated in ocean currents or "rafted" to Hawaii (Beccari and Rock 1921). There is fossil evidence of the genus in Hawaii during the Pleistocene, 40,000 years ago (Carlquist 1980).

Table 1. *Pritchardia* species in NTBG living collections.

Taxon	Island	USFWS (US Fish and Wildlife Service) Status
P. affinis	Hawaii	Endangered
P. arecina	Maui	
P. aylmer-robinsonii	Niihau	Endangered
P. beccariana	Hawaii	
P. forbesiana	Maui	Species of Concern (SOC)
P. glabrata	Maui	SOC
P. hardyi	Kauai	SOC
P. hillebrandii	Molokai	
P. kaalae	Oahu	Endangered
P. lanaiensis	Lanai	SOC
P. lanigera	Hawaii	SOC
P. limahuliensis	Kauai	SOC
P. lowreyana	Molokai	
P. martii	Oahu	
P. minor	Kauai	
P. munroi	Molokai	Endangered
P. napaliensis	Kauai	Endangered
P. pacifica	Tonga	
P. perlmanii	Kauai	SOC
P. remota	Nihoa	Endangered
P. schattaueri	Hawaii	Endangered
P. thurstonii	Fiji	
P. viscosa	Kauai	Endangered
P. waialealeana	Kauai	

It is NTBG's goal to create a comprehensive conservation collection of *Pritchardia*. The difference between a synoptic collection and a conservation collection is significant. Whereas a synoptic collection may have one or two plants representing a species or genus, a conservation collection involves representing the greatest genetic diversity of a species by growing many plants of each species and representing every population over a number of years. In a conservation collection there may be as many as 50 trees per species for proper representation. NTBG currently has 25 species of *Pritchardia* in its collection and will continue to collect, making an effort to represent the entire genus (Table 1).

The living palm collections of NTBG are not only for conservation and aesthetics, but they are also used for research and education. The living collections afford an excellent research laboratory because the plants are accessioned, and the origin and collector of each plant can be traced. It is also an exceptional study area because the trees are easily accessible over a long period of time. For example, a phenological study was conducted on eight species of palms from different regions of the world (Chapin 1999). All that was required were weekly sampling walks through Lawai Valley over a year and one half. Currently, research is being conducted on palm flower and fruit ontogeny and their taxonomic implications. Anatomical, developmental, and histological studies are all easily conducted on fresh samples taken directly from the living palm trees. Examinations requiring destructive sampling of material such as palm fruits are easily conducted because there is usually an abundance of fruits or flowers available until completion of the study. For example, the rare Marquesan palm *Pelagodoxa henryana,* fruits almost continuously in Lawai Valley. Examination of the fruits involved dissecting them into pieces, testing them for floatation, and measuring and weighing various parts, and histochemical tests were performed on tissues shaved off the fruit. In the wild, using such a rare palm for these purposes would be unthinkable. However, using a garden collection allows for further understanding of its natural history and biology without further endangering its wild status.

At NTBG palms from all over the world can be discovered within walking distance. This highly diversified and mature plant collection also provides educational opportunities. Morphological and taxonomic studies of palms would be difficult to undertake using only photos or drawings. NTBG has held a number of graduate level courses in which students can measure, make drawings, voucher, and better understand the palm family by meeting the trees "in person" and learning their characteristics first hand. Other aspects such as pollination structures and systems, nectaries in palm flowers, and many other features of these extraordinary plants are all potential study subjects.

Even with early and current efforts to develop an extensive palm collection at NTBG, only 8% of the 2,700 species in the Arecaceae are represented in our living collections. A wish list of species to target for future expeditions and exchanges includes members of the Phytelephantoideae, Geonomeae, Iriarteeae, Calameae, Lepidocaryeae and Podococceae.

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Following Page

6. *Pinanga insignis* is a common palm in the wet forests of Babeldaob, Palau's main island (Photo by Diane Ragone).

Ravenea hildebrandtii in Mayotte

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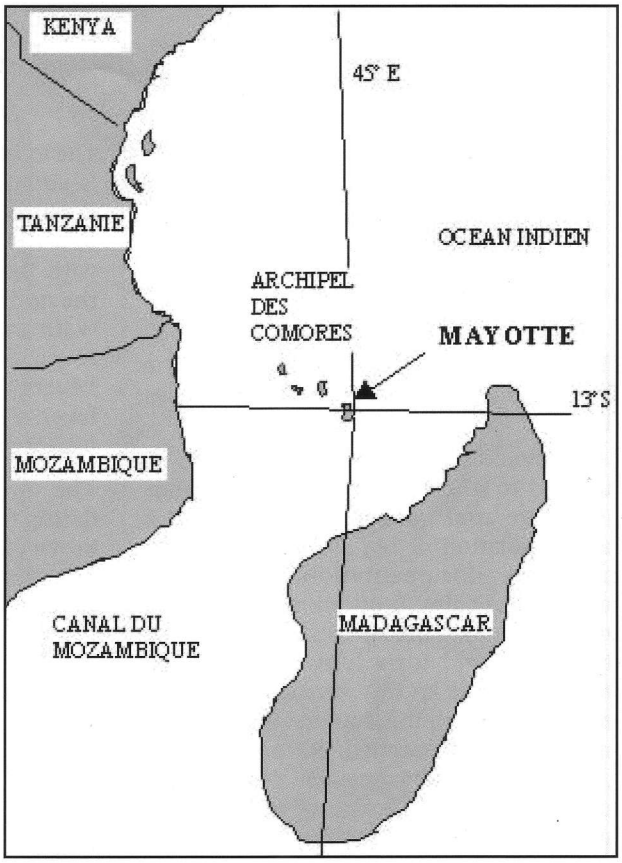


1. The position of Mayotte.

Mayotte is the oldest of the four islands that make up the archipelago of the Comores in the Mozambique Channel between Africa and Madagascar (Fig. 1). This volcanic island appeared about 8 million years ago from the oceanic crust at a depth of about 3000 m.

Situated at 12°50′ S and 45°10′ E, Mayotte has a tropical maritime climate with a hot and humid season from November to April and a dry and cooler season from May to October. Rainfall averages 1100 mm annually on the windward coast and more than 2000 mm on the hill tops.

2. The major summits of Mayotte.

The relief of the island is moderate, with the highest point being Mt. Bénara at 660 m above sea level (Fig. 2).

During an exploratory visit made in June 1999, we were surprised to discover some different palms with distinctive appearance, in the midst of a significant population of *Dypsis lanceolata*. After checking local documentation, everything suggested that the palm in question was *Ravenea hildebrandtii* (Fig. 3). This species had not been collected in the wild for a long time and the localities where it was known were thought to be on three other islands in the Comores group where it is restricted and threatened. Here was a new locality. We thus decided to organize a second visit on 7 August 1999 with the aim of verifying the characteristics described by Dransfield and Beentje (1995) in their superb book on the palms of Madagascar.

This article is the summary of observations made during this last visit. It is also worth noting that recent trips in other areas of the island have turned up two more populations of *R. hildebrandtii*, one on Tchaourembo (75 individuals) between 550 and 580 m altitude and the second on Mtsapéré (60 individuals) between 520 and 570 m altitude.

Distribution in Mayotte

At the present day, therefore, three localities for *Ravenea hildebrandtii* have been found. This is perhaps not surprising when one considers the requirements of the species. From existing descriptions it would appear that the species is usually restricted to altitudes between 600 and 800 m above sea level. Now it happens in Mayotte that only two summits exceed 600 m, Mlima Bépilipili at 643 m and the higher Mlima Bénara at 660 m. Mlima Choungui (594 m) has a relief and geology not at all suitable for the establishment of *Ravenea*. Not a single sighting of this species or of *Dypsis* has been made here. Mlima Mtsapéré (572 m) and especially Tchaourembo have suitable localities which have recently been explored, revealing beautiful populations of *Ravenea hildebrandtii*. However, we have made an exhaustive inventory only of the population at Bénara. The results of this inventory are provided below.

Bénara Population

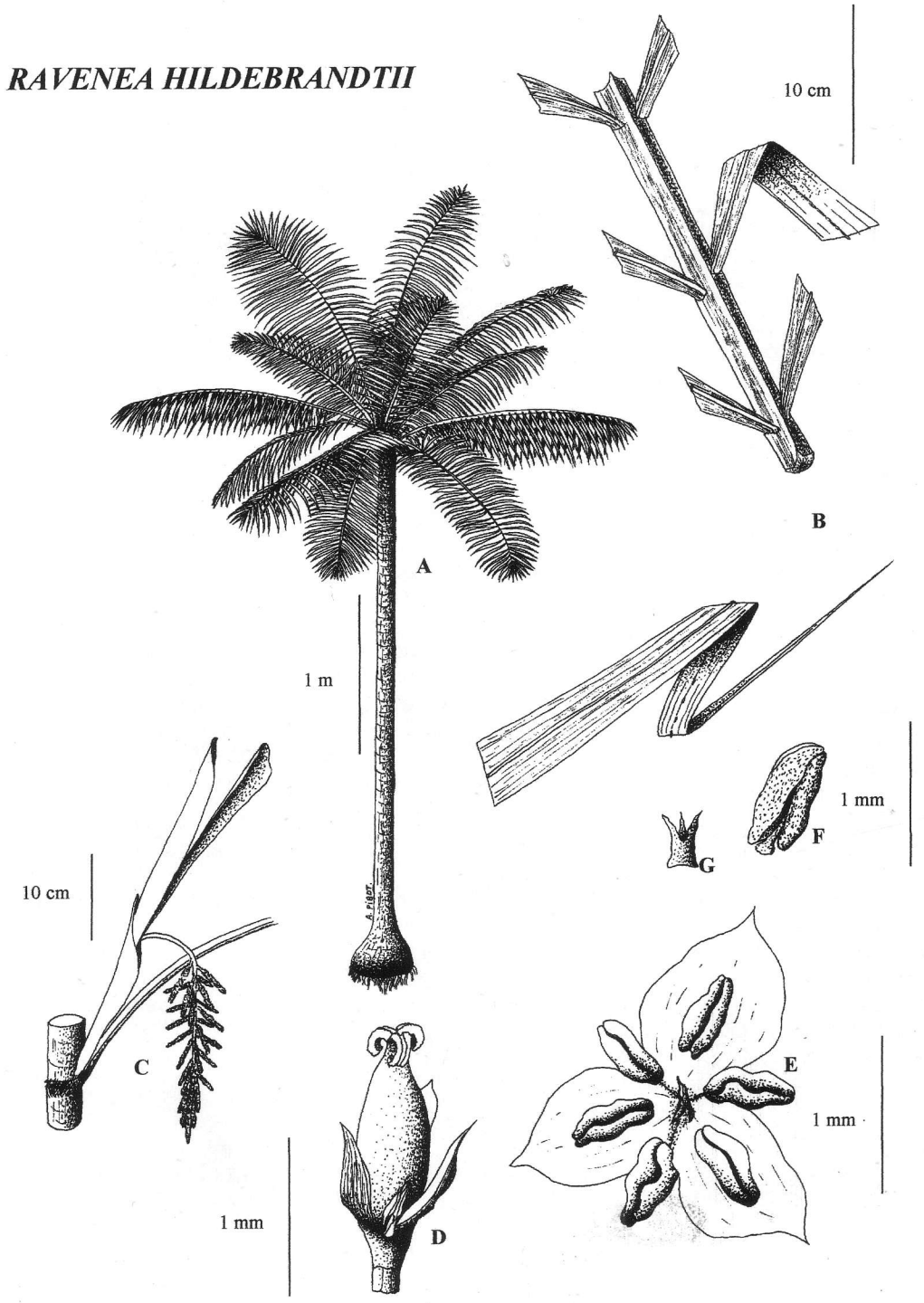
The locality that we inventoried on 7 August 1999 is situated in the summit zone of Bénara and Bépilipili. The topography of the site corresponds to a very narrow ridge crest orientated west–east, with the slope varying from 0° to 35°, and with the north and south faces varying from 35° to 90° (with maximum slope on the rocky walls of the south face). Two summits punctuate the crest, Bénara at 660 m and Bépilipili at 643 m above sea level. The lowest elevation at which *Ravenea hildebrandtii* has been observed is 550 m.

The underlying rock is an alkaline phonolite dating to 2.4–3.5 million years ago. The soils are brown, thinner and with boulders on the slopes. The climate is characterized by a rainfall in the order of 2000–2200 mm/year, with a dry season less than three months long and frequent cloud cover, that is more persistent above 550 m altitude (where the trees are thus covered in mosses and ferns).

The surrounding vegetation is a montane forest preserved by the high relief and its status as a Forest Reserve. It is made up of the following species: *Aphloia theiformis, Nuxia pseudodentata, Grisollea myrianthea, Cussonia spicata, Erythroxylum elegans, Olea capensis, Syzygium guineense, Labramia mayottensis, Scolopia coriacea* and *Dypsis lanceolata*. There are numerous orchids including *Calanthe sylvatica, Liparis sambiranoensis, Cynorkis fastigiata*

Table 1. Size class distribution of *Ravenea hildebrandtii* at Bénara.

Height (m)	0–1	1–2	2–4	4–6	6–8	>8
Number	54	6	3	3	3	1



3. *Ravenea hildebrandtii*. A habit; B rachis with brown indumentum and leaflet tip; C male inflorescence; D female flower; E male flower; F stamen; G pistillode. Drawn by Alain Pibot.

and *Disperis hildebrandtii*, as well as ferns such as *Diplazium proliferum*, *Tectaria puberula*, *Arthopteris palisotii*, *Christella dentata* and *Marattia fraxinea*.

During our inventory of *Ravena hildebrandtii* we counted 80 individuals of all sizes, isolated or grouped, with most important group consisting of 44 individuals. The principal characteristics observed are given in Tab. 1.

The stems are grey with fine vertical cracks and varying from 20 to 28 cm in girth. A swelling of

4. View into the crown of *Ravenea hildebrandtii* in full male flower.

5. Close-up of male inflorescence of *Ravenea hildebrandtii*.

the stem at the base is not consistently present. The largest that we measured was 38 cm in diameter (in an individual 6.5 m tall and 24 cm girth) and was asymmetrical with the greatest amount of swelling being towards the downslope. The number of leaves in the crown varies from 3 to 7 in individuals without visible trunks and 8 to 23 in individuals with erect stems. The number of leaflets varies from 14 to 52 on each side of the rachis, which in turn varies from 57 to 183 cm in length. Individuals that emerge above the forest canopy appear stressed under such conditions because they have fewer shorter leaves, with the older ones being yellow. These same individuals produce numerous inflorescences (Fig. 4, 5). The tallest individual (11 m) occurs beneath the forest canopy in a site where the canopy reaches 15–20 m, whereas the canopy on the crest of the ridge

does not exceed 6–7 m. Pale brown to brown tomentum is always present on sheath and petiole.

We observed several male inflorescences just after they had opened (Fig. 5) and the remains of female inflorescences from the previous year. We found just one female individual with open flowers. The inflorescence emerges between the sheaths. The young male flowers have a strong scent reminiscent of that of ylang-ylang (*Cananga odorata*) and turpentine. We observed bees visiting the flowers.

Three sets of herbarium collections (male and female flowers) were made for confirmation and have been sent to Muséum Nationale d'Histoire Naturelle in Paris and Royal Botanic Gardens Kew. On the day of our visit we saw eight other indigenous or naturalized palms: *Areca catechu, Bismarckia nobilis, Borassus sambiranensis, Cocos nucifera, Dypsis lanceolata, D. cabadae, Hyphaene coriacea* and *Phoenix reclinata*.

Acknowledgments

We thank John Dransfield of Royal Botanic Gardens Kew for comments.

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PALM BRIEF

Dypsis hovomantsina

When this beautiful palm was first described and named in 1995 in Palms of Madagascar, we knew it from but four collections, two from Mananara Avaratra and two from the Masoala Peninsula. During fieldwork in November 1999, we found several populations of the palm, some so easily accessible that we wondered how we had missed them during the Palms of Madagascar project. The photograph shows a single palm left in a cleared area south of Soanierana-Ivongo. Here the palm was called '*tsaravoasira*' – and this is potentially confusing as *Dypsis tsaravoasira* is a completely different palm. IPS members who buy seed of this latter species may find it useful to know that some seed exporters who rely on local names for identification rather than actually checking the identity properly may be exporting seed of *D. hovomantsina* masquerading as *D. tsaravoasira*. *Dypsis hovomantsina* is immediately distinguished by the patch of thick reddish-orange hairs near the mouth of the leaf sheath.

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An Introduction to the Palms of New Caledonia

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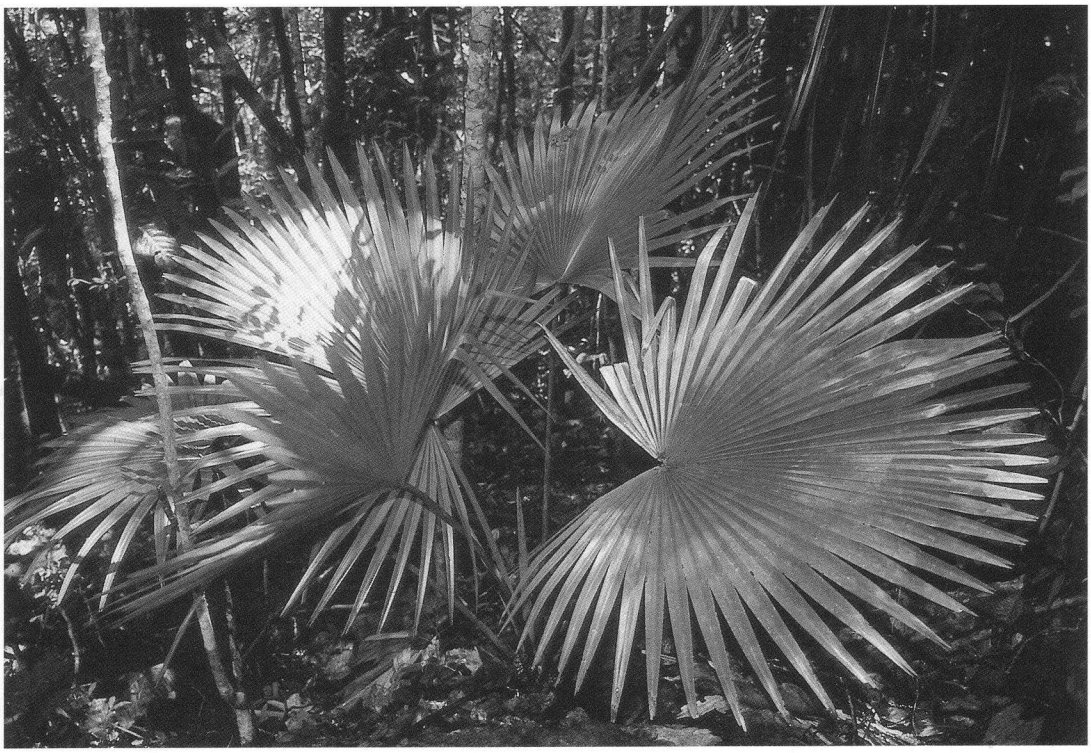


1. *Pritchardiopsis jeanneneyi.* One of the few juveniles growing near the only known adult specimen, southern New Caledonia.

The unique palm flora of New Caledonia has had a special appeal to palm enthusiasts, nurserymen and scientists ever since the earliest days of botanical exploration of the island.

Palms were among the first groups of native plants to be studied by the French botanists Brongniart and Vieillard in the 1860–70s (Brongniart & Gris 1864, Brongniart 1873, Vieillard 1873). At the same time, Linden, the great Belgian nurseryman of the late 19th century appointed another botanist, Pancher, to collect seeds of New Caledonia palms. A few years later, Linden's catalog included species such as *Actinokentia divaricata* and *Cyphokentia macrostachya* at prices that only the most prominent palm collectors of the time, such as Dr Prochowski on the French Riviera, could afford. In the 1890, Charles Moore from the Royal Botanic Gardens, Sydney became especially interested in an undescribed fan palm, the only one in New Caledonia, known from a single population at the southern tip of the island. It was being destroyed by convicts of Prony's penitentiary settlement who were harvesting palm hearts. Charles Moore sent to the Royal Botanic Gardens Kew complete herbarium material as well as living specimens of what is now known as *Pritchardiopsis jeanneneyi* (Fig. 1).

Nothing is left from these early days of palm introductions in Europe (Pintaud 1999a) but the good fortune of New Caledonia palms was just beginning. Beccari, the great palm specialist of his time wrote a full treatment of the island's palms which was published in 1920, and remained the standard reference until H. E. Moore began a modern revision in the 1960s. At that time, the taxonomy of New Caledonia palms was still extremely confused. Hal Moore made several field trips to New Caledonia between 1966 and 1980; throughout the island he collected excellent material, later studied at Cornell University by himself, Natalie Uhl and their collaborators. Moore sorted out most of the problems left by his predecessors, described many new species and genera, and built a firm taxonomic base for the years to come. These achievements resulted in "The indigenous palms of New Caledonia" (Moore & Uhl 1984), the first practical book on the subject. This work looked so definitive that botanists, even in New Caledonia, did not see the need for further research on palms there, and I had to be quite persuasive to justify new taxonomic work when I wanted to prepare a Ph.D. thesis on the New Caledonia palms in 1994. In the mean time, local interest on palms was growing rapidly, with the creation of Association Chambeyronia in 1993, bringing together palm enthusiasts who rapidly gained excellent expertise on the local palm flora. They brought to my attention several unusual palms which now are among the five new species I described from the island with Don Hodel (Pintaud & Hodel 1998a, b), allowing us to update Moore and Uhl's treatment in our "Palms of New Caledonia" (Hodel & Pintaud 1998).

As an introduction to what is to be seen during the year 2000 IPS Biennial Meeting, I will present some general features of New Caledonia palms, which should be helpful for visitors to get a better understanding of the palms they will encounter.

Endemism

Endemism is a magical word in New Caledonia, most of the living things there being endemic–that is to say existing nowhere else in the world. New Caledonia separated from Australia and New Zealand about 75 million years ago and the relative position of these land masses in the western Pacific was fixed about 65 million years ago (Kroenke 1996). In addition to this long isolation, New Caledonia did not undergo the climatic changes that affected Australia, which began to desertify about 20 million years ago, and New Zealand, which lost most of its tropical flora during the Pleistocene glaciations (Stevens 1980, White 1998).

Figs 2–5, p. 134.

2 (upper left). *Basselinia pancheri* , habit, Upper Neuméni River, 900 m elevation, Port Bouquet, southeastern New Caledonia.

3 (upper right). *Basselinia pancheri*, crownshaft, Upper Neuméni River, 900 m elevation, Port Bouquet, southeastern New Caledonia. *Basselinia pancheri* is a species very widespread on the main island of New Caledonia, but occurring only on ultramafic rocks. It is an extremely variable species. The montane form of the Neumeni River is distinctive by its small size (1–3 m tall), regularly pinnate leaves with somewhat twisted leaflets, and a spectacular, waxy-bluish crownshaft. It possibly hybridizes with the co-occurring *Basselina deplanchei*, giving intermediate forms that retain the regularly pinnate leaves of *B. pancheri* but have the cespitose habit of *B. deplanchei*.

4 (lower left). *Basselinia pancheri*, habit, Col de Yaté, 350 m, southeastern New Caledonia.

5 (lower right). *Basselinia pancheri*, crownshaft, Col de Yaté, 350 m, southeastern New Caledonia. In the gum-oak forest (*Arillastrum gummiferum*, Myrtaceae) of Col de Yaté, in the very south of New Caledonia, exists a surprisingly polymorphic population of *Basselinia pancheri*. The most diminutive individuals have pencil-thin, barely self-supporting trunks, small, bifid leaves and reduced inflorescences while the largest ones can reach 8 m tall, with a trunk of 5 cm in diameter and with irregularly to regularly pinnate leaves. The crownshaft in this population is black outside, but is bright golden-yellow inside. Many New Caledonian palms have attractively colored crownshafts, either on the outside or inside or both parts.

As a result, the flora and fauna of New Caledonia is primarily composed of organisms that evolved there during a long period of isolation, and relicts of groups extinct elsewhere. This is especially true for palms since not only are all 37 native species endemic, but also 15 out of the 16 genera to which they belong are also endemic. Only *Cyphosperma* is shared with Vanuatu and Fiji, but with different species on each island. Among the other genera, *Pritchardiopsis*, the only Coryphoid palm of the island, can well be regarded as a relict, while two groups of Arecoid palms have diversified – the Archontophoenicinae (with three genera and eight species) which have male flowers with numerous stamens (15 to 55) and endocarps laking an operculum, and the Iguanurinae (12 genera and 28 species), with male flowers having six or 12 stamens and endocarps distinctly operculate. The Archontophoenicinae include *Actinokentia*, *Chambeyronia* and *Kentiopsis* which have diversified on the island from a single ancestor (Pintaud 1999). Among the Iguanurinae, most if not all of the 12 New Caledonian genera have probably a single origin as well, but this still needs to be confirmed by further phylogenetic studies.

The endemism of New Caledonia palms is also remarkable at the level of their distribution within the Territory, most species being restricted to a very small area or even known from a single population. This is sadly exemplified by *Pritchardiopsis jeanneneyi*, presently known from a single adult individual serendipitously found by a hunter in 1980, most probably in the forest visited by Charles Moore one century before. Many other species are hardly more abundant, including *Cyphophoenix nucele*, *Kentiopsis pyriformis*, *Lavoixia macrocarpa*, *Actinokentia huerlimannii*, *Burretiokentia grandiflora*, which are all known from less than 100 mature plants. Several species have a very small area of occurrence (less than five sq. km), but are extremely abundant where they grow, such as the astonishing *Kentiopsis piersoniorum* which dominate the vegetation in a small area of Mont Panié. In fact, only three or four species are found more or less commonly throughout the main island, including *Basselinia gracilis*, *Burretiokentia vieillardii* and *Chambeyronia macrocarpa*.

Figs. 6–9, p. 135.
6. (upper left) *Basselinia gracilis*, Plateau de Dogny, 1000 m elevation, west-central New Caledonia.

7 (upper right). *Chambeyronia macrocarpa*, closeup of rachilla with staminate flowers and unusual tetrads of flowers. Cultivated, Noumea, New Caledonia.

8 (lower left). *Cyphophoenix elegans*, photographed in late afternoon light, Lower Parari river, 150 m elevation, Ouegoa, north New Caledonia.

9 (lower right). *Moratia cerifera*, showing the white-waxy crownshafts and inflorescences, Col d'Amos, 550 m elevation, northeastern New Caledonia

Polymorphism and geographical variation.

The most widespread species are usually structured in morphologically distinct populations, often corresponding to geographical forms. This simple pattern is well illustrated by *Burretiokentia vieillardii* and *Chambeyronia macrocarpa*, but is very complex in the genus *Basselinia*, in which several distinct forms of the same species can occur together, while some populations are extremely polymorphic and interspecific hybrids not rare (Figs 2–5).

Everyone who is familiar with the cultivation of *Chambeyronia macrocarpa* is well aware of the morphological variation within the species, and with some experience, it is often easy to tell from which part of the island come a given cultivated plant. The southern populations are very tall palms (reaching easily 25 m in height or more) with an elongated, solid green crownshaft, divaricate inflorescences and shortly ovoid, pruinose fruits. The "watermelon" types, with a striped, green and yellow crownshaft, are characteristic of the central-western region. Among them, a population at Katrikoin never produces red new leaves, and should be known by growers, at least to avoid it! Several very distinctive and highly ornamental forms are locally distributed along the east coast. The former *Chambeyronia hookeri*, with a pale yellow crownshaft and broad, spreading leaflets is known from the Ba River valley and adjacent areas near Houailou. Another form with a yellow crownshaft, but otherwise very different, exists a few kilometers farther south at Poro. Unlike any other form of *C. macrocarpa*, it has arching leaves, with stiff, erect leaflets, inflorescences with scarcely diverging branches, and staminate flowers with a prominent pistillode (Fig. 10). Another very distinctive eastern form is located at the base of the Panié massif. It is a stout, massive form, with a whitish-tomentose crownshaft and elongate, 5.5 cm long fruits, the largest for the species, distinctive also by the dense, short, erect, inner mesocarp fibers. The exact pattern of variation within *Chambeyronia macrocarpa* is still not fully understood, and more studies are needed before a reliable infraspecific treatment can be made.

Morphology, architecture and growth

At first sight, many New Caledonian palms are puzzling, as they all look so similar. Most species

are indeed medium-sized, solitary palms (10–15 m tall), with rather slender trunks, a prominent crownshaft, short-pedunculate infrafoliar divaricate inflorescences, pinnate leaves with a recurved rachis and stiff, erect leaflets, as illustrated by *Cyphophoenix elegans* (Fig. 8). One needs to look more closely at characters such as the aspect of the trunk (smooth or indented with leaf scars – Fig. 11), the indument of the crownshaft (glabrous, waxy or variously tomentose – Figs. 3, 5, 9) or the ramenta (scales) underneath the leaflets, for a proper identification. A few species escape this general pattern and are instantly recognizable. *Cyphosperma balansae* is striking with its numerous (up to 18), long-pedunculate inflorescences projected outside the crown of leaf. *Campecarpus* is noteworthy for its stilt roots which can reach 2 m in height (Fig. 13). Three species of *Basselinia* (*B. gracilis*, *B. deplanchei* and *B. vestita*) are small cespitose palms of the forest understorey. This morphology, so common is the rainforests of Asia, Madagascar and the Americas, is very rare in Pacific islands east of New Guinea.

Most of these palms are very slow growing. Measurements of growth rate of forest palms showed that most of them produce one or two leaves per year in their natural environment, and increase trunk height by 5 to 20 cm in the same time. *Actinokentia divaricata*, which has a crown of only 3 to 5 leaves, produces less than a leaf per year, each lasting about 7 years. The stilt roots of *Campecarpus fulcitus* have a growth rate of 25 cm per year, which means that the longest ones (2 m) can take 8 years to reach the ground (Fig. 13) (Pintaud 1999). The only really fast growing species is *Chambeyronia macrocarpa*.

Ecology

All New Caledonia palms are rainforest species. They grow in environments receiving from 1500 to 4000 mm of rain annually. The absence of palms adapted to rather dry environments such as those of the western lowlands in noteworthy.

The richest palm communities are located at low to medium elevation (150–900 m), and include six to ten species. These communities are usually stratified, with small clustering palms (e.g. *Basselinia gracilis*), solitary, sub-canopy species (the vast majority) and a few emergent species (*Basselinia* spp., *Chambeyronia*, *Kentiopsis*). Most communities also have a spatial structure, with some species having a distinctive gregarious behaviour such as *Kentiopsis* (Pintaud & Hodel 1998a), others preferring to grow in valley bottoms where they can be very abundant and line steams and gully bottoms (*Burretiokentia vieillardii*, *Chambeyronia macrocarpa*, *Alloschmidia glabrata*), while others prefer ridges and upper slopes (*Moratia*, *Clinosperma*), or rocky habitats (*Campecarpus*, *Actinokentia*).

Above 1000 m elevation, where the temperature can occasionally drop to 0°C in winter, the palm diversity decreases rapidly. Only a few species of *Basselinia* grow above 1400 m elevation and reach the summits, Mont Humboldt (1618 m) in the south (*B. deplanchei*), Mé Maoya (1508 m) in the central part (*B. sordida*) and Mont Panié (1628 m) in the North East (*B. gracilis* and *B. velutina*).

The most unusual biotas in New Caledonia are those on ultramafic rocks. These rocks originating from the seafloor covered the island entirely during a major geological event called obduction that took place between 43 and 38 million years ago. These rocks were much eroded subsequently but still cover one-third of the island, including most of the southern part. Soils derived from ultramafic rocks are very poor in essential nutrients and contain high levels of phytotoxic heavy metals such as nickel, chromium, cobalt and manganese. These soils carry a highly endemic flora adapted to this peculiar environment and some very distinctive vegetation types such as *maquis minier*, a heath-like vegetation composed of sedges and sclerophyllous shrubs, including the clustering *Basselinia deplanchei*. Fifteen species of palms are restricted to ultramafic rocks. *Basselinia pancheri* is very typical of this habitat; it occurs on nearly all ultramafic outcrops of the island and is never found on other soil types. *Campecarpus fulcitus* is a very distinctive component of rainforests on ultramafic rocks in southern New Caledonia. It is mostly found in rocky habitats where it becomes established by means of its long stilt roots (Fig. 13).

Outside ultramafic areas, the rocks are mostly schistose and carry an essentially different palm flora, including 13 species restricted to soils derived from schists. In fact, only eight species are to be found on both ultramafic and schistose

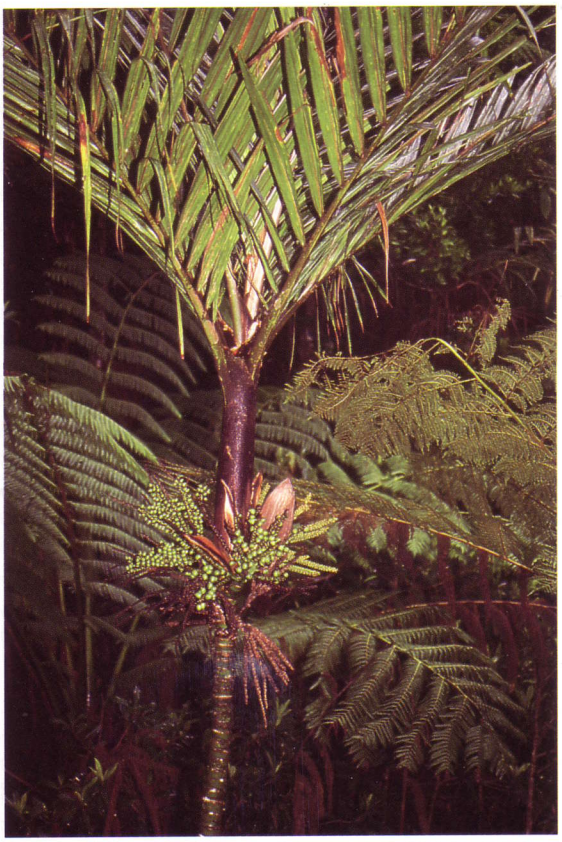
Figs. 10–13, p. 138.

10. (above left) *Chambeyronia macrocarpa*, form from Poro, Cultivated, Poindimié, New Caledonia.

11 (above right). *Burretiokentia vieillardii*, Mandjelia, 600 m elevation, Puébo, northeastern New Caledonia

12 (lower left). *Kentiopsis pyriformis*, growing in disturbed habitat, mouth of Kuébini river, 50 m elevation, Goro, southeastern New Caledonia.

13 (lower right). *Campecarpus fulcitus*, showing aerial root system, Rivière Blanche, 150 m elevation, Yaté, southern New Caledonia.



soils, including the common *Basselinia gracilis*, *Burretiokentia vieillardii* and *Chambeyronia macrocarpa*.

Natural history

Natural history is certainly the aspect of New Caledonia palms which is the least known. No precise studies of fruit dispersal nor of pollination have been made. The largest pigeon able to fly, called *notou* (*Ducula goliath*), endemic to the rainforests of New Caledonia is well known to eat and disperse the large fruits of *Chambeyronia macrocarpa*, and hunters often look for *Chambeyronia* stands in order to find the notous. Smaller fruits are eaten and dispersed at least by a species of parakeet, *Cyanoramphus novaezelandiae* subsp. *saisseti* (MacKee et al. 1985). It would be interesting to know if there is a correlation between some morphological traits such as the small, spherical black fruits of most *Basselina* species (Fig. 6) or the bright red, oblong ones of *Kentiopsis* species and dispersal. Since the introduction of the Pacific rat, however, this rodent interferes much with dispersal and predation of fruits by native animals. Another question still unanswered is the significance of the strange sculptured endocarps found in several genera. Although sculptured endocarps are not very rare in palms, their occurrence is nowhere else as high as in the New Caledonian flora, where *Burretiokentia*, *Cyphosperma*, *Veillonia*, *Lavoixia* and *Pritchardiopsis* (in all 9 species) display this feature. The last two genera, although completely unrelated, share large (4–5 cm), spherical fruits, dull-colored, with thick fleshy-fibrous mesocarp and bony, compressed, sculptured endocarps. Both *Lavoixia* and *Pritchardiopsis* are at the verge of extinction, and known from a single population. Their fruits are not dispersed, they fall on the ground and germinate there. Those of *Lavoixia* germinate with extreme difficulty and even in the wild, very few seedlings are encountered. It is thus tempting to follow the hypothesis of Dransfield and Beentje (1995) for *Satranala* and *Voanioala*; they invoked the role of a giant extinct bird in the dispersal of these palms from Madagascar with similarly sculptured large fruits lacking present means of dispersal. A giant megapod bird, *Sylviornis neocaledoniae*, is indeed known as subfossil bones, but its diet is unclear (Balouet 1991).

Floral biology is another aspect of great interest in New Caledonian palms, yet so far not investigated. In all Arecoid species, the fall of the peduncular bract occurs a long time prior to anthesis, exposing flower buds sometimes during months prior to it. Petals are consequently very hard and thick, and protect flower buds from predation (Fig. 7). Related palms elsewhere in Australasia such as *Rhopalostylis*, *Archontophoenix*, *Clinostigma*, have flowers which open immediately after bract fall and are very soft and generally white. This duality of flowering pattern is common in Arecoid palms, but has not received explanation. All the New Caledonian species are also monoecious and protandrous, with the staminate flowers opening sometimes weeks before the pistillate ones. The timing of anthesis of the staminate, and subsequently the pistillate flowers is variable and often of taxonomic significance. Anthesis of both flower types is simultaneous in *Burretiokentia*, and the inflorescences are spectacular at staminate anthesis, being entirely covered by flowers which attract insects and even birds. Anthesis is progressive and random in *Brongniartikentia*, *Lavoixia* and *Clinosperma*, three very closely related genera with small flowers opening one after another anywhere along the rachillae. Anthesis is progressive but basipetal in *Kentiopsis piersoniorum* and *K. pyriformis*, with flowers begining to open at the tips of the rachillae, and opening progressively toward the base in a sequence lasting about one to two weeks. Other distinctive floral characteristics are prominent, nectariferous pistillodes in staminate flowers, and raphides intermixed with pollen grains, an adaptation against pollen-feeding insects.

Another remarkable trait of some New Caledonia palms, is the red color of the newly expanded leaf. Many small understorey tropical palms are known to produce red leaves, such as some species of *Geonoma*, *Pinanga* and *Calyptrocalyx*. In New Caledonia such leaves are produced by large species, and a massive burst of new red leaves of *Chambeyronia* above the forest canopy is an unforgettable sight. This character is not completely consistent, even within a species, and the actual color can vary from reddish-brown or purplish to bright red. However, it is a diagnostic character in some cases. For example, *Actinokentia divaricata* always produces a new red leaf, while *A. huerlimannii* never does so. *Burretiokentia dumasii* and *Burretiokentia koghiensis* are the only species producing such red leaves in the Iguanurinae group, although those of *Brongniartikentia* and *Lavoixia* can occasionally be pinkish.

Uses and conservation

Native palms have very few uses in New Caledonia. The coconut traditionally provided nearly all palm resources needed by Melanesian inhabitants. Uses have been essentially destructive, such as harvest of palm heart and building material, resulting in endangerment of

Pritchardiopsis and *Kentiopsis pyriformis* (Fig. 12). Other causes of endangerment are loss of habitat due to forest clearing for agricultural purpose, bush fires and mining, practices which have a strong detrimental effect on palm species which are essentially rare and unable to survive in disturbed environments. Nineteen of the 37 palm species are considered of conservation concern in New Caledonia (Pintaud et al. 1999). However, rain forests are still extensive with a growing network of protected areas, and it is to be hoped that they will ensure the conservation of this unique palm flora.

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(continued from President's Message, p. 108)

So, what of the future? It is indeed bright. We have a great selection of new Directors and Officers coming up to serve you in future years. We are fiscally sound. We have a great journal. But most of all, we have a great Membership. Without you, the Society would not exist. I thank all of you for your contributions during my tenure and hope that you all flourish and prosper for years to come.

Phil Bergman
IPS President

The Successful Palm Sale

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1. By properly using basic retailing skills, a vendor can make his or her personal sales area attractive and inviting. (Photo by Chris Migliaccio)

During the first weekend of November 1999, the South Florida Chapter of the IPS held its second major palm sale of the year at Fairchild Tropical Garden in Miami. Altogether, nearly 3000 plants representing 500 species and valued at approximately $90,000 were sold to the public. With receipts from our March 1999 sale at $80,000, gross plant-sale income for the year was $170,000.

The purpose of this article is to share with other IPS chapters what the South Florida Chapter has learned over the past twenty years about having a successful palm sale. We are not so presumptuous as to say that our way to run a sale is the only way or even the best way, but we can say that it's a good way.

There are six basic steps to a successful sale. These are:

Develop and implement a plan for conducting the sale itself.

Make the sale "user-friendly."

Know your market.

If possible, affiliate with a botanical garden.

Aggressively promote the sale.

Make the sale interesting.

Develop and implement a plan for conducting the sale itself

At a typical sale we have 30 to 35 growers or vendors, some of whom are professional nurserymen and others who are backyard hobbyists. To participate in the sale, vendors must be members of IPS and must pay the local chapter 21.5% of whatever they sell (20% to the chapter and 1.5% for advertising). Some years ago, it was decided not to collect a flat fee from the growers because it would discourage participation by those who have only a small number of plants to sell. Each vendor is required to sign a vendor application before the sale acknowledging that he or she understands the rules of the sale. Two of these rules are that vendors cannot sell wild-collected, endangered palms or palms that are highly susceptible to Lethal Yellowing disease.

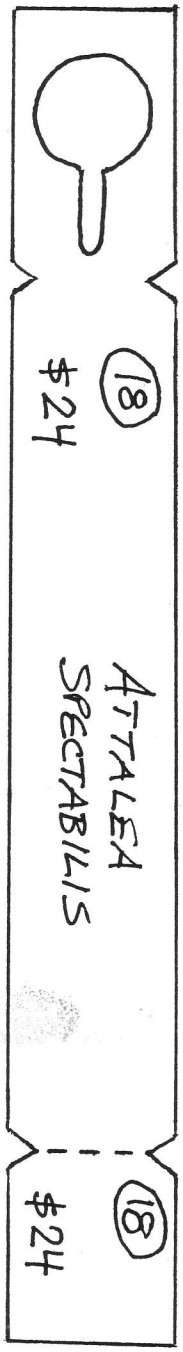
Within the sale area, each vendor is assigned a particular space, the size of which is determined by the number and size of plants the vendor is bringing (Fig. 1). Vendors also have the choice of a sunny or shaded location. The entire sale area itself is fenced off using a lightweight plastic fencing material. The only way out of the sale area is by the cashiers. To keep the overall sale area as attractive as possible, vendors are not permitted to display any advertising or other promotional signs. They may, however, distribute business cards.

Each vendor is assigned an identifying number that he or she retains indefinitely. Each plant is identified by a tag with a tear-off end that lists the vendor number and the sale price of the plant (Fig. 2). The tags are sold to the vendors for five cents apiece, which is basically our cost. The tags are not distributed for free because there are always some vendors who will take far more tags than they need.

At the cashiers' tent, volunteer tag clippers cut off the ends of the tags and give them to the cashiers. (Palm buyers in the checkout line with their newly acquired plants are shown in Fig. 3). The cashiers add up the prices of the palms, add the appropriate sales tax, collect the customers' money (cash or checks), and place the tag ends in a can that is periodically taken to the "back room." Tax-free sales are logged in a notebook at the cashiers' table.

Using a program developed by one of our members, the vendor numbers and plant prices are entered into laptop computers in the "back room." At any given time we can find out the total sales processed for any or all of the vendors. At the end of the sale, the chapter's treasurer receives a listing that shows the number of plants sold by each

2. The specially-designed plant tags tell the buyers what they bought and from whom (the vendor's assigned number) and what they paid. The tear-off end is used by the chapter to keep track of each vendor's sales.



vendor, the total price of the plants sold, and the vendor's 78.5% share of the proceeds. After the checks and cash from the sale are deposited in the chapter's bank account, checks for the appropriate amounts are sent to the vendors.

Make the sale "user-friendly"

At the entrance to Fairchild Tropical Garden, buyers can pick up one of our sale booklets. The booklets list, in alphabetical order, all of the palm species being sold and the numbers of the vendors who are selling those palms. Also included is a map of the sale area so the shoppers can easily find the vendors they are looking for. The booklet usually has one or two articles of general interest about palms or palm horticulture. (We do sell advertising in the booklet and offer a reduced rate to other plant societies that might want to promote their own sales. A one-third-page ad for commercial growers sells for $50.)

Many of the vendors apply their retailing skills to make their personal sales areas inviting. Also, good plant identification can help boost sales.

Between the cashiers and the Garden's gates we provide a plant holding area where buyers can put their plants while they eat, buy more plants, or spend time enjoying Fairchild.

We also sell palm fertilizer to our customers. Normally we will buy two pallets of 50 lb. bags of "palm special" and sell the bags individually at a small markup. What we don't sell by the end of the weekend is donated to Fairchild.

To assist customers during the sale, boys and girls with plant carts are available to move palms and fertilizer between the sale area, the plant holding area, and the parking lots. These volunteers work for tips. Just outside the main entrance to the Garden we have roped off a loading zone where buyers can bring their vehicles to pick up their plants.

Know your market

While the South Florida Chapter has been holding palm sales for many years, it was not until recently that good data about the sales' customers were collected and analyzed. To get this customer information, the chapter has a free drawing (raffle) for one donated palm of significant value ($150–$250) at each sale. (The vendor who donates the palm receives a full-page ad in our sale booklet.) To enter the drawing, customers fill out an entry form and deposit it in a box. Only one entry per person is allowed, and we have learned that we do have to check to make sure that the winners have

3. Customers wait in the checkout line with the palms of their choice. (Photo by Chris Migliaccio)

not entered more than once. (A copy of the form is shown in Fig. 4.) From the hundreds of entries, it is possible to determine where in South Florida our buyers are coming from (our "trading area") and how they are finding out about the sale. The customers can also indicate on the entry forms that they wish to be added to the chapter's mailing list.

From the entry forms we know that the great majority of our customers come from within a ten-mile radius of Fairchild Tropical Garden. This area is best described as middle and upper-middle class suburbia where most of the homes are single-family residences. This trading area information is invaluable to the effective targeting of our advertising, but more about that later.

If possible, affiliate with a botanical garden

The importance of our chapter's relationship with Fairchild Tropical Garden cannot be over-emphasized. In addition to providing us with an attractive, centrally-located place to hold our event, we have learned that Fairchild's own member notices and bulletins are how the greatest number of people learn about our sales. We also know that many local visitors to the Garden who didn't know about the sale before they arrived, do shop for our palms while they are there. And finally, the Garden helps with our print advertising layouts and makes a financial contribution to our advertising.

Fairchild benefits from our sale as well. First, our sales bring hundreds of paying visitors to the

FREE PALM RAFFLE

ONE ENTRY PER PERSON

Please Print Clearly

Name: _____

Address: _____

_____

Telephone: _____

e-mail: _____

_ Add me to the Palm Society mailing list.

How did you hear about this palm sale?

_ Fairchild mailings
_ Learned about it here today
_ Outdoor banner or sign
_ Newspaper ad
_ Newspaper article
_ Radio
_ Palm sale mailer
_ From a friend
_ Internet
_ Other

You do not need to be present to win. You must pick up your plant in person.

4. The entry forms for a free palm raffle allow the chapter to add names to its mailing list. It also is used to collect important information about the people who come to the sales.

Garden, many of whom have never been there before. Second, the additional visitors mean increased business for the Garden's gift shop and café. Third, our chapter pays a fee to the Garden equal to 5% of our receipts (after sales taxes are subtracted).

Aggressively promote the sale

The promotional and advertising budget for our sales is set at 3% of projected revenue, and is shared equally by the vendors and the chapter. Most of our advertising money is spent in the appropriate neighborhood sections of the local newspaper. Our ads, at about 15×15 cm, are large enough to cut through the clutter of most other advertising. The ads generally appear on the Sunday and Thursday prior to the sale.

In the fall of 1999 we also bought three weeks of radio advertising on a locally-produced, Sunday morning garden show that is broadcast throughout South Florida. During the Sunday broadcast on the weekend of the sale itself, a reporter from the station conducted several live, on-air interviews with vendors and customers. With all of this, our total radio expenditures were just $400.

We do not limit ourselves strictly to paid advertising, however. We send press releases to the major print and broadcast media in Miami in order to get listed on their community calendars. Where we are permitted, we place large, reusable banners at strategic road intersections throughout the area where most of our customers come from. (Before each sale, the sign company we use changes the dates on the banners for a small charge.) One week before the sale we place an attractive sign just inside the main gate to Fairchild announcing the upcoming sale.

We provide the newspaper's garden editor with the names of local people who effectively use palms in their home landscaping and are willing to be featured in palm-related stories. Over the years, several excellent articles have appeared in the paper on the Sunday prior to the sale. The sale always gets at least a mention in these articles. If you haven't done it already, develop and cultivate a relationship with your own garden editor.

A postcard announcement is mailed to everyone on our chapter's mailing list. The list, now with about 1,200 names, has doubled in size in the past year simply as a result of our palm giveaway at each sale.

Make the sale interesting

During our sales, Fairchild allows us to use their auditorium for a palm show where rare and interesting plants are displayed. Prizes are awarded to growers of the best palms. The Master Gardeners, a local volunteer horticultural group, have a table in the auditorium where free palm seeds are distributed. Custom-designed T-shirts and large posters of botanical drawings of palms are for sale at another table. (T-shirt sales alone were over $700 at our fall sale.) In many of our sales we have had seedling potting demonstrations and giveaways throughout the weekend. At our most recent sale, we prominently displayed the ten winning pictures from a palm art contest for Miami-Dade County schoolchildren that was sponsored by our chapter.

While our chapter has learned about the many things that make for a successful sale, we have also learned that what may seem like a good idea may not be. We know, for example, that speakers do not draw big crowds during the sales. It seems that people come to the sales to browse and shop and talk and enjoy the environment. They do not come to sit in a room and look at photographic slides, however interesting they may be. Those presentations are best saved for a regular chapter meeting. We also know that advertising in adjacent counties or in local nursery trade magazines is not particularly effective. For the most part, and there are exceptions, ours is a local, retail market.

Two final sale notes: Ensure that you have a secure place to store cash and checks overnight and ensure that you follow the appropriate state or local regulations regarding the collection and payment of sales taxes.

It is hoped that some of what we have learned in the South Florida Chapter can be used by other chapters to conduct successful palm sales. While the palms that are sold will mean an increase in the number of palms in the landscape, the money earned can be used to fund worthwhile palm projects in the local community or elsewhere. This year alone, our chapter has acquired numerous mature palms for plantings at our county zoo, we are helping to fund research on rattan palms, and we have made a significant contribution to a conservation project in Madagascar.

Additions to the Genus *Bactris* (Arecaceae) of Mesoamerica

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Two new species of *Bactris*, found in the understory of humid forest on the Pacific Coast of Costa Rica, are described and illustrated.

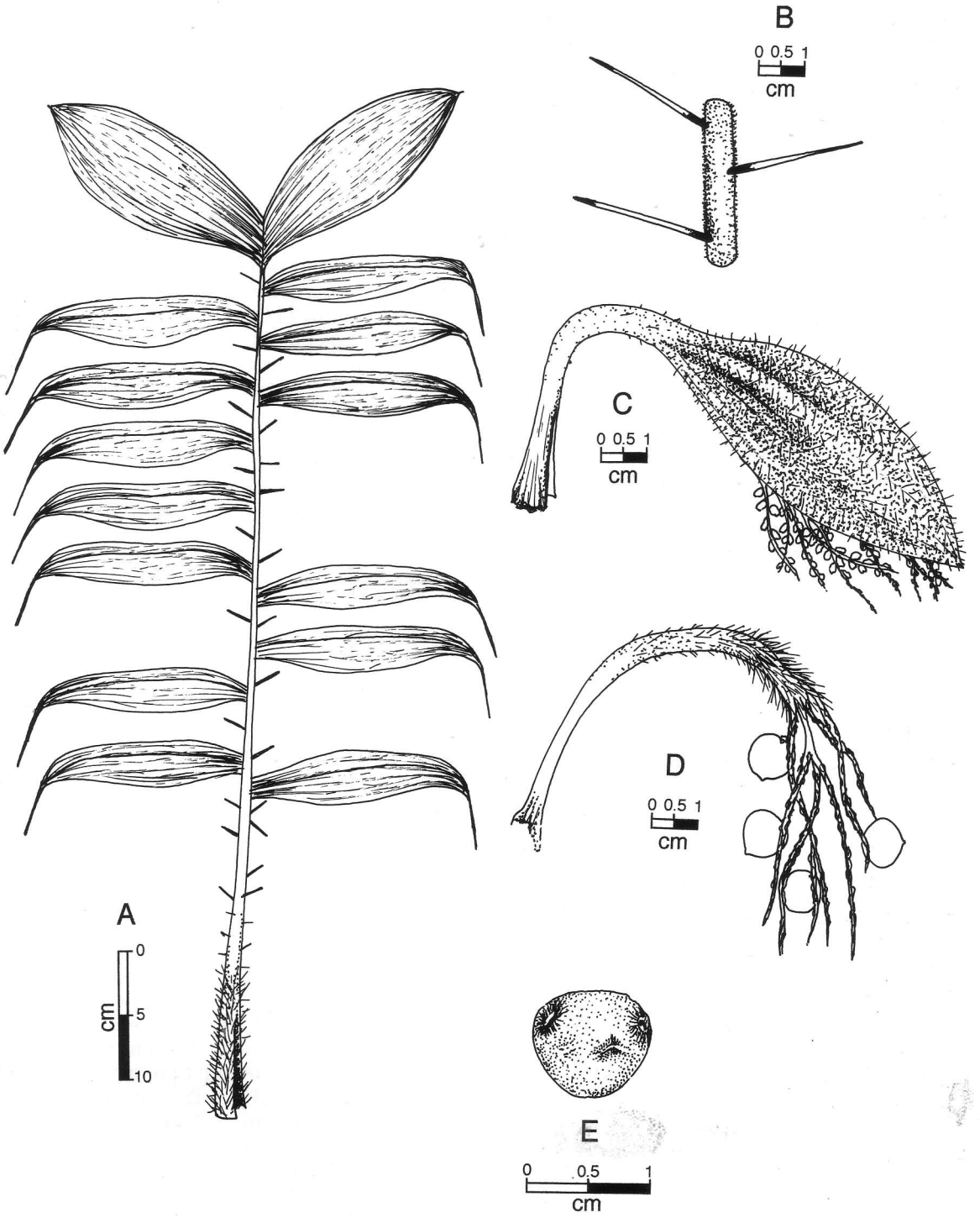
The genus *Bactris* Jacq. ex Scop. is one of the most diverse groups of palms in the Neotropics. It has fewer species than the *Chamaedorea* group and more than *Geonoma*. Henderson et al. (1995) recognized 64 *Bactris* species for the whole of the Americas, and the latest treatment of the genus for the Mesoamerican region comprises twenty species; four of them new for science (de Nevers et al. 1996).

Costa Rica possesses between thirteen to fifteen species of *Bactris*, two of which are apparently endemic to the country (Grayum 1998): *B. longiseta* H. Wendl. ex Burret, and *B. polystachya* H. Wendl. ex Grayum (in press). In this paper two additional endemic species of *Bactris* from the Pacific Coast of Costa Rica are newly described and illustrated.

Bactris ana-juliae Cascante, **sp. nov.** Fig. 1.

Inflorescentia *B. hondurensi* Standl. affinis sed foliis pinnatis, foliolis fasciculatis utrinque pubescentibus, apicem aristatibus, spinis luteis differt. Typus: COSTA RICA. San José: Perez Zeledón, Fila Tinamaste (17 km from San Isidro in road to Dominical), 1000 m , 9° 17´ 40" N, 83° 46´ 00" W, 28 May 1998. *O. Valverde 993* (Holotypus CR; isotypi MO, USJ).

Stem cespitose, 1.8–3.0 m tall, stems 4–6, 1.2–1.5 cm diam., internodes usually spiny. Leaves 5–8, sheaths to 16.0 cm long., covered with black spines; petiole glabrous or with a short whitish pubescence, 11.2–16.0 (–25.5) cm long; spines yellow with the extremes dark brownish tips, (0.5–) 1.6–3.5 cm long, the basal portion of the petiole with more abundant, shorter spines. Lamina rachis (33.0–) 41.0–54.0 cm long, bearing a whitish pubescence and spines abaxially as on the petiole, pinnate, the pinnae (4–) 7–10 per side, irregularly arranged in groups of 2–3 and spreading in different planes; terminal pinnae larger than the middle ones, 17.0–31.0 (–39.5) long, and 5.5–14.5 cm wide, apex apiculate; middle pinnae sigmoid and convex, 15.0–22.5 (–28.7) cm long, and 4.2–5.1 (–7.0) cm wide, whitish pubescence on both sides, with (1–) 2 prominent main veins, apex strongly aristate, 3.5–7.0 cm long, and bent downward. Inflorescence infrafoliar, peduncle 5.0–8.0 cm long, 5.0 mm wide, recurved at anthesis, spinulose on the distal part, prophyll 8.0 cm long, peduncular bract 11.0–14.6 cm long, covered with short blackish-brown spines, rachis short (0.7–) 1.4–1.7 cm long, rachillae 8–12, 3.2–5.0 cm long, covered with glandular hairs; triads irregularly arranged. Staminate flowers not seen. Pistillate flowers sessile, sepals connate, to 1.5 mm long, glabrous; corolla tubular, 2.1–2.8 mm long, glabrous and striate (when dry). Fruits obovate, to 1.2 cm long and 1.0 cm diam. the stigmatic residue prominent, orange-red when mature, glabrous and striate, corolla evident in fruit, irregularly divided, to 3 mm long (Fig.1).



1. *Bactris ana-juliae* Cascante: A. leaf general view; B. spines on the lower surface of leaf rachis; C. inflorescence at anthesis; D. infructescence; E. seed.

ADDITIONAL SPECIMENS EXAMINED. COSTA RICA. San José: Perez Zeledón, Fila Tinamaste, semi-cloudy forest, remnants on the top of the hill, 900–1050 m, 9° 17′ 40″ N – 83° 46′ 00″, 2 December 1998, *A. Cascante et al. 1472* (CR); 25 March 1998, *O. Valverde 773* (CR, MO, USJ).

DISTRIBUTION AND HABITAT. Known only from the type locality on the Pacific Coast of Costa Rica,

on the Fila Tinamaste, Pérez Zeledón; between 900–1050 m. The forest in this area has been severely fragmented, but some remnants are located on top of the Fila Tinamaste, a rocky formation that arises abruptly in the landscape. The climatic conditions on the top of the "Fila" form a certain type of microclimate, which is very humid and characteristic of a cloud forest. The palm community in the remnants is mainly composed of understory species, such as: *Asterogyne martiana, Bactris herrerana, B. dianeura, Chamaedorea pinnatifrons, C. pumila, Geonoma ferruginea* and *Synechanthus warscewiczii.*

ETYMOLOGY. The specific epithet refers to my friend and companion of several years, Ana Julia Sánchez.

COMMENTS. *Bactris ana-juliae* shares similar floral characteristics with *B. hondurensis* Standl., and *B. dianeura* Burret; these species have a short rachis (<3.0 cm long.) in the inflorescense, and possess relatively few rachillae (<17), in relation to the other species of *Bactris* in Costa Rica.

Bactris ana-juliae resembles *B. hondurensis*, a common species in the Atlantic side of the country, in the general morphology of its inflorescence. In the latter, the peduncle is regularly erect in fruiting vs. recurved in the new species, and possesses fewer rachillae (3–9 vs. 8–12). The main differences between *B. ana-juliae* and *B. hondurensis* are in the leaf morphology of the former. It usually has more pinnae per side (7–10 vs. 5 or fewer) than the pinnate form of *B. hondurensis*, also the middle pinnae are wider (4.2–5.1 vs. 1.2–4.0 cm); the lamina is pubescent on both sides (less dense above), and it lacks the cross veined pattern present in the leaf blade of *B. hondurensis*. Moreover, in *B. ana-juliae* the leaflets have an aristate tip (3.5–7.0 cm long.), opposed to an acuminate tip in *B. hondurensis*, and the spines on the petiole and leaf rachis are yellow with the ends darker, although *B. hondurensis* may have yellow spines, but in younger leaves.

Bactris ana-juliae is easily separated from *B. dianeura* by the leaf shape. This new species possesses fewer pinnae per side (8–10 vs. 12–20), these are sigmoid vs. linear-lanceolate, pubescent vs. glabrous, and they lack cross veined blades.

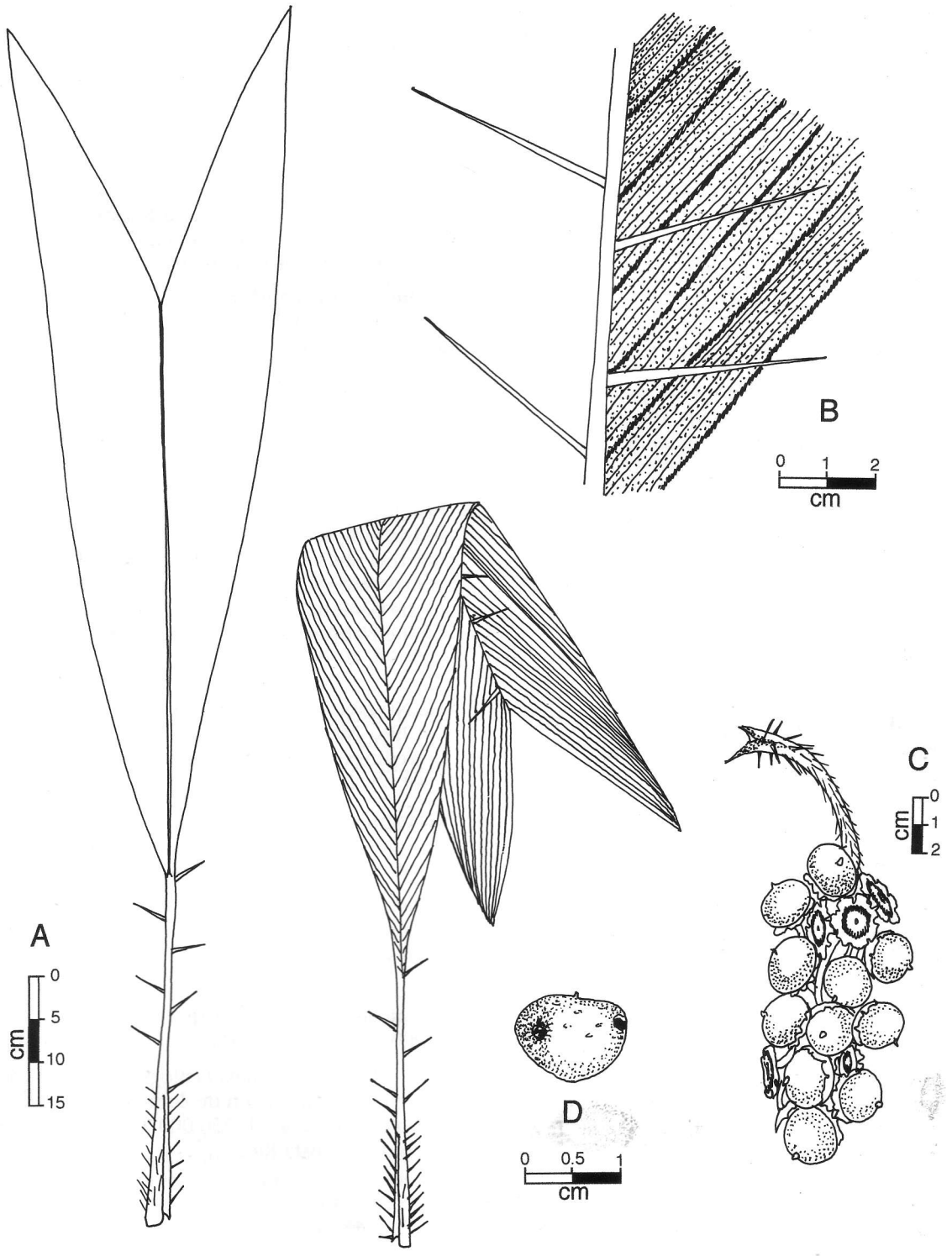
The sigmoid and convex pinnae with a long tip pointing downward is a striking feature of *B. ana-juliae* in natural conditions. The pinnae have a shiny dark green color above that becomes lighter near the tip of the blade. At the type locality the population produces flowers in March and April; fruiting occurs from November to March.

Bactris herrerana Cascante, **sp. nov.** Fig. 2.

Inflorescentia *B. glandulosae* Oerst. affinis sed foliis simplicibus bifidis abaxialiter pubescentibus differt. Typus: COSTA RICA. San José: Perez Zeledón, San Cristobal, Finca Tinamaste (17 km from San Isidro on road to Dominical), remnant forest near Fila Tinamaste, 650–680 m, 9° 17′ 54″ N, 83° 46′ 20″ W, 2 December 1998. *A. Cascante et al. 1470* (Holotypus: CR; isotypi: MO, USJ).

Stems cespitose, 2.0–3.0 m tall, stems 3-6, 1.5–2.5 cm diam., internodes usually spiny. Leaves 4–6 (–11), sheaths to 24.0 cm long, covered with short black spines; petiole glabrous or shortly pubescent, (15–) 20–28 (–43) cm long, with black spines (0.5–) 2.5–3.6 (–5.7) cm long, the basal portion with more numerous, shorter spines. Lamina simple and deeply bifid (rarely irregularly divided), 0.8–1.2 m long, glabrous adaxially and the secondary veins prominent, abaxially with a short brownish pubescence, lobes 10.0–17.0 cm wide at apex of rachis, 35–45 cm long, spinulose margin. Rachis pubescent underneath, with or without black spines, (2.5–) 3.5–5.0 (–5.7) cm long. Inflorescence infrafoliar, peduncle 3.5–7.0 cm long, 5.0–7.0 mm wide, recurved in anthesis, covered with short spines especially on the basal portion, prophyll ca. 9.0 cm long, peduncular bract 12.0–18.0 cm long., spinulose, with short blackish-brown and yellowish spines; rachis 4.5–7.2 cm long, rachillae 31–45, 4.5–7.5 cm long, densely covered with glandular hairs. Staminate flowers grouped on the proximal part of the rachillae, pedicel 0.4–0.6 mm long, sepals fused at the base, lobes apiculate, ca. 1 mm long, glabrous; corolla 2.0–3.5 mm long, petals white-cream, glabrous, fused at the base and apically, thecae ca. 0.5–0.6 mm long., longitudinally dehiscent. Pistillate flowers sessile, cupular calyx, 1.0–3.0 mm long, glabrous or sub-glabrous, and striate (when dry); corolla forming a tube, 3.0–4.5 mm long, with brown ascendent trichomes outside, glabrous inside, style glabrous, to 4.0 mm long, stigma capitate. Fruits obovate with a prominent stigmatic residue, (0.9–) 1.0–1.2 (–1.5) cm diam., (0.7–) 1.1–1.3 (–1.5) cm long, red when ripe, glabrous, and striate; endocarp black, corolla conspicuous in the fruit, irregularly divided (Fig. 2).

ADDITIONAL SPECIMENS EXAMINED. COSTA RICA. Puntarenas: Golfito, Reserva Forestal Golfo Dulce, Estación Aguabuena, ca. 5 km W of Rincón, Quebrada Aguabuena, 250 m, 7 June 1992, *A. Henderson et al. 1819* (INB), 1824 (INB, MO), 1826 (INB); Golfito, Península de Osa, Cerro Rincón, cabecera de los ríos Tigre, and Rincón, 700 m, 7 May 1993, *R. Aguilar 1885* (INB); Parrita, and Pirrís-



2. *Bactris herrerana* Cascante: A. leaf detail and leaf blade; B. spines on the lower surface of leaf rachis; C. infrutescence; D. seed.

Damas rivers watershed, SW side of Cerro Cabeza de Chancho, 600 m, 1 May 1998, *J. F. Morales 6425* (INB). San José: Acosta, Fila Bustamante, SE side of Fila Pital, ca. Quebrada Colorado, 180-600 m, 10 April 1997, *J. F. Morales 6175* (INB); Puriscal, Zona Protectora La Cangreja, forest near Río Negro, ca. 1.5 km E of Santa Rosa de Puriscal, 320 m, 14 May 1987, *M. Grayum et al. 8310* (INB); Zona Protectora La Cangreja, Santa Rosa de Puriscal, primary forest on Fila La Cangreja, 500 m, 10 Setember 1992, *J. F. Morales 637*; Perez Zeledón, San Cristobal, Finca Tinamaste (17 Km from San Isidro in road to Dominical), remnant forest near Fila Tinamaste, 650-680 m, 9° 17′ 54″ N – 83° 46′ 20″, 25 March 1998, *O. Valverde 782* (CR, MO).

DISTRIBUTION AND HABITAT. Along the central part and the south region of the Pacific Coast of Costa Rica, and possibly extending to Panamá. From 200–300 m in La Cangreja Protected Zone and Corcovado National Park, to 950–1000 m in the Fila Tinamaste in Pérez Zeledón, San José. In "Tropical humid forest, transition to premontane," and in "Pluvial premontane forest" according to Holdridge's "Life Zones Classification" (Tosi 1969); or "Sub-tropical, Tropical, humid with three to four dry months," and "Tropical, tropical, humid with one to two dry months" according to Herrera and Gómez's "Biotic Units Classification" (1993).

ETYMOLOGY. The epithet honors our Costarican botanist colleague Gerardo Herrera, whose unsurpassed work in the recent botanical exploration of the country has given many new species to science.

COMMENTS. *Bactris herrerana* is related to *B. glandulosa* Oerst., and *B. baileyana* H. E. Moore, which have in common the numerous filiform rachillae (> 40) of the inflorescence. Floral morphology of *B. glandulosa* is very similar to *B. herrerana*, but the former has more rachillae (ca. 60–80+), and develops more numerous, smaller fruits than *B. herrerana*. This group of related species grows simpatrically in Costa Rica, however *B. herrerana* can be distinguished in natural conditions by its long simple leaves with the strongly bifid apex, contrary to pinnate leaves in the other two species.

Some individuals of *B. herrerana* may seem to have pinnate leaves from a distance, but a close examination reveals that the leaf divisions do not follow a regular pattern, and are probably due to leaf age and effect of the wind.

Flowering of *B. herrerana* occurs during the ending of the dry season and begining of the rainy season (March to May). This phenological pattern is shared with *B. glandulosa* and *B. baileyana* along its distribution range in Costa Rica, and it may be in response to the climatic pattern of the region.

In herbarium conditions the specimens of *B. herrerana* usually have leaf blades grayish above, and brownish underneath.

Acknowledgments

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Horticulture Column

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Q. I have tried, probably twenty times, to root offshoots from *Rhapis subtilis* always without success. There are no nice long stolons on this species; the new shoots come right from the base of the plant. So far I have tried three ways. First, I made sure the offshoot had some roots of its own, I cut it free, removed and planted it. Next, I tried making sure the offshoot had some roots of its own, cut it free from the parent plant but left it in place until it had recovered from the initial shock, then I removed and planted it. Finally, I made sure the offshoot had some roots of its own, cut it partially free from the parent plant so as to allow it still to derive some sustenance from its parent and to develop more roots, and then removing and planting it after several months. I have tried all of these methods but no joy. Do you have any suggestions? John Higgins, Bahamas.

A. I was surprised to hear that it is so difficult to root and grow offshoots of *R. subtilis* since the nursery production of its relative *R. excelsa* has depended for so long on division and rooting of offshoots. I asked Lynn McKamey of Rhapis Gardens of Gregory, Texas for advice on dividing *R. subtilis;* Lynn has specialized in the production of rare clones of *R. excelsa* for many years and her knowledge of the genus *Rhapis* is quite extensive. She said that in addition to its lack of the "nice long stolons" which you mentioned, *R. subtilis* also posesses "stiff, quite breakable roots" in contrast to the roots of *R. excelsa* which are more flexible and thus easier to work with. Lynn added that she "was never able to divide *R. subtilis* either, either by single cane or clump."

I took all of this lack of success as a challenge, and since I have a large clump of *R. subtilis* in my back yard, I took shovel and saw and set about figuring a way to divide it. I selected a portion consisting of five mature stems and several smaller shoots, carefully dug around and under the outside perimeter of it so as to produce a ball of roots and then attempted to saw through the side of the clump that was attached to the parent plant, as I ordinarily do when dividing *R. excelsa*. Lynn was right, the short stolons and roots that connected the part of the plant that I wanted to separate from its parent were hard and stony, and the saw was not able to make much progress in cutting through them – very different from other *Rhapis* species that I have divided. Eventually I used a large chisel and a heavy mallet to cut through the hard material which shattered as much as it was cut. The resulting clump of five mature stems was potted in a suitable container and survived without any setback. So it is possible to divide *R. subtilis*, at least if one takes a large portion of a well established clump, but it certainly is not the way to produce these plants on a commercial basis. Lynn mentioned that seeds of *R. subtilis* are readily available, and I have observed that many clumps in cultivation appear to consist of both male and female plants. When planted together this way, the plants produce seeds quite freely. Further, now that I look at the awkward gap left in my once symmetrical clump of *R. subtilis,* I almost wish I had replanted the divided portion instead of giving it away.

There are said to be around twelve species of *Rhapis*. They are native to southern China and

southeastern Asia, with one species reportedly in Sumatra. The northern species, *R. excelsa* and *R. humilis*, seem to be the ones that produce the long stolons which make them rather easy to propagate by cuttings or division. Vegetative propagation makes it possible to reproduce the many horticultural varieties for which *R. excelsa*, in particular, is noted. The southern species with which I have personal experience, *R. subtilis*, *R. multifida* and *R. laosensis*, are all smaller plants than their northern relatives and posess the tight clumping, more difficult-to-propagate growth habit. They are generally grown from seed.

Q. I am growing some palms on a piece of property that I own in hopes of selling them at a later date. Recently I have noticed that the newest leaves of my young *Washingtonia robusta* palms have died and bent over. I am also growing queen palms and pindo palms, and they are fine. I have always heard that *Washingtonia* palms are very hardy and disease resistant palms. What could be the cause of this problem? I have used weed killer recently. Len Dunlap, California.

A. If you have been using a herbicide containing the chemical glyphosate to control weed growth around the base of your palms and applied some of it to the foliage of the *Washingtonia* it would produce an effect similar to what you have described. It is a rather odd effect that although you may accidentally spray the older and lowest leaves of the palm, the damage occurs to the new growth and somewhat mimics the effects of a fungus or bacterial bud rot. Glyphosate is one of the most commonly used herbicides both for homeowners and professionals. It is sold under such brand names as Roundup, Kleenup and several others. It is safe to use glyphosate to control weeds around palms, and in fact, it is much better to control weeds this way than by using a string trimmer or mower which might damage the trunks of your palms and provide an entry point for disease. Care must be taken when using glyphosate not to let the spray touch the foliage of the palm. Young palms which may have leaves that hang down close to the ground should be trimmed prior to spraying for weeds, or some sort of shield could be used to protect the leaves while the weeds are being sprayed. Palms are generally resistant to injury from glyphosate and some species seem quite immune. *Sabal palmetto* seedlings seem quite unaffected by repeated attempts to kill them by spraying, *Syagrus romanzoffiana* or queen palm and *Butia capitata* or pindo palm are both rather resistant to glyphosate, at least in light doses, and this may explain why they were unaffected by your herbicide spraying. The good news is that your *Washingtonia* specimens should recover and resume normal growth within a month or two. It would not be wise to purposely spray the foliage of even very resistant palm species such as *Sabal* or coconut, since the long term effects of such exposure are not known.

Q. I have several big trees of *Livistona decipiens* planted out in my landscape and they are suffering from a mysterious problem which disfigures them to the point that I had to cut one down last year. I first noticed that the top leaves were coming out at an angle a few years ago, then the whole leafy part of the top went off in one direction and the leaves were also distorted in shape, sort of compressed. Finally the poor thing was growing aimed toward the ground and looked very ugly, so I got rid of it. Now the same problem is happening to two of the remaining five trees, one of which has cracks in the petioles; these palms are less than ten years old, they get a lot of water both from mother nature and me, and I fertilize them frequently with a palm fertilizer. Can anything be done to save them? Mike Grant, Florida

A. Unfortunately I am quite familiar with this problem myself, I have had to destroy a number of young *Livistona decipiens* that had the same malady. It seems to be a fairly common problem with this species in Florida and one that is not easy to understand. I sent photos of an affected *L. decipiens* and one of its leaves (Fig. 1 & 2) to Dr. Timothy K. Broschat of the University of Florida's Fort Lauderdale Research and Education Center. He advised me that the symptoms shown in the photos are consistent with those of boron deficiency. Dr. Broschat cautioned that only a leaf nutrient analysis done in a laboratory can actually prove that this is the cause of the problem. Boron deficiency is most often seen in palms grown in areas with high rainfall or frequent irrigation. Since boron is easily leached from the soil, sandy soils like those in much of Florida only add to the problem. The coconut and its relatives *Butia*, *Allagoptera*, *Syagrus* and other Cocoid palms are perhaps the palms most commonly recognized as suffering from a boron deficiency. When these palms are boron deficient their leaflet tips are permanently bent over at a sharp angle as the new leaf emerges (Fig. 3). This condition has been referred to as "frond bent tip syndrome" in the past. Rarely are these palms as severely affected as *L. decipiens* when it is boron deficient.

Boron deficiencies can be a little tricky to correct. Boron is an essential micronutrient for plant health, but too much is toxic to plants. The tricky part is that the difference between too much and the correct amount is relatively small. Unfor-

tunately, as Dr. Broschat points out, many fertilizer manufacturers leave boron (abbreviated as B) out of their fertilizers for fear that too much B in some portion of their product might make the fertilizer toxic to plants. Their concerns about potential liability in case of an excess of B outweigh the possibility that B deficiency may actually be induced by the use of their products. To prevent B deficiency, use a fertilizer that contains it. In situations where high rainfall or heavy irrigation cause excessive leaching, one can fertilize frequently with relatively small amounts, or better still, use a slow release encapsulated fertilizer. To correct an existing deficiency like that which is affecting your *L. decipiens,* use either boric acid or sodium borate at the rate of 2–4 ounces per tree two times per year. With such severely deficient palms, it will take some time (probably at least one growing season) before they return to normal growth, so patience will be required.

1 (upper right). The crown of a *Livistona decipiens* with boron deficiency. The leaves have been cut away on one side for a better view.

2 (lower right). A leaf of *Livistona decipiens* with boron deficiency, note the split petiole and crinkled segments.

3. (below) Some leaflets of *Allagoptera arenaria* with symptoms of boron deficiency, note the hooked tips.