Palms

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THE INTERNATIONAL PALM SOCIETY, INC.

The International Palm Society

Founder: Dent Smith

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FRONT COVER

Sabal palmetto consumed by fire in Bill Baggs Cape Florida State Park. See article by S. Wright, p. 117. Photo by K. Wendelberger.

Palms (formerly PRINCIPES)

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Like all rattan palms, fruits of *Calamus arborescens* are scaly (*Hodel et al. 1949*). See story by D. Hodel, p. 121.

BACK COVER

Looking up into the crown of *Syagrus vermicularis*, a species newly described in this issue of PALMS by L. Noblick, p. 109. Photo by L. Noblick.

NEWS FROM THE WORLD OF PALMS

Starting with this issue, PALMS is now all-color! At last May's board of directors' meeting, the board approved an increase to the production budget of PALMS that now allows us to print color illustrations on any page. Prior to this change, color illustrations had to fall on certain pages, and this constrained both authors and editors. Often, the editors were forced to reproduce images in black and white because there was not enough space on the color pages. Those days are behind us. We encourage authors to submit high-quality, color images along with their manuscripts. We welcome color slides and prints. Please contact the editors before submitting digital images.

The Asociación de Palmeras y Cicas de El Salvador is the latest group to become affiliated with the IPS. We welcome the new Salvadoran members and hope their enthusiasm for palms spreads throughout Central America. We might also add that the Sydney branch of the Palm and Cycad Societies of Australia has a new name. It is now called the Sydney Tropical Garden Society.

Fairchild Tropical Garden, renowned for its palm collection, also has a new name. In March, Fairchild's board and members voted unanimously to change Fairchild's name to Fairchild Tropical Botanic Garden. According to the Director, Dr. Mike Maunder, this decision was made to recognize FTBG's heritage of tropical plant collecting and exploring, as personified by one of its founders, Dr. David Fairchild, and to reflect its status as a botanic garden, an institution focused on the serious issues of education, research, tropical horticulture and conservation.

A bizarre story appeared in the London-published newspaper *Metro* on 11 May 2004, linking *Lodoicea maldivica* with one of the world's cosmetic giants and a sex shop that sells whips and other paraphernalia. Samantha Roddick (daughter of Anita Roddick, the founder of the famous Body Shop in UK), who owns an adult shop in London's Covent Garden, lost a legal battle over the use of her brand name and logo, Coco-de-Mer. Ms Roddick used the logo, featuring the erotic form of the double-coconut seed, to identify her range of products, suggesting that the nut had significance that was both "spiritual and sexual" and was a potent symbol of fertility. The cosmetics giant Chanel took issue, claiming that the public would be confused by products bearing the logo and brand-name Coco-de-mer with their own Coco brand, named for the company's founder Gabrielle "Coco" Chanel. The judge ruled in favor of Chanel. To the palm aficionado, the ruling seems bizarre – how could anyone confuse the seed of *Lodoicea* linked to a line of adult equipment with the name of a long-established brand of perfume?

On a more serious note: We have learned that Robert Lee Riffle and our president, Paul Craft, have been awarded the prestigious 2004 American Horticultural Society Annual Book Award for their recent book, *An Encyclopedia of Cultivated Palms*, published by Timber Press and reviewed by Don Hodel in PALMS 47(3). Our congratulations go to the authors. Many members will already have purchased this excellent book – if you have not done so already, then the announcement of the award must surely encourage you to consider buying one of the best popular introductions to palms.

Exciting new insights into the relationships of palms have been made over the last few years, especially thanks to the development of analytical methods for interpreting variability in DNA of palms. These insights have forced palm scientists to rethink how palms should be classified. Work on the new edition of *Genera Palmarum* is in its final year and co-authors John Dransfield, Natalie Uhl, Connie Asmussen, Bill Baker, Carl Lewis and Madeline Harley met in June in Cornell University to encapsulate the results of recent research in a new classification that will form the backbone of the book. It is hoped that the first draft of the manuscript will be completed by the end of 2004.

THE EDITORS

Syagrus vermicularis, a Fascinating New Palm from Northern Brazil

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1. *Syagrus vermicularis* showing inflorescence with worm- or ramen noodle-like branches.

Brazil holds many surprises, but none more fascinating than the palm with inflorescences that resemble ramen noodles (Fig. 1). A search through the palm literature on *Syagrus*, especially Glassman's (1987) revision, reveals that there is no species that is quite like this one.

The discovery of this new palm was rather accidental. I arrived in the late afternoon at the Açailandia bus station in Maranhão, Brazil (Fig. 2) with all of my voluminous collections and collecting equipment. The drive from the bus station to the research center at Fazenda Itaibaiana, a research facility of the Companhia Vale do Rio Doce, was actually quite depressing. Charred by fires, most of the deforested land had been laid barren of all native plant life. We drove past some stands of *Syagrus*. I had just collected *Syagrus inajai* the day before, and as we passed these *Syagrus* stands, I assumed that these were the same. So when I jumped out of the vehicle and ran up the hill the next morning, I fully expected to see *Syagrus inajai* fruits and seeds lying on the ground, but was surprised when I stooped down to pick up something very different. This seed was larger and had a distinctive trilobed beak at its apex, a character that I had only occasionally seen in seed of *Syagrus botryophora,* a palm of the Atlantic Forest. As I lifted my eyes, I immediately noticed that the infructescence was hanging on the trunk well below the crown and without a peduncular bract, having shed it before the fruits were mature. One infructescence hung exposed on the trunk as much as 50–100 cm below the crown. Inflorescences were born in the interfoliar position, but then the trunk grew and dropped its leaves and the peduncular bract faster than the fruits could mature, making this appear to be one of the fastest growing *Syagrus* yet discovered. So I must admit a bit of disappointment with MBC's specimens, when the trees did not literally jump out of the ground. Instead there was a period of slow growth as the palms established their girth. Only in the last few years have several trees leaped out of the ground as I had expected they would. Now, only nine years from seed, they are over eight meters tall, with first inflorescences starting to initiate at 5–6 meters above the ground. The young smooth trunks covered by a white pubescence attract the attention of all who visit the garden. Its attractive habit and rapid growth make this palm a very promising candidate for the nursery industry.

The most distinctive character of this new species lies in the structure if its inflorescence. Unlike normal *Syagrus* species with male (staminate) flowers born up to and including the very tip of the primary branches, in this new species the branches extend far beyond the flowering portion and continue as pale yellow, interfolding, sterile appendages. The tip of a newly emerged inflorescence is not unlike a package of ramen noodles, all interfolded with one another. One might also liken them to an interfolded mass of

2. Map showing distribution of *Syagrus vermicularis*.

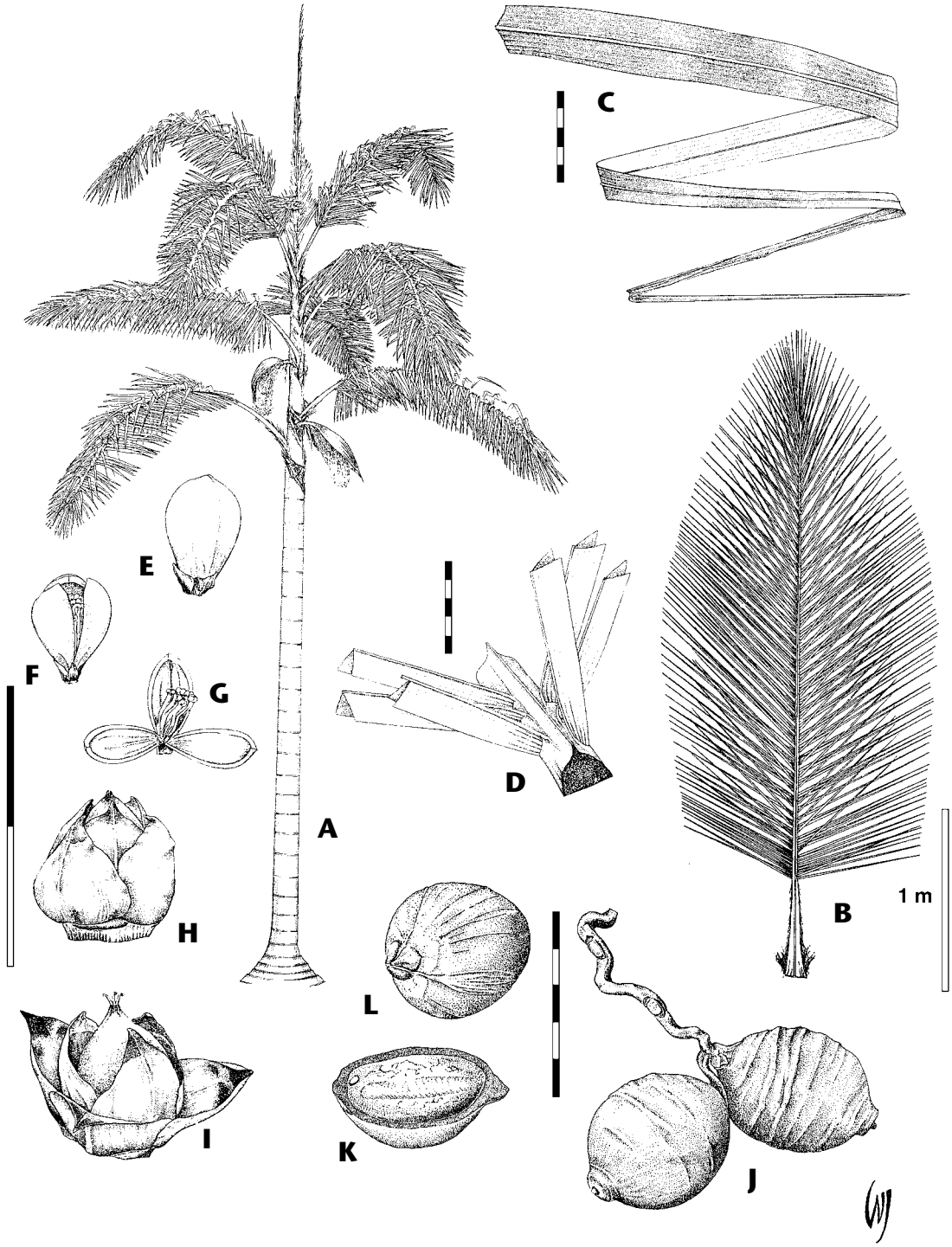
3. *Syagrus vermicularis*. View looking up into the canopy showing the fine sheath fibers and inflorescence.

worms and thus the epithet, *vermicularis,* meaning worm-shaped, referring to the shape of the primary branch tips.

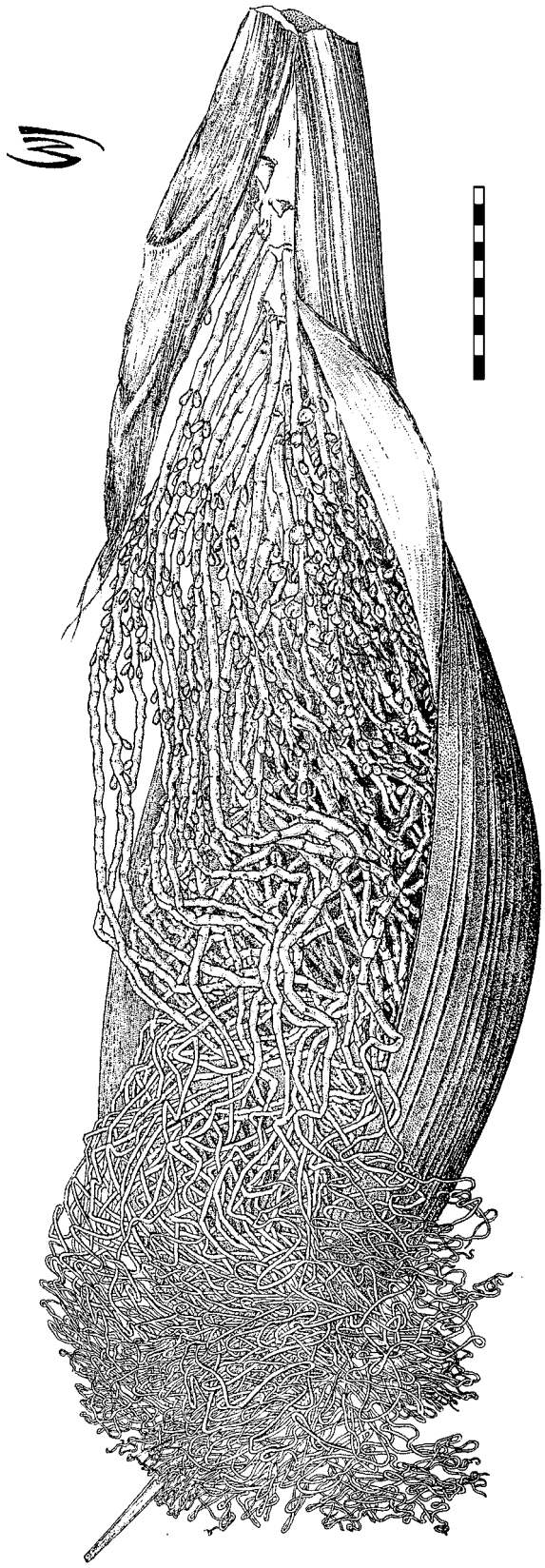
Syagrus vermicularis Noblick **sp. nov.**

Palma solitaria tronco conspicue articulato. Folium reduplicato-pinnatum foliolis numerosis. Inflorescentia ad ca. 1.2 m longis solitaria axillaris interfoliaris in unum ordinem ramificans. Rachillae numerosae ca. 80–100 prope basin triades, prope apicem flores masculos solitarios vel binatim ferentes sed apicem longis vermicularis et nudus sine floribus. Fructus endocarpio, basin 3 (–4)-poratum, prope apicem rostrum trilobatum ferens. Typus: BRAZIL, Maranhão, Açailandia. *L. R. Noblick & J. A. Feitosa 4971* (Holotypus IPA*;* isotypi FTG, Herbarium of Fazenda Itaibaiana, K, MO, NY, US)

Solitary palm tree. Stem erect, 10 m tall, ca. 12–20 cm diam., basally with a large root boss to ca. 45 cm diam., distally stem very conspicuously ringed with oblique leaf scars, new internodes densely covered with white caducous wooly indument; internode ca. 9–17 cm long. Leaves ca. 12–15 in crown, spirally arranged and spreading; leaf sheath plus petiole ca. 90–100 cm long × ca. 18–20 cm wide at the base, composed of finely-netted matting of fibers breaking away easily and leaving a finely fibrous margin on the apparent petiole, apparent petiole adaxially channeled and abaxially rounded and covered adaxially with wooly caducous indument; true petiole 6–8 cm long, ca. 3.1–4.4 cm wide and 1.5–2.2 cm thick at the base of the leaf blade; rachis 2.2–2.5 m long with ca. 100–140 pairs of leaflets distributed in clusters of 2–3 along the rachis in various divergent planes; middle leaflets ca. 80–90 cm long × 3–4 cm wide. Infloresence interfoliar, androgynous, erect in bud, later horizontal; peduncle 60–61 cm long × 4 cm wide × 2 cm thick; peduncular bract ca. 90–103 cm long including a beak 4–5 cm and the expanded or inflated part of the bract measuring ca. 55–65 × 27–29 cm and with a perimeter 33–37 cm, 5–9 mm thick, often separating from the peduncle before the fruits reach full maturity; rachis 49–52 cm long; rachillae ca. 70–100, apical ones ca. 54 cm long and basal ones ca. 118 cm, a major part of the distal portion of the rachillae devoid of any flowers, sterile and folded back and forth on themselves like dried noodles or worms. Flowers bright yellow drying white or cream-colored. Staminate flowers near the base ca. 9–10 mm long, sessile; sepals 3, distinct, triangular, imbricate but briefly connate at base, acute, membranaceous, glabrous; petals 3 distinct, unequal, obovate, valvate, fleshy, glabrous, with inconspicuous venation, ca. 8–9 × 4 mm, obtuse to broadly acute;



4. *Syagrus vermicularis*. **A** Habit; **B** Leaf; **C** Leaflet; **D** Section of leaf rachis showing inserted leaflets; **E–G** Staminate (male) flower; **H** Receptive pistillate (female) flower; **I** Pistillate flower showing tomentose ovary; **J** Fruit with a portion of the primary branch; **K.** Endocarp in longitudinal section; **L.** Endocarp showing the trilobed beak at the apex. Habit drawn from MBC accession number 94690*G; Leaf, leaflet and flowers drawn fresh from 94690*D; and endocarp and fruit drawn from *Noblick & Feitosa 4971*. All scales are in centimeters with exception of 1 m scale. Drawn by Wes Jurgens.



5. Inflorescence only a few days old showing highly folded sterile tips and how male flowers are shed quickly; drawn fresh from 94690*D. Drawn by Wes Jurgens. Scale as in Fig. 4.

6. Collector J. A. Feitosa (left) and driver showing leaves and infructescences of *Syagrus vermicularis*.

stamens 6, distinct, 4–5 mm long, with filaments 1.5 mm long; pistillode trifid, less than 0.5 mm long. Pistillate flowers, conical, sessile; sepals glabrous, without visible venation, sclerenchymous or fleshy, imbricate, ca. 9–10 × 8–9 mm, acute, faintly keeled at tip; petals 3, distinct, imbricate at base, valvate at apex with valvate tip ca. 2–3 mm long, triangular, indistinctly nerved, glabrous, 11 × 8–9 mm, acute; gynoecium of receptive flower ovoid, 9 × 7 mm, covered in wooly tomentum, persisting on the apex of the fruit; stigmas 3, ca. 2 mm long; staminodal ring ca. 3 mm long, undulate with ca. 6 undulations and three small residual teeth, one on every other undulation. Fruits orange when mature, 5–6 × 4 cm, ovoid; cupule (persistent perianth) dark brown, ca. 2 cm in diam. × ca. 1 cm high; petals slightly longer than sepals; staminodial ring truncate, ca. 3 mm high × 10 mm diam.; epicarp smooth for most part but tomentose at apex; mesocarp fleshy, fibrous or pulpy remaining as a fibrous mat over endocarp; endocarp ovoid, 4.5–5 × ca. 3.5–4 cm, ca. 6 mm thick, hard, bony, brown to red-brown, apex with a distinctive, trilobed protuberance or beak, interior smooth, trivittate, slightly triangular in cross-section, outer surface nearly smooth, with small fibers, only slightly pitted, pores 3(–4) nearly even with surface, sutures visible especially at apex. Seed 1, elliptical, 3 × 2.5–3.2 cm; endosperm homogeneous. Germination remote tubular with cotyledonary tube penetrating deeply before sending up a plumule; eophyll simple, lanceolate. (Figs. 3–5; Back Cover).

COMMON NAME: *pati*. It is interesting to note that this same common name is also applied to *S. botryophora* from the Atlantic coastal rain forest.

HABITAT AND CONSERVATION. In pre-Amazonian seasonally wet, marginal or secondary forests on terra firme with deep lateritic clay soils on rolling or steep hilly slopes at ca. 100–200 m. elevation. Often growing in open pastures. Also seen on lower slopes adjacent to river floodplains. Other palms present were *Oenocarpus bataua*, *Oenocarpus disticus*, *Attalea maripa* (*Maxmiliana maripa*) with *Euterpe oleracea* in the low lying areas. *Syagrus vermicularis* is threatened by the heavy lumbering practices that are reducing the regional forests to pasture. However, this palm species seems to thrive in secondary growth and farmers often maintain the trees in their pastures.

DISTRIBUTION: Brazil, state of Maranhão (mid-western portion) near Açailandia and Imperatriz, Maranhão, state of Para (at least in the mid-eastern

7. *Syagrus vermicularis* in its native habitat near Açailandia, Maranhão, Brazil.

part) near Serra Carajás and the Rio Paraupebas and probably the northern part of the state of Tocantins (Figs. 2, 6 & 7).

PHENOLOGY: Many of the trees in September had immature developing fruits. A small number had mature fruits and fewer still had flowers. Fortunately, I found a few sporadic inflorescences, but all contained only male flowers. I found this initially perplexing, but after growing them at MBC, it has been observed that the first few inflorescences of young palms do frequently produce only male flowers and often these flower outside their normal season. However, it must be noted that female flower bearing inflorescences were observed opening at MBC in September.

SPECIMENS EXAMINED. BRAZIL: Maranhão, Açailandia, Fazenda Itaibaiana (Companhia Vale do Rio Doce), ca. 17 km S. on BR 10 km 1, Lat. 05° 02' S, Long. 47° 01' W, 6 Sep 1994, *L. R. Noblick & J. A. Feitosa 4971* (Holotype IPA; Herbarium of

Fazenda Itaibaiana, FTG, K, MO, NY, US); Açailandia, 5–6 km S. of the city on BR-010 (Açailandia/Imperatriz road), Lat. 05º 02' S, Long. 47º 01' W, 8 Sep 1994 *L. R. Noblick et al. 4974* (FTG, IPA, K, NY); Par·, Marab·: Carajás – Marab· Highway, 8 km from the entrance to Serra Caraj·s, 20 Apr 1985. *A. B. Anderson & M. Rosa 2202* (MG); Parauapebas, Serra dos Carajás, fazenda em Parauapebas [ranch in Parauapebas]; *J. B. P. Rocha & J. P. Silva 666* 12 Jan 1990 (Herbarium of Carajás – HCJS); *J. P. Silva 695* 12 Jan 1990; Proximo Sitio de Chagas [Near Chagas farm, margin of the Parauapeba River, Raimundo Mascarenha road]; *J. P. Silva 650* 19 Oct 1990 (Herbarium of Carajás – HCJS).

COMMENTS: A study of the leaf anatomy reveals that just below the upper leaf epidermis, there is a continuous one-cell thick layer of sclerenchyma fibers that is present in more or less all Amazonian species and in a few Atlantic coastal species of *Syagrus*. The Amazonian *Syagrus* are *S. sancona, S. inajai, S. orinocensis, S. stenopetala, S. cocoides, S. smithii* and *S. stratincola*. The closely related *Syagrus* from the Atlantic Forest are *S. botryophora* and *S. pseudococos*.

Seeds collected in September 1994 and sown before the end of the month started germinating shortly after mid-October and continued until February of 1995. No plants resulted from the holotype collection, MBC accession number 94694, due to its immature fruit. However, another more mature MBC seed accession, 94690, collected from the same Açailandia population is represented at MBC by 25 plants. Additional seed was collected and donated by Bernard Fischer in 1996 and is represented in the garden by two plants, accession 96364. Bernard's collection came from a specimen that had four instead of the usual three basal pores on the endocarp.

In summary, *Syagrus vermicularis* is easily distinguished from other *Syagrus* by long, sterile, strongly folded inflorescence tips, by a peduncular bract that frequently is shed before the inflorescence reaches full maturity (not yet observed in any other species of *Syagrus*); prominent trilobed endocarp beak (seen only occasionally in *S. botryophora*); and the young attractive trunk covered (at least initially) with a dense white cauducous tomentum.

Acknowledgments

I thank the 1994 staff at Fazenda Itaibaiana (Companhia vale do Rio Doce) who facilitated this collection: Juan Alfonso Rodrigues Ataides, José Mario, Deonizio Mendes and my designated guide, Josely Alves Feitosa (Té). I am grateful to Professor Nivaldo de Figueiredo of the Universidade Federal of Maranhão, São Luiz, for his help collecting in the northern part of the state and for connecting me up with Juan Alfonso at the Fazenda. Sincere thanks goes to staff of IPA Herbarium in Recife, Pernambuco, for the generous use of their facilities to process plant material between trips. Also, sincere thanks to Fairchild Tropical Garden Research Center and staff, where I am a research associate. Thanks to Dr. Scott Zona for his valuable advice and Wes Jurgens for his wonderful line drawings. The impetus and financial support for this work was provided by the National Science Foundation Grant # 0212779 and by the Montgomery Botanical Center.

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Fire Returns to Native Palms in Coastal South Florida

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1. *Sabal palmetto* (Sabal palm) completely engulfed in flame.

The raw visual intensity of a raging fire burning through palms (Front Cover; Figs. 1 & 2) could cause the palm enthusiast to look on in horror. Fear not, frond friends, fire is no foe to these Florida palms.

2. Fire burning through large stand of *Serenoa repens* (Saw palmetto).

Fire was once very common along South Florida's coastal dune and coastal strand habitats. Fire caused by lightning was believed to have occurred every four to five years along South Florida's barrier islands (Austin et al. 1977). As in the pineland communities of Florida, periodic natural fires historically maintained the integrity and openness of coastal strand habitats while sustaining a high diversity of native flora and fauna. Prescribed burning is now a widely accepted management tool used for reducing fuel loads, managing exotics and restoring the native species composition of Florida's natural habitats.

On January 17, 2004 the Florida Department of Environmental Protection (FDEP) conducted a prescribed burn on 6.5 ha (16 acres) designated for coastal strand restoration at Bill Baggs Cape Florida State Park, Key Biscayne. Fairchild Tropical Botanic Garden biologists were invited to participate in monitoring the effects of the fire on the strand vegetation and assist as observers during the fire.

The burn crew utilized the method of back burning (burning against the wind), making the fire more manageable, but also making the beginning stages very anticlimactic. At the start of the burn I noticed the slow movement and uneventful behavior of the fire. Upon ignition, the flames crept along slowly at a snail's pace through the low herbaceous understory. The fire methodically marched along as a 15 cm (6 in) tall army of small flames (Fig. 3) through the *Coccoloba uvifera* (sea grape) leaves. The mood of the fire changed dramatically once the fire reached either *Serenoa repens* (saw palmetto) or *Sabal palmetto* (cabbage palm). Once coming in contact with the flammable dead fronds at the base of the palms the fire quickly spread and engulfed each palm and within seconds transformed it into a towering inferno (Fig. 1 & Front Cover). I stepped back in

facing page:

3. Low intensity fire burning *Coccoloba uvifera* (sea grape) leaves.

4. *Serenoa repens* (saw palmetto) inflorescences produced less than 3 weeks after burn.

5. A few weeks after the fire, singed seedlings of *Sabal palmetto* make strong growth.

awe of the speed and the intensity that the fiery blaze burned through these native palms.

Both species of palm are well adapted to fire-maintained habitats and are known to recover quickly from fire. Immediate post fire responses of *Serenoa repens* include higher flowering frequencies and increased vegetation production (Abrahamson 1999), increased fruit production (Carrington et al. 2000) and increased total sugar and moisture content of rhizomes (Hough 1968). Less than one month after the Cape Florida burn, both palms had vigorous new growth. *Serenoa repens* produced inflorescences (Fig. 4). New *Sabal palmetto* seedlings germinated, while existing seedlings made rapid growth (Fig. 5).

With the use of management tools such as prescribed burning, land managers plan to restore the natural habitats of South Florida and once again return the native palms to their majestic rule as the overseeing monarchs of the coastal strand.

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Night Train to Mandalay, Part II

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1. *Corypha umbraculifera* in Bago Division has a large terminal inflorescence signaling its impending decline and death. The species is uncommon in Myanmar.

Exploring for palms in Myanmar, formerly known as Burma, is exciting but arduous and sometimes frustrating work. This account, the second of two parts, reports the findings of two expeditions exploring for palms.

Part II. November: Bago Division, Taninthayi Division, Mon State.

Taninthayi Division including the Myeik Archipelago, the most southern part of Myanmar, held exciting promise not only for palms but also for bat research. The monsoon nature of the climate and vegetation is less pronounced in Taninthayi, and the forests are the most rich and diverse in Myanmar. I was expecting to find genera and species common to southern Thailand and Peninsular Malaysia but lacking or poorly represented elsewhere in Myanmar, such as *Areca*, *Korthalsia*, *Licuala*, *Myrialepis*, *Pinanga*, *Plectocomia*, *Plectocomiopsis* and *Salacca*. Other palms I was especially keen to find in Taninthayi were the limestone-dwelling *Maxburretia* and *Rhapis*. Although not recorded from Myanmar, both occur not too far to the east and south in Thailand. Limestone rocks and hills are a conspicuous feature in Taninthayi, and a few of the more than 800 islands of the Myeik Archipelago are composed entirely of limestone. It would be an exciting find to discover new records or even new species of these genera in Taninthayi. The limestone features also contain many caves, prime bat habitat, so Taninthayi offered something for everyone.

I arrived in Yangon on the evening of October 31, five days prior to the official start of The Harrison Institute's expedition to Taninthayi Division including the Myeik Archipelago. I had arrived early in order to try to track down the still elusive *Calamus arborescens*. This time I was much more confident I was going to find it because Andrew Henderson of the New York Botanical Garden,

2. A young girl scrapes leaf sheaths and spines from rattan canes at a processing facility in Wanbeinn Village, Bago Division.

3. A man straightens curved canes by pulling and pushing them between two pieces of wood at a processing facility in Wanbeinn Village, Bago Division.

who had traveled to Myanmar just a few months after my March trip in preparation of his work on old world palms, had seen but not collected it and had provided me with the geographical coordinates of the palm in a small village in Bago Division north of Yangon.

Armed with the coordinates Andrew had given me programmed into my GPS finder, several faculty members from the zoology department of Yangon University and I set out in a taxi on the morning of November 1 for Bago Division and what I hoped was *Calamus arborescens*. On an earlier trip to the area the zoology department researchers had located a rattan cane processing facility and we planned to stop to view its operation and ask about locations of rattan palms in nearby forests. As we traveled northeast out of Yangon toward Bago we observed *Areca catechu*, *Borassus flabellifer*, *Cocos nucifera*, and infrequently *Corypha umbraculifera* (Fig. 1) cultivated around homes and farms.

We made a short stop in Bago for some tea and pastries. Small cafes or shops serving various types of tea, probably a holdover from the former British colonial rule, are common throughout Myanmar and are typically packed with customers in mid morning and late afternoon. Indeed, partaking in tea seems to be a national pastime in Myanmar. The tea and pastries are excellent but what is unusual about these cafes are the miniature tables and chairs, the perfect size for small children. It easily became a pleasurable habit to take tea once or twice a day in these cafes, and sitting at the miniature tables and chairs just added to the experience.

I frequently checked my GPS finder as we progressed north of or beyond Bago, the capital of Bago Division, and was relieved to see that our objective, *Calamus arborescens*, was directly ahead of us and that the distance was progressively decreasing. Ah, the marvels of modern technology! As we neared our target I was confident I was finally going to see the elusive and handsome *C. arborescens*. When we were within 15 kilometers of our prey I began to read off the decreasing distances as we zeroed in on our target, "15 kilometers, 13, 11, 10, 9.5, 9, 9.5, 10, 11 . . . . ." Suddenly I was alarmed. The distance to our quarry was actually increasing and the directional arrow was now pointing off toward the east, not straight ahead! How could this be? I looked to the right or east out the auto window and could see nothing but rice paddies. Could we be on the wrong road? I asked my colleagues if there was another road paralleling ours farther to the east but they said there was nothing, only rice paddies as far as the eye could see. I was rapidly becoming discouraged, thinking I had been given or entered incorrect coordinates in my GPS finder, or that the device was not even functioning properly. I was beginning to lose faith in the marvels of modern technology. Would I ever find *C. arborescens*?

Discouraged and perplexed we decided to continue on toward Wanbeinn Village, site of the rattan cane processing facility, to see if we could garner any information concerning the whereabouts of *Calamus arborescens*. There we observed young girls scraping leaf sheaths and spines from canes (Fig. 2), men straightening curved canes by pulling and

pushing them between two pieces of wood (Fig. 3), and stacks of cleaned, straightened canes curing and drying. Perhaps most impressive were larges bundles of six-meter-long petioles/rachises of *Salacca wallichiana* stacked vertically on end under a large tree ready for sale (Fig. 4).

Unfortunately, villagers knew nothing of *Calamus arborescens* but they did direct us to remnants of disturbed forest several kilometers west of the village. With a villager acting as our guide, we drove off the main highway onto a rough, dirt track, heading toward some distant hills and the Salu Forest where we hoped to encounter *C. arborescens*. After about an hour of driving and covering about 10 kilometers the track became impassable to ordinary vehicles. Fortunately, we were near some low, wet areas and remnants of seasonally moist secondary forest that seemed to hold some promise for palms. There we observed *Daemonorops jenkinsiana* and collected *Calamus longisetus*, both climbing rattans, and *Salacca wallichiana*, but no *C. arborescens*. Night was rapidly approaching and we wanted to be back on the main highway before dark, so, frustrated and dejected at not finding *C. arborescens*, we headed back to Yangon.

I spent the next day sightseeing in Yangon and taking in an extended walking tour of the giant Shwe Dagon Pagoda complex. Although I had visited this large and sacred site on my previous trip, new revelations awaited me as my guide showed and explained various features of the pagoda and surrounding buildings. Also, weekend worshippers were thronging the complex, making for colorful and eye-catching scenery.

The next morning my zoology department colleagues and I set out for Hlawga Wildlife Reserve just north of Yangon. Andrew Henderson had told me that it harbored a few palms so we thought it would be a good place to continue our search for *Calamus arborescens*. The wildlife reserve

4. (left) Large bundles of six-meter-long petioles/rachises of *Salacca wallichiana* stacked vertically on end under a large tree ready for sale at a processing facility in Wanbeinn Village, Bago Division were impressive. 5 (right). One of the most common palms at Hlawga Wildlife Reserve near Yangon is the large, climbing rattan *Calamus longisetus*. It forms large clumps and has leaves with long flagella for climbing and pinnae clustered in groups. 6 (right, inset). Leaf sheaths of *Calamus longisetus* are impressively armed with partial whorls of large, flat, brown spines.

7 (left). *Licuala peltata*, noted for its orbicular leaves divided into several, broad, wedge-shaped segments with truncated, toothed tips, was common at Hlawga Wildlife Reserve near Yangon. It is one of the most widely distributed and conspicuous understory palms of western Myanmar. 8 (right) *Daemonorops jenkinsiana* forms especially attractive, large, impenetrable thickets with long, climbing stems and pinnate leaves with elegantly pendulous pinnae at Hlawga Wildlife Reserve near Yangon.

has a meandering road that circles through the park, up over hills and down into low, seasonally wet swales and ravines, passing through moist secondary forest. There we observed *Calamus longisetus* (Figs. 5 & 6), *Calamus viminalis*, *Daemonorops jenkinsiana*, and *Licuala peltata* (Fig. 7). The *Daemonorops* was especially attractive, forming large, impassable thickets with long, climbing stems and pinnate leaves with elegantly pendulous pinnae (Fig. 8). We collected the climbing rattan *Calamus guruba*, a species I had not previously seen in Myanmar. Once, when discovering a juvenile, upright, erect, not-yet-climbing individual of *C. longisetus*, we thought we had finally found our long lost prey, *C. arborescens*. Close inspection dashed our hope, though, when it revealed irregularly arranged pinnae, green rather than silver-gray, on the underside.

Back in my hotel room that night I once again poured over my notes, trying to determine where I had gone wrong in my search for *Calamus arborescens*. I was startled when, rereading my notes, I saw that Andrew had said he had seen the *C. arborescens* east of Bago, on the road to Waw! I realized that "east of Bago" explained everything. We were near Bago two days earlier when the arrow on my GPS finder had pointed to the east into endless expanses of rice paddies. Because I was so focused on the geographical coordinates, I simply skimmed over Andrew's note about the location being "east of Bago," and I eventually forgot about this seemingly unimportant bit of information. I quickly grabbed a map and, sure enough, there was a road heading east to Waw from the main highway north of Bago. The GPS finder had been correct after all. We simply had not been on the right road!

Armed with this clarified information and new enthusiasm, my zoology colleagues and I set out again the next morning for Bago. About 20 kilometers north of or beyond Bago we came to the road that headed east to Waw. Once on the

9 (left). One of the few non-climbing rattans, the clustering *Calamus arborescens* would make a handsome ornamental. Kyaik Hla Village, Bago Division (*Hodel et al. 1949*). 10 (inset). The light- or yellow-green petioles of *C. arborescens* are handsomely armed with whorls of three-inch-long, jet-black, triangular spines (*Hodel et al. 1949*). 11 (right). Stems of *C. arborescens* are erect or upright but sometimes leaning, green, and conspicuously ringed while the regularly pinnate leaves are glossy dark green above (left) and strikingly silver-gray below (right) (*Hodel et al. 1949*).

road to Waw, the directional arrow on my GPS finder unwaveringly pointed straight ahead and I began reading off the decreasing distances as I had done three days earlier, "10 kilometers, 8, 5, 4, 3, 2, 1, 0.5, and finally 0." We were there! I yelled, "Stop!" and the taxi pulled to the side of the road. I immediately looked up and to the right out the auto window and, much to my surprise, saw nothing but endless expanses of rice paddies. I was momentarily stunned but then my colleagues were excitedly pointing to the left and there, not 25 meters away in a fencerow, was a palm I had never seen before, *Calamus arborescens*! Ah, the marvels of modern technology.

We had arrived at Kyaik Hla Village. We walked into the village, which was densely planted with various trees and shrubs and gave one the impression of being in an open forest or perhaps the village actually contained some forest remnants, and encountered about a dozen handsome clumps of *Calamus arborescens* scattered in low, wet areas along elevated pathways connecting houses and neighborhoods (Figs. 9–11; see p. 107). These low, wet areas were obviously covered with water during the height of the rainy season because they were soggy wet now at the end of the rainy season. The palm is attractive, and would make an outstanding ornamental. It forms large clumps to 15 meters tall and 10 meters wide of erect, upright but sometimes leaning, green, ringed stems each topped with a crown of regularly pinnate leaves, glossy dark green above and strikingly silver-gray below. The light- or yellow-green petioles are handsomely armed with whorls of three-inch-long, jet-black, triangular spines. Unfortunately, we could find only immature fruits.

We spent about two hours photographing the palms, taking notes and making collections. After such a long, dramatic search for this species, spanning several years and two countries, I was in

no hurry to leave. By the time we were ready to depart, a crowd of about 30 curious villagers, young and old alike, had gathered to watch the proceedings. Although some of the clumps of *Calamus arborescens* might have been natural, most were primarily cultivated or semi-cultivated. Historically this outstanding ornamental was reported as being common and widespread in Ayeyarwaddy, Yangon, and Bago divisions but most of the suitable habitat in these areas has been converted to growing rice or pastureland, and this species now seems to be rare. It primarily survives in the village where we found it because the local people use the leaves for thatching roofs. They report that they can defoliate the plant once every three to four years.

We were a happy crew as we drove back to Yangon, even stopping along the way to photograph and collect *Calamus guruba* again (Figs. 12 & 13), a climbing rattan with dark, triangular spines.

The bat research team from the Harrison Institute arrived in Yangon on November 5 and we spent a day making introductions, checking our gear, buying supplies, obtaining airplane tickets to Myeik in Taninthayi Division, and securing government permits for travel. Although we had initially intended to fly out of Yangon for Myeik on November 7, aircraft were unavailable for a day and our flight were canceled, allowing us ample time to recheck our gear and supplies and do some additional sightseeing. Finally on November 8 we were in the air and headed for Myeik and some promising bat and palm exploration.

Our first trip out of Myeik was to Pahtaw Island, several kilometers off the coast to the west. *Nypa fruticans*, the mangrove palm, formed vast, extensive colonies in estuarine areas on Pahtaw Island and on some of the other islands we passed and on the mainland as well. We landed in a small

12 (left). The clustering, climbing rattan *Calamus guruba* has regularly pinnate leaves and long flagella. Near Wanbeinn Village, Bago Division (*Hodel et al. 1950*). 13 (inset). Leaf sheaths of *Calamus guruba* are distinctive in their triangular, dark reddish-brown-tipped spines. At the sheath mouth there are a few extra long, slender, needle-like spines and a conspicuous, long, tattered ocrea (*Hodel et al. 1950*). 14 (right) *Salacca wallichiana*, with short, creeping trunks and long, ascending, plumose leaves, is a conspicuous element of coastal forests on Pahtaw Island near Myeik, Taninthayi Division.

village and after partaking in some tea and cookies began to walk along a track paralleling the coast before heading inland to explore some caves known to harbor bats. *Areca catechu*, *Cocos nucifera*, and *Salacca wallichiana* (Fig. 14) were common if not abundant near the immediate coast and up to about 500 meters inland. In remnants of moist secondary forest at about 30 meters elevation I collected *Calamus concinnus*, noted for its creeping, shortly erect stems that show no tendency to climb (Fig. 15).

After about 45 minutes of walking, we arrived at the first "cave," which turned out to be a tunnel dug by the Japanese Army during World War II. While the bat team remained at the cave to set up nets and equipment to collect bats, a village boy and I headed farther up the trail to the pagoda at the island's summit. In moist forest on steep slopes at about 150 meters elevation along the trail I collected what I tentatively referred to as *Calamus burkillianus* (Fig. 16), basing my determination on the large, regularly long-pinnate leaves, presence of flagella, and, particularly, the sparsely armed leaf sheaths (Fig. 17). Unfortunately, I found only one sterile plant. If it is *C. burkillianus,* it is a new record for Myanmar. Nearby I collected *Calamus palustris*, noted for the cirrus at the leaf tip and the relatively few pinnae clustered in groups of two along the rachis (Fig. 18).

The next day our group split into two smaller groups, one venturing out to one of the large, offshore islands to look for bats around pagodas, temples, and other structures while the other group traveled inland to investigate limestone hills and caves around the village of Tharabwin in the interior of Taninthayi Division. The two groups would reunite five days later for a boat trip south through the Myeik Archipelago. I went with the second group because I was eager to explore some of the limestone areas for palms.

15 (left). The non-climbing rattan *Calamus concinnus* has creeping, shortly erect stems and was common in coastal forests on Pahtaw Island near Myeik, Taninthayi Division (*Hodel et al. 1953*). 16 (right). This climbing rattan on Pahtaw Island near Myeik, Taninthayi Division, which I tentatively refer to as *Calamus burkillianus*, has long, regularly pinnate leaves, flagella, and sparsely armed leaf sheaths (*Hodel 1951*). 17 (inset). Leaf sheaths of the tentatively identified *Calamus burkillianus* are distinctive in their few, solitary or paired, yellowish spines and prominent, knob-like knee (*Hodel 1951*).

After saying our farewells to the first group, we departed on the morning of November 10 on a hired bus for the two-hour ride to the small town of Taninthayi on the banks of the great Taninthayi River. We stopped twice to pick up about a dozen Myanmar army troops and local law enforcement personnel. Accompanying us everywhere we went, their presence was required under the terms of our permit to be in the area and conduct scientific research. They were purportedly required to protect us from insurgents who fomented civil and political unrest in the hinterlands of Taninthayi Division. They were a good-natured group, always laughing and seeing the lighter side of the most trying circumstances and even helping with collecting bats or palms. By the end of our five days in Tharabwin they had become our good traveling companions.

On the road to Taninthayi in remnants of seasonally moist secondary forest, mostly along streams or in low, wet areas, I observed *Caryota mitis* and *Salacca wallichiana* and several climbing rattans, including *Calamus longisetus*, *C. myrianthus*, *C. palustris*, *C. tenuis*, *C. viminalis*, *Daemonorops jenkinsiana* and *D. kurziana*. On hillsides and mountain slopes isolated individuals and small groups of *Livistona jenkinsiana* stood as lonely sentinels. Unfortunately, nearly all the forest in the area had been destroyed or was highly

18 (above). The climbing rattan *Calamus palustris* is a member of the *C. latifolius* complex of species characterized by the pinnae clustered in groups and a cirrus at the leaf tip. Pahtaw Island near Myeik, Taninthayi Division (*Hodel 1952*).
19 (below). Vast stands of *Areca catechu*, the betel nut palm, lined the Taninthayi River and adjacent hillsides on the way to Tharabwin Village. Betel nut is a major cash crop of Taninthayi Division.

20 (left). Betel nut palm fruits are sometimes distinctively scraped prior to drying. Tharabwin Village, Taninthayi Division. 21 (right). Halved betel nut palm fruits, showing the seed (betel nut) positioned at one end, dry in the sun in Tharabwin Village, Taninthayi Division.

disturbed. Remnant patches of tall, apparently undisturbed, tropical evergreen forest, the best habitat for palms, was restricted to steep slopes and hilltops quite some distance from the road.

At the road's end at Taninthayi Village we boarded a boat for the four-hour trip up the Taninthayi River to Tharabwin, our headquarters for five days of work in the area. From the open boat under a blazing tropical sun I could see vast groves of *Areca catechu* (betel nut), primarily cultivated but some semi-wild, lining the river and covering adjacent hillsides (Fig. 19). In Tharabwin large quantities of fruits were commonly seen drying in beds and on large tables (Figs. 20 & 21). Betel nut is a major cash crop of this region of Taninthayi Division. Villagers in Tharabwin stated that one *viss* (1.6 kilograms or 3.6 pounds) of betel nuts sells for 700 to 1000 *kiat* (about US $1 at the time). Other cash crops of the region include rattan canes, rubber and cashew nuts.

Because there is no hotel in Tharabwin, we were housed in private homes, men in one and women in another. The men's quarters were upstairs in a home on the main street. I delighted in waking early, stepping out on to the balcony to watch Tharabwin, a charming village, coming to life in the early morning light. Dogs, pigs and chickens aimlessly roamed the street. Children ran here and there, always shouting and laughing. Betel nut fruits, picked up the previous evening, were again spread out on the ground to dry. Vendors, mostly women with children in tow, started or tended fires to cook snacks for passersby. Other women, balancing trays of green coconuts, sticky rice, pastries or other food items on their heads, strolled the street searching for buyers. The occasional bullock cart, there were no motorized vehicles in Tharabwin, and men and women carrying heavy loads moved endlessly up and down the street going to or coming from the dock on the Taninthayi River.

We ate breakfast and dinner in a private home just across the street from our quarters. Each morning after breakfast, we would begin our trek out to various sites surrounding Tharabwin. These sites were limestone hills riddled with caves and required two to four hours walking one way. Because we had so much gear for trapping and collecting bats, we hired a bullock cart and driver to accompany us. Although we usually walked, a few of us rode in the bullock cart with the bat gear from time to time, but it was an unusually rough ride, making one wonder about the merits of riding rather than walking.

We visited three different limestone hills in three days, returning to the first site on our fourth and final day. The vegetation and palms were more or less the same at the three sites. Most of the forest has been destroyed or is highly disturbed secondary forest. Among the limestone rocks at about 40 meters elevation I observed the large, solitary *Arenga westerhoutii* (Fig. 22) with regularly pinnate leaves, dark green above and rusty silver-gray below, and the multi-stemmed *Caryota mitis*. I collected the climbing rattan *Calamus rudentum* (Figs. 23 & 24), a new record for Myanmar, which has leaf sheaths ferociously armed with whorls of large triangular, straw-colored spines with extra long spines at the sheath mouth; regularly pinnate leaves; and long, whip-like flagella. Unfortunately, I did not find any *Rhapis* or other limestone-dwelling palms such as *Maxburretia*.

In forest remnants in low, wet areas at the base of the limestone cliffs and rocks I collected the small, shrubby *Arenga caudata* (Fig. 25) and the climbing rattans *Calamus myrianthus*, *C. tenuis* (Figs. 26 & 27), *C. melanacanthus* (Figs. 28 & 29) and *Daemonorops jenkinsiana*. On drier, gently sloping hillsides in grain fields I saw the large fan palm *Livistona jenkinsiana* (Fig. 30).

I refer to *Calamus melanacanthus* only tentatively, as it was sterile, and additional collections of flowers or fruits may show it to be *C. diepenhorstii*, a species heretofore known from peninsular Thailand and Malaysia. Occurring in dense, secondary forest, this rattan has regularly pinnate leaves, flagella and distinctively and attractively armed leaf sheaths. Of uniform length and size, the short, upswept, densely placed, dark spines with hairy or floccose margins are solitary or arranged in short, curved, partial whorls. Because of the dense, short, dark nature of the spines, the leaf sheaths appear to be fuzzy or covered with short hairs when viewed from a distance. Further study may show that *C. diepenhorstii* is synonymous with *C. melanacanthus*. Because *C.*

22 (left). *Arenga westerhoutii*, with regularly pinnate leaves dark green above and rusty silver-gray below, was conspicuous on limestone hills and rocks near Tharabwin Village, Taninthayi Division. 23 (right). The large, climbing rattan *Calamus rudentum* has regularly pinnate leaves and long flagella. It grows on limestone hills and rocks near Tharabwin Village, Taninthayi Division (*Hodel 1959*). 24 (inset). Leaf sheaths of *Calamus rudentum* are ferociously armed with whorls of large triangular, straw-colored spines with extra long spines at the sheath mouth (*Hodel 1959*).

25 (above). The shrubby, understory palm *Arenga caudata* with toothed pinnae dark green above and silvery gray below, is common in forest remnants near Tharabwin Village, Taninthayi Division, and makes a handsome ornamental (*Hodel 1954*). 26 (below, left). *Calamus tenuis* was uncommon on limestone rocks near Tharabwin Village, Taninthayi Division (*Hodel 1956*). 27 (inset). Leaf sheaths of *C. tenuis* from Taninthayi Division have much shorter spines than those in Rakhine State (*Hodel 1956*). 28 (right). This climbing rattan near Tharabwin Village, Taninthayi Division, which I tentatively refer to as *Calamus melanacanthus*, has regularly pinnate leaves, flagella, and distinctively armed leaf sheaths (*Hodel 1957*). 29. (inset). Leaf sheaths of the tentatively identified *C. melanacanthus* bear attractive and distinctive armor. Of uniform length and size, the short, upswept, densely placed, dark spines with hairy or flaccose margins are solitary or arranged in short, curved, partial whorls (*Hodel 1957*).

30 (left) *Livistona jenkinsiana* occurs in a variety of habitats in the region from Myeik to Tharabwin Village in Taninthayi Division. It frequently survives forest clearing, as seen here in a grain field. 31 (right) *Calamus myrianthus*, probably the most common rattan in the region surrounding Tharabwin Village, Taninthayi Division, is easily distinguished by its flagella and few, irregularly arranged, well spaced, multi-nerved pinnae green above and mealy to chalky white below (*Hodel 1955*). 32 (inset) Leaf sheaths of *C. myrianthus* have a mixture of needle-like spines and green-based, brownish tipped, upward-pointing, triangular spines with a few extra long ones at the sheath mouth (*Hodel 1955*).

melanacanthus is an older name, it would have priority. If the collection actually turns out to be *C. diepenhorstii* and it is distinct from *C. melanacanthus*, then the former is a new record for Myanmar.

Calamus myrianthus (Figs. 31 & 32) is probably the most common rattan in the area and occurred wherever there were patches of forest. It is easily distinguished by its few, irregularly arranged, well spaced, multi-nerved pinnae, green above and mealy to chalky white below; long flagella; and leaf sheaths armed with a mixture of needle-like spines and green-based, brownish tipped, upward-pointing, triangular spines with a few extra long ones at the sheath mouth.

On several occasions on our treks from Tharabwin out to the limestone hills I saw extensive expanses of what appeared to be undisturbed, tropical evergreen forest, prime palm habitat, several kilometers distant on ridge tops and hillsides. The local villagers called this "tall forest," and I was just "itching" to get into it. But each time I expressed a desire to visit these areas to look for palms, our military escorts denied me permission to do so, citing safety concerns because dangerous insurgents purportedly were lurking in the forest.

On the morning of November 15 we had several hours of free time before our boat was scheduled to depart downriver for Taninthayi and our bus back to Myeik. So after packing our gear and collections, a few of us strolled out to the south end of Tharabwin to visit a rattan depot on the banks of the Taninthayi River. There we observed large bundles of at least six different kinds (sizes) of rattan canes that had been brought on rafts downriver to the site for additional processing and eventual sale (Fig. 33).

The return trip to Myeik was uneventful but involved a several hour layover in Taninthayi while we hunted for a bus. Once enroute to Myeik, we stopped so I could photograph a thicket of *Calamus tenuis* near Banshawn and farther on,

33. Bundles of at least six different kinds (sizes) of rattan canes that had been brought on rafts downriver to this rattan depot at Tharabwin Village, Taninthayi Division await additional processing, sorting, and eventual sale.

near Dalashaung and Pharame villages, I spotted two species of *Daemonorops* but, because it was too late to stop, I made arrangements to return the next day to collect and photograph these rattans. Upon arrival in Myeik, we had a happy reunion with the other bat research team, which had a successful trip exploring nearby coastal islands.

The next day we made final arrangements and purchased supplies for our five-day cruise south through the Myeik Archipelago. There was sufficient free time to allow me to hire a car and return on the road back to Taninthayi Village to see the two *Daemonorops* I had observed the previous day. Near Dalashaung Village, growing on a slope above the road, I collected *D. kurziana* (Figs. 34–36), which differs from *D. jenkinsiana* in its fewer, wider, more remotely spaced pinnae. Not too far away near Pharame Village, growing along a stream next to a rubber plantation, was *D. jenkinsiana* (Fig. 37). Both these *Daemonorop*s are in a group of closely related and difficult-to-distinguish species, including *D. angustifolia*, *D. sepal*, and *D. melanochaetes*, among others, characterized by their short inflorescences with all the bracts enclosed within one outermost bract, the entire structure somewhat resembling an unhusked ear of corn. Further work is needed to clarify the species in this complex. Late that afternoon I took a short walk from the hotel and observed *Caryota mitis* and *Salacca wallichiana* growing along a stream in a residential area.

On November 17 we departed Myeik for a five days cruise south through the Myeik Archipelago bound for Kawthoung, the most southerly town in Myanmar, where we would then fly back to Yangon. We had chartered a sleek, fast, inter-island

34 (below). The climbing rattan *Daemonorops kurziana*, which differs from *D. jenkinsiana* in its fewer, wider, more remotely spaced pinnae, grows on a hillside beyond Dalashaung Village near Myeik, Taninthayi Division (*Hodel et al. 1960*). 35 (inset). Leaf sheaths of *D. kurziana* are densely armed with various sizes and types of spines. (*Hodel et al. 1960*).

36. Infructescences of *Daemonorops kurziana* are short and compact. Dalashaung Village near Myeik, Taninthayi Division (*Hodel et al. 1960*).

37 (below). Leaf sheaths of *Daemonorops jenkinsiana* are densely armed with a variety of long spines and Infructescences are short and compact, as those of *D. kurziana*. Pharame Village near Myeik, Taninthayi Division (*Hodel et al. 1961*). Both these *Daemonorops* are in a group of closely related and difficult-to-distinguish species, including *D. angustifolia*, *D. sepal*, and *D. melanochaetes*, among others, characterized by their short inflorescences with all the bracts enclosed within one outermost bract, the entire structure somewhat resembling an unhusked ear of corn.

passenger ferry that would be our floating home for five days. Because it was not set up for overnight passengers, there were no showers, eating facilities, or quarters for sleeping. We simply threw our sleeping bags on the passenger seats, ate on benches on the top deck, and took quick sponge baths in the two tiny, cramped restrooms or bathed in fresh water streams on the islands if the opportunity arose. The fresh water brought on board was primarily restricted for cooking and drinking. The crew was excellent and helpful. The cook and his helpers were especially creative and resourceful, and prepared all the meals for our large group in immense kettles on propane burners on the back steps leading from the engine room to the aft deck. We were a rather large group when we finally departed Myeik, our numbers swollen by the addition of ornithologists, cave explorers, and another contingent of Myanmar army troops as security escorts.

The Myeik Archipelago includes over 800 islands, most of them uninhabited, of which only a few are limestone. Our two main objectives in the archipelago were a tight group of four, small, limestone islands about 130 kilometers south of Myeik and just east of Pan Daung Island, and Lampi Island, about 215 kilometers south of Myeik. We passed many islands as we cruised from Myeik, all heavily forested with thick, dark green vegetation extending from the mountaintops down to the beach, and just begging to be explored for palms. They stood in stark contrast to the mainland, such as areas around Taninthayi where we had stayed for five days, which was mostly deforested.

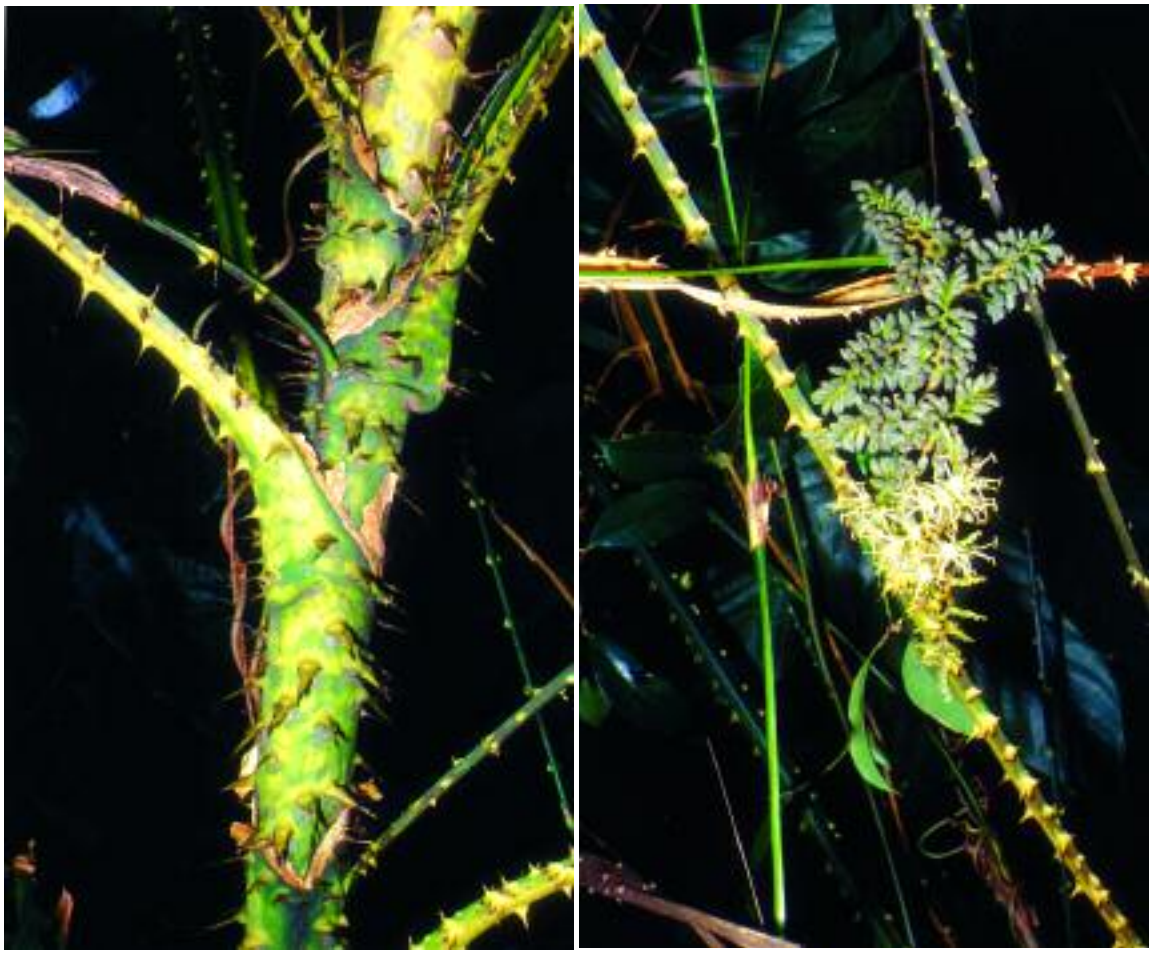
We arrived at Pan Duang Island in the late afternoon, slipping dramatically right between the

four small limestone islands on the way, and moored for the night about a kilometer off shore. We arranged for some smaller boats to transport us to Pan Duang Island and the limestone islands. The cluster of four limestone islands arises abruptly from the ocean. All four have vertical sea cliffs and otherwise steep slopes of razor-sharp, pitted, fissured karst limestone covered with scrub forest, of which many plants are of a succulent nature. Although I observed no palms on these limestone islands, I did spot numerous individuals of a cycad, *Cycas clivicola*, a new record for Myanmar, clinging tenaciously to the cliffs and steep slopes. Because it was late in the day we decided not to land and explore these limestone islands and instead returned to the main boat, planning to return the next day to explore for caves, bats and palms.

Early the next morning our large group scattered in several directions in small boats. Two groups went to Pan Duang Island to look for birds while the rest of us headed back to the limestone islands. After some searching we found a suitable landing location on one of the limestone islands, Kyauk (Thin Bone) Island or Yay Aye Island, and a bat team member and I were dropped off, the small boat taking the others to explore for caves at other sites and planning to return to pick us up in two hours. We climbed up the steep, rough but dangerously sharp, nearly vertical limestone and were able to make a collection of the *Cycas clivicola* with its bizarre, pendant, saxophone-shaped trunks hanging from the cliffs and slopes.

Late that afternoon I landed on Pan Duang Island for less than an hour, not far from a fish-processing plant and opposite Kyauk Island, primarily to bathe in a nearby freshwater stream. The area was rich in palms. In coastal forest just back of the beach and in low wet areas near the stream I observed *Calamus concinnus*, *C. longisetus*, *C. rudentum*, *Daemonorops jenkinsiana*, *D. kurziana*,

38 (left) *Calamus luridus* is a small to moderate-sized, clustering rattan with flagella and relatively few, irregularly spaced, remote pinnae. Lampi Island, Myeik Archipelago, Taninthayi Division (*Hodel et al. 1963*). 39 (right) Leaf sheaths of *Calamus luridus* are densely armed with yellowish green, bulbous-based spines (*Hodel et al. 1963*).



40 (left). Leaf sheaths of *Calamus peregrinus* have large, scattered, triangular spines, a conspicuous knee, and a quickly disintegrating ocrea at the sheath mouth. Lampi Island, Myeik Archipelago, Taninthayi Division (*Hodel et al. 1964*). 41 (right). Staminate flowers of *C. peregrinus* are fragrant and cream-colored with long, conspicuous stamens (*Hodel et al. 1963*).

and *Korthalsia laciniosa*, the latter having handsome, diamond-shaped pinnae with jaggedly toothed margins. Unfortunately, there was no time to make collections or take photographs due to our imminent departure for Lampi Island.

Lampi Island probably held the most promise for palm exploration of any site during the expedition. Relatively large, about 40 kilometers long, it is, like most of the other islands in the Myeik Archipelago, densely covered with undisturbed, primary, tropical forest and is uninhabited, so I was quite excited at the prospect of landing and exploring for palms. We arrived during the night and docked at a fish processing plant at a village on Warkyune (Dolphin) Island, just off the east coast of Lampi Island.

Early the next morning, I joined a group of bird explorers and took a small boat to the east coast of Lampi Island for a quick look. We did not have much time because later in the morning we planned to move to the west side of Lampi Island where there was better anchorage and access to freshwater streams. We made a beach landing and at the high tide line in secondary coastal forest and scrub at the beach's edge I observed *Calamus longisetus*, *C. palustris*, *C. rudentum*, *Daemonorops jenkinsiana*, and *Plectocomiopsis geminiflora*, all climbing rattans. Several of the plants were actually on the beach and had foliage burned from splashing salt water.

About 50 meters inland in moist primary forest I observed seedlings of *Livistona jenkinsiana* and hastily collected the climbing rattans *Calamus luridus* (Figs. 38 & 39) and *C. peregrinus* (Figs. 40 & 41), the latter two being new records for Myanmar. Both rattans lack a cirrus at the leaf tip but possess flagella for climbing. The former is a small to moderate-sized, clustering rattan with

42. A girl in Kyaiktia Village, Mon State prepares betel nut for sale by placing bits of the chopped seed together with pieces of lime and a dollop of a cream-colored pasty clay, and wrapping it all in piper leaves.

densely spiny leaf sheaths and relatively few, irregularly spaced, remote pinnae. The latter is a large, solitary rattan with scattered, triangular spines, numerous, regularly spaced pinnae, and fragrant, cream-colored, staminate flowers.

During breakfast back at the boat we began our cruise to the west coast of Lampi Island. We had been underway for about an hour when suddenly the boat came to a lurching halt. We had become grounded on an unseen reef. After waiting three hours for the tide to rise sufficiently, we were able to float free but the grounding had damaged the propeller drive shaft, necessitating a return to the dock at Warkyune Island for repairs. We spent the night at Warkyune Island and the morning of November 20 set off once again for the west coast of Lampi Island. Unfortunately and sadly, disaster struck the expedition shortly after breakfast in the tragic drowning death of one of the Burmese boat crewmembers who had become our good friend. We immediately changed course and headed directly for Kawthoung, our final port of destination about six hours away. Upon arrival the grieving family of the victim met our boat and later we learned that the military officials had revoked our permit to be in the area, effectively cutting short our exploration and research in the Myeik Archipelago two days prematurely.

After overnighting in Kawthoung, our somber group flew back to Yangon the next afternoon. Because we were now presented with a few extra days, we decided to visit the Golden Rock, a sacred Buddhist site in Mon State, a half-day bus journey northeast of Yangon. The location was sufficiently high that there was evergreen forest, so there was the prospect of seeing palms.

On November 22 we headed for the Golden Rock in our hired bus. At Kyaikto at the base of the mountain upon which the Golden Rock sits, we were required to transfer to open-backed trucks fitted out with hard, wooden benches; these trucks would take us part way up the mountain on a narrow, single-track, winding road that has one-directional traffic at timed intervals. As the road from Kyaikto winds upwards into the mountains, at 300 to 800 meters elevation I observed an *Arenga* species, *Calamus longisetus*, *Caryota maxima*, *Livistona jenkinsiana*, and a *Pinanga* species with mottled leaves growing in moist forest, especially along streams.

About half way up the mountain we arrived at another transfer point, a small village teaming with religious pilgrims preparing for the trek to the Golden Rock, vendors selling a plethora of goods, and pushy porters who vied and jostled among themselves for the opportunity to carry our gear for the remainder of the trip up the mountain. As in other areas throughout Myanmar, vendors were preparing betel nut for sale by placing bits of the chopped seed together with pieces of lime and a dollop of a cream-colored pasty clay to enhance the flavor, and wrapping it all in piper leaves (Fig. 42).

Betel nut contains a mild narcotic that produces a pleasant, soothing feeling. Betel nut chewing reddens the saliva and often darkens the gums and teeth. The ground around areas where chewers congregate is usually stained red from the spat

43 (left). *Calamus henryanus* has regularly pinnate leaves and long-flagelliform inflorescences (looping to the right and then going up to the left of the stem). Mt. Kyaikhtiyo (Golden Rock), Mon State (*Hodel 1967*). 44 (right). Leaf sheaths of *C. henryanus* have a light brownish to cream-colored, felt-like covering and greenish, generally upward-pointing, triangular spines with a few extra long ones at the sheath mouth and base of the petiole (*Hodel 1967*). 45 (inset). Partial inflorescences of *C. henryanus* appear spike-like because of the short, appressed rachillae (*Hodel 1967*).

saliva. A popular and often-told story states that when one person was asked why he chewed betel nut, he responded by smiling pleasantly and rolling his eyes up before beginning to chew again.

Only Burmese were allowed to ride in vehicles from this village to the top of the mountain and the Golden Rock. Foreigners were required to walk the remaining three kilometers. Although the walk was steep and the sun was hot, it was not too trying because the porters were carrying our gear up to the hotel and numerous enterprising vendors had set up stands along the route, providing ample opportunity to stop, rest, and have a drink or other refreshment. Also, the wide variety of souvenirs and handicrafts, herbs and animal parts for medicinal use, and other diverse items offered for sale was nothing short of astounding and easily captured one's interest and distracted one from the onerous walk. Chairs lashed to two, sturdy bamboo poles and manned by four strong porters were available for a fee to carry the truly weary walker or the faint of heart to the summit. However, because fatigue was not great enough to overcome the embarrassment of having to be carried up the mountain, all of us declined the porters' persistent solicitations to indulge in such extravagance.

Upon arrival at Kyaik-tia Village at the summit and checking into our hotel, I asked at the front desk if there were any streams in the area. I suspected that there would be forest, and hopefully palms, around any permanent water sources. The hotel manger said there was a stream that served as the hotel's water supply a short distance down the north slope of the mountain. The manager sent a young man who worked at the

hotel to guide me to the site. As it was late in the day we made a quick 30-minute descent to the small stream, and there in moist forest at about 900 meters elevation I collected the climbing rattan *Calamus henryanus*, a *Pinanga* species with mottled leaves and *Wallichia caryotoides*.

Calamus henryanus (Figs. 43–45), a new record for Myanmar, has regularly pinnate leaves and long-flagelliform inflorescences with partial inflorescences appearing spike-like because of the short, adpressed rachillae. The mottled-leaved *Pinanga* is similar to if not identical to the one I collected in March near the Chin State/Rakhine State border. It is also probably the same as one that occurs at similar elevations in western Thailand and should be expected in Laos, southwestern China, and eastern India. It was dark by the time I had completed making the collections and taking the photographs. With the aid of a small lamp we stumbled back up the trail to the hotel, which in the dark seemed to take two or three times as long as our descent.

The next morning I made a quick visit to the Golden Rock (Fig. 46) before our departure to Yangon. Back in the capital the next day I visited Yangon University and dropped off the duplicate set of collections, finished sorting and repacking my gear, and then attended a farewell dinner where I said my good-byes to our Myanmar colleagues and discussed the possibility of a return trip to complete our work in the Myeik Archipelago. Although an exciting and rewarding expedition, our enthusiasm was tempered somewhat by the tragic and sad circumstances surrounding the death of our Myanmar friend.

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I gratefully acknowledge The Southern California Chapter of the International Palm Society and the Montgomery Botanical Center for partially supporting my participation on these two expeditions. I also thank the Harrison Institute and the Zoology Department of Yangon University, whose unusually capable, personable and professional staff members were unsurpassed traveling companions and instrumental in making both expeditions richly rewarding and thoroughly enjoyable, at times under the most trying of circumstances. Malcolm Pearch provided maps.

46. The Golden Rock on Mt. Kyaikhtiyo, Mon State is one of the most heavily visited Buddhist shrines in Myanmar.

Edible Palms of Southern Ecuador

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1. *Aiphanes grandis* in Cerro Azul, El Oro, a palm endemic to Ecuador.

In southern Ecuador 26 edible palm species were recorded during a study of wild edible plants. These grow mainly in humid coastal and Amazonian lowlands. Most palms have edible palm hearts or edible fruits. The indigenous Shuar people, especially, know and use many palm species.

From 1994 onward, we have carried out research into the wild edible plants of southern Ecuador. The first step was to make an inventory of all wild edible plants in the area, for the Centro Andino de Tecnología Rural (CATER) of the National University of Loja in Ecuador. Research then continued with studying the cultivation potential of certain species and the traditional management of wild plants by local farmers.

The study area of about 30,000 km^2 is formed by the southern provinces of El Oro, Loja and Zamora-Chinchipe (3°30′ to 5°00′ S, 78°20′ to 80°30′ W). Altitude ranges from 0 to 3800 m. The relief is dominated by the Andes, which divide the region into three major geographical areas: coast, Andes and Amazonian area. In southern Ecuador, the branching out of the Andean mountain ranges in all directions creates a very irregular relief. Together with various climatic influences, this results in a large diversity of ecological zones within a relatively small area. For example, within one hour's drive by car from the Andean town of Loja (where we lived), you can be in a hot semi-arid valley (Catamayo), in a dry temperate valley (Vilcabamba), in cold humid mountains (San Lucas) or in a humid tropical environment (Zamora). One important consequence of this diverse ecology is an enormous plant richness. An estimated 6200 species of higher plants grow in southern Ecuador (Jørgensen & Léon-Yánez 1999). The population in the region is 95% mestizo, with small communities of indigenous Saraguros in the Andes and Shuar in the lowland Amazonian region.

Palms always stood out in our research, first of all quite literally, because they are so clearly visible in the landscape. In the largely agricultural coastal and Andean landscape, palms are often tolerated in pastures or home-gardens, and are some of the few trees left in the landscape. Even in patchy forest remnants and in the extensive Amazonian forests, palm trees usually tower above other tree species. A second reason they always stood out is that they would not fit into our plant press. Used to collecting 'ordinary' plant specimens, we were at first puzzled as to how to fit a palm leaf or inflorescence onto a standard herbarium sheet. Simply being able to reach the leaves seemed impossible, especially for those palms covered in vicious spines. The first collected palm samples, where we brought back small leaf parts and fallen fruits, caused hilarious laughter from Henrik Pedersen, the Danish palm specialist then working at Loja herbarium, when we asked him to identify these palms. He showed us how to collect palm specimens properly, folding massive leaves and inflorescences back to 30 × 40 cm samples and then encouraged us to collect any interesting palm we would come across, as they were so under-collected compared to other plant families (because they are indeed so awkward to collect). This way we got to eat a lot of delicious fresh palm heart.

Henrik's advice meant that the Loja herbarium gained 40 complete palm specimens (and the extra cupboards we had to buy to fit them all in). Another small hiccough was the fact that cardboard boxes to store them in were impossible to get hold of in Ecuador, so we resorted to making our own to size from sheets of cardboard. Many an hour was spent cutting and folding boxes, so the palms remained exceptional until the end.

The idea to write this article was suggested by Dennis Johnson, who informed us that we had recorded for the first time that juvenile inflorescences of *Dictyocaryum lamarckianum* are eaten. Rather than write about that species alone, we decided to include in this article all the information we collected on palms in southern Ecuador.

Where palms grow in southern Ecuador

Of the 354 species of wild edible plants we recorded in southern Ecuador (Van den Eynden et al. 1999; Van den Eynden et al. 2003; Van den Eynden 2004), 26 are palms. They are the second most represented plant family. The majority of palms grow in the coastal and Amazonian humid lowlands and up to 2000 m altitude. Eleven species were found in the coastal area and eighteen in the Amazonian region. Five species grow on both sides of the Andes. Only three species are found in the Andes above 2000 m. Five species – *Aiphanes grandis*, *A. verrucosa*, *Astrocaryum urostachys*, *Ceroxylon echinulatum* and *Phytelephas aequatorialis* – are endemic to Ecuador (Jørgensen & Léon-Yánez 1999).

Palm trees are fairly abundant in relatively intact forests, like those found on the eastern Andes slopes and in the Amazonian region, where few people live. In the Andes and the coastal areas, few forests remain today. Palm trees may be found here in small forest remnants or as managed trees in the agricultural landscape. Many edible plants in southern Ecuador are indeed not strictly wild, but are managed by farmers within the agricultural area (Van den Eynden 2004). Plants may be sown or planted, wild plants may be transplanted and spontaneously grown plants may be tolerated. Such managed plants are found in all parts of the agricultural area, but mostly in gardens, pastures and hedges.

Palm trees are still relatively abundant in pastures in recently colonized areas in the humid coastal

2. *Ceroxylon echinulatum* palms tolerated in a maize field in Chalanga, Loja.

lowlands (Casacay, Cerro Azul) and on the Amazonian slopes (Quebrada Honda, Tutupali). In other areas that have been farmed for centuries, palms are a lot rarer. Some individual trees may be found planted in gardens and villages. In the Amazonian region, where palms are relatively abundant, Shuar people also plant and manage species such as *Bactris gasipaes*, *Mauritia flexuosa* and *Astrocaryum urostachys* in their gardens and in the forest.

How palms are used

Most palm trees in southern Ecuador have edible palm heart (21 species) or edible fruits (11 species). It is usually the fruit mesocarp, sometimes the endosperm or seed that is edible. Of one species,

3. The edible juvenile inflorescence of *Dictyocaryum lamarckianum*.

Dictyocaryum lamarckianum, the immature inflorescence is eaten. In the Andean region, palm heart is an important ingredient of the traditional dish *fanesca*, which is prepared on Good Friday. *Fanesca* is a stew made of various grains, beans, pulses, root vegetables, pumpkins, dried fish and rice, garnished with shredded palm hearts, hardboiled eggs, cheese, fish and chili peppers. The heart of any palm species can be used, but *Prestoea acuminata* is the most common in the Andes. This is often the only time of year people in Andean communities harvest palm heart, mainly because there are so few trees left.

Palms in the coastal region and western Andean foothills

In the humid coastal lowland area in the north of El Oro province, an area with evergreen lowland and premontane vegetation (Casacay, Cerro Azul), we find many palm species tolerated in pastures. *Iriartea deltoidea* is a solitary palm, locally known as *pambil*, that grows from 400 to 1900 m above sea level. Its palm heart is eaten raw or cooked. The juvenile fruits can be eaten too. *Bactris setulosa*, named *chontilla*, is found at altitudes from 100 to 1400 m. This multi-stemmed palm with black spines has an edible palm heart. Its wood is used for making fencing posts. *Bactris macana* (*chonta*), another multi-stemmed spiny palm grows in humid areas, but also in slightly drier regions (Orianga), at altitudes from 600 to 1300 m. The red spherical fruits (2 cm diameter) are cooked or roasted and the pulp (mesocarp) is eaten The palm heart is eaten raw or cooked. The wood is used for joists and rafters in house construction and for fences. Other species with edible palm hearts are *Euterpe precatoria* (*palmo real*), a solitary palm growing between 900 and 1300 m above sea level, *Prestoea ensiformis* (*caño*), a solitary palm with red stilt roots found between 500 and 1200 m above sea level, and *Wettinia kalbreyeri* (*pambil*), a solitary palm with thick stilt roots, found between 700 and 1200 m. The wood of this last palm is used for house construction and fences.

The endemic palm *Phytelephas aequatorialis* (*tagua*), is found up to 1500 m above sea level. The palm heart is edible. The liquid inside juvenile fruits can be drunk and is considered to be good for the kidneys. Mature seeds are used for carving as vegetable ivory. The leaves can be used for thatching and brooms are made from the fibers of the leaf bases. *Attalea colenda* (*chivila*) has seeds from which oil can be extracted. Although locally the plant is not used for this purpose, the orange oval fruits about 6 cm long are fed to pigs. This palm normally grows between 400 and 500 m, but was found introduced in gardens in Orianga at 1300 m altitude.

At higher altitudes, in areas with humid montane vegetation, we find *Aiphanes grandis* (*chonta*) (Fig. 1) between 1100 and 1700 m above sea level. This palm with very long black spines is endemic to Ecuador. The palm heart is eaten raw or cooked. The seeds can be made into a nougat – the fruits are boiled in water and the seeds then pureed and cooked with crude cane sugar until the mixture thickens. *Ceroxylon echinulatum* (*palma*) (Fig. 2) is a solitary palm with red spherical fruits (2 cm diameter) with edible seeds, which are roasted or cooked before eating. This endemic Amazonian palm was found in humid forest and tolerated in maize fields in Loja province at around 1300 m elevation.

Palms in the Andean region

Prestoea acuminata is the palm most widely found in southern Ecuador. It grows at elevations between 800 and 2600 m on both sides of the

4. *Dictyocaryum lamarckianum* inflorescence being harvested in Tutupali, Zamora-Chinchipe.

Andes range. It has various common names that differ from place to place: *palmito*, *caño*, *tinguiso* or *sake*. This multi-stemmed palm with spiny stilt roots has an edible palm heart that can be eaten raw, fried or cooked. *Aiphanes verrucosa* (*chonta*) is endemic to southeastern Ecuador, where it grows between 1800 and 2800 m above sea level. This multi-stemmed palm has clustered black spines and large inflorescences with greenish-white spherical fruits (2–3 cm diameter). The fruits are eaten raw or poached. The leaves are used for thatching. *Ceroxylon vogelianum* (*coco*), a solitary palm with grey trunk is found between 2000 and 3000 m. The small green fruits (1.5 cm diameter) are edible and the leaves are used for thatching.

Palms in the Amazonian region

Many palm trees are used by indigenous Shuar people, who live in the easternmost part of Zamora-Chinchipe province, along the Río Zamora, Río Nangaritza, Río Numpatakaime and their tributaries, at around 900 m altitude. Palms play an essential role in their subsistence. Palm heart and fruits are regularly eaten. *Bactris gasipaes* (*chonta* in Spanish, *uwí* in Shuar language) especially is very important in Shuar culture. The orange fruits (up to 5 cm diameter) are an important food. Each year in April, the *fiesta de la chonta* takes place (Anon. 1977; Borgtoft et al. 1998), celebrating nature's life cycle. *Chicha* made of *uwí* fruits is drunk during these celebrations. The fruits are also eaten after boiling or roasting them, or can be cooked in milk and then pureed into a stew. The palm heart is edible too. *Bactris gasipaes* is often cultivated or managed near the houses.

Palms with edible palm heart eaten by the Shuar are *Astrocaryum urostachys* (*awant'*), *Ceroxylon amazonicum* (*paik'*), *Iriartea deltoidea* (*ampakai*), *Mauritia flexuosa* (*achu*), *Oenocarpus bataua* (*kunkuk'*), *Oenocarpus mapora* (*shímpi*), *Prestoea acuminata* (*sake*), *Prestoea schultzeana* (*tinkimi*), *Socratea exorrhiza* (*kupat*) and *Wettinia maynensis* (*terén*). *Oenocarpus bataua* is considered to have the tastiest palm heart. Palm heart is eaten raw or prepared in *tonga*. *Tonga* are made by wrapping a mixture of fish, meat, vegetables and condiments in large banana, *Canna edulis* or *Renealmia alpinia* leaves. The *tonga* are then roasted in an open fire.

The seeds of the endemic palm *Astrocaryum urostachys* and juvenile fruits of *Iriartea deltoidea* are eaten raw. The fruits of *Mauritia flexuosa*, *Oenocarpus bataua* and *Oenocarpus mapora* are softened in hot water and then eaten. The first species has large oval fruits (7 × 4 cm) covered with red-brown scales. The two *Oenocarpus* species have oval purple fruits of about 3 to 4 cm long.

Palm trees are also used for other purposes. The wood of *Bactris gasipaes*, *Iriartea deltoidea*, *Oenocarpus mapora* and *Socratea exorrhiza* is used for making walls and roof structures of houses. The leaves of *Oenocarpus mapora*, *Prestoea schultzeana* and *Wettinia maynensis* are used for thatching roofs. The rachides (leaf stalks) of *Oenocarpus bataua* and *Oenocarpus mapora* are used for making *huashimas* and in the past for making arrows. *Huashimas* are a type of fish trap made by tying 2–3 m long palm leaf rachides together to a width of about 60 cm. Fish stupefied by throwing fish poison into the river are caught downstream by *huashimas* that have been placed vertically in the water.

The rest of the Amazonian region is inhabited by mestizo colonizers, who also frequently use palm trees. *Bactris setulosa* (*chonta*) grows up to 1400 m altitude. The red fruits (2 cm diameter) are cooked or roasted and the pulp eaten. *Dictyocaryum lamarckianum* (*palma*) (Figs. 3 & 4) grows between 1000 and 1800 m. The juvenile inflorescence of this palm is eaten raw. It is harvested when still surrounded by the bract. This is apparently the first time this use is recorded for this species (Dennis Johnson, pers. comm). *Euterpe precatoria* (*shimbe*), growing between 900 and 1900 m, *Pholidostachys synanthera* (*palma paja cambana*), growing between 900 and 1400 m, and *Wettinia* cf. *maynensis* (*palma*) found at around 1000 m, all have edible palm hearts.

Conclusions

Palm trees are known throughout the neotropics to be useful species. This is confirmed in our study in southern Ecuador, where the palm family is the second most represented family with edible species. Twenty-six edible palms were recorded. They are not only eaten but also used for other purposes throughout the humid areas of southern Ecuador.

The indigenous Shuar people, especially, use and know many different palm species. Palm heart and fruits of twelve palm species form an important part of their diet. Trees are typically cut down to harvest the fruits or palm heart. The cultural importance of palms to Shuar people is also reflected in the names given to them. Shuar people give each palm tree a unique name, whereas mestizo people use more general and vague names like *palma* (palm tree) or *chonta* (spiny palm) for many different palms (Van den Eynden 2004).

The fact that a new palm use was recorded from mestizo colonizers in the Amazonian region (the eating of *Dictyocaryum lamarckianum* inflor-

escences) shows that non-indigenous people also have important and often unrecorded plant knowledge.

Palm trees are commonly found in the forests of the Amazonian region or as tolerated trees in pastures and near houses. In coastal lowlands, palms are still commonly found in areas that have recently been colonized, where they are often left to grow in pastures. In other areas, they are very scarce. This is probably due to a combination of forest clearance and use of the palms, which usually requires them to be cut down. Although palm heart is considered to be a delicacy in the Andean region, and an essential ingredient of the traditional dish *fanesca*, it is not often used nowadays, due to its scarcity.

Distribution ranges given here are for southern Ecuador only and are based on field research and on Borchsenius et al. (1998). Detailed descriptions of each species and its use and distribution, as well as lists of all collected specimens, can be found in Van den Eynden et al. (1999) and Van den Eynden et al. (2003). All collected specimens are held in the LOJA herbarium, with duplicates in the QCA and QCNE herbaria in Quito. No doubt other palms grow and are used in southern Ecuador, but we recorded only edible palms during our research.

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CLASSIFIED

Natalie Uhl Awarded Robert Allerton Medal by the National Tropical Botanical Garden

The 2003 Robert Allerton Award was presented to Dr. Natalie Whitford Uhl by Dr. David Lorence of the National Tropical Botanical Garden (NTBG). The Allerton Award honors an individual who has demonstrated excellence in tropical botany or horticulture and is named for one of the founding trustees and a principal initial benefactor of the NTBG. The award is given either for a specific achievement or to reflect an entire career in science. It consists of a bronze medal designed by Joseph Feher of the Honolulu Academy of Arts and an honorarium of $1000. The biennial meeting of the International Palm Society in Hilo, Hawaii was chosen as a venue to grant Dr. Uhl well-deserved recognition before a group of her peers and fellow palm enthusiasts.

The Robert Allerton Award recognizes Dr. Uhl's lifetime career in plant science. She is a well-known plant systematist, anatomist and morphologist, and, since 1987, Professor Emerita at Cornell University. In 1940 she obtained her bachelor's degree in botany from Rhode Island State College specializing in plant anatomy. Attending Cornell University during the war years, she studied plant anatomy for her Master's degree, which she obtained in 1943. She began her Ph.D. program at Cornell the same year and married Charles Uhl in 1945. After successfully defending her thesis in 1947, she took a 13-year gap from academia to raise four children. In 1963 Natalie was appointed as Research Associate at Cornell and began collaborating with Professor Harold E. (Hal) Moore, Jr. at the L.H. Bailey Hortorium. Together they worked toward a comprehensive synthesis of the genera in the large and economically important palm family. Her numerous detailed studies of the inflorescence, floral structure and development of palms, and her evolutionary surveys throughout the family formed a basis for the classification used by Moore, who died in 1980 before completing his life's work. Uhl then collaborated with Dr. John Dransfield, palm specialist at Royal Botanic Gardens Kew, resulting in the completion of the monumental book titled *Genera Palmarum*, which was finally published in 1987.

Uhl and Dransfield with four new co-authors (Drs. Connie B. Asmussen, William J. Baker, Madeline Harley and Carl E. Lewis) are currently revising *Genera Palmarum* incorporating new molecular data, cladistic analyses and other important advances in knowledge of the evolutionary relationships of palms gained since the 1987 edition. Dr. Uhl served as co-editor with Dransfield of the journal *Principes* (now *Palms*) from 1979 to 2000. It is notable that Natalie Uhl was able to become a distinguished scientist while successfully raising a family of four children, essentially pursuing two full-time careers. Always the dedicated researcher, Natalie was not able to attend the meetings in Hawaii due to publication deadlines. Her colleague, Dr. Scott Zona of Fairchild Tropical Botanic Garden, accepted the award on her behalf at the International Palm Society banquet.

DAVID H. LORENCE

Rat Damage on Native Hawaiian Palms

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1. The last living *Pritchardia remota* leaf when this event was discovered.

Rats can cause catastrophic damage to palms in Hawaii and this can be especially annoying when the palm is a prized indigenous rarity such as *Pritchardia remota*.

Hawaii is graced with twenty-three endemic *Pritchardia* (loulu) palms (Chapin et al. 2004). These extraordinary trees are diverse and captivating. Among the array of introduced species that plague native Hawaii *Pritchardia* palms are rats (*Rattus rattus*, *R. exulans*, *R. norvegicus*). Before any human contact, about 400 AD, the Hawaiian archipelago, the most isolated landmass in the world, had only two native mammals, the monk seal (*Monachus schauinslandi*) and hoary bat (*Lasiurus cinereus semotus*) (Burney et al. 2001), along with about twice as many native birds, many of which were flightless (Olson & James 1982 and 1991, Olson 1989, James & Olson 1991). Fossil evidence suggests that loulu palms dominated lowland, coastal and mid-elevation regions of the Hawaiian island chain (Athens & Ward 1993, Burney et al. 2001, Carlquist 1980, Hotchkiss & Juvik 1999). Then, along came the rat. Early travelers, including the Polynesians and the Europeans, had this stow-away in their vessels and the rats multiplied in the favorable environment of Hawaii. The resulting population explosion of rats changed the native biota radically as these pests, eating eggs and fledglings, reduced the flightless bird populations, as well as feeding on native fruits and seeds (Cuddihy & Stone 1990, Staples & Cowie 2001, Chapin et al. 2004). A major item on the rat's menu was and still is *Pritchardia* fruits, seeds and petioles. It is not uncommon to find isolated populations of *Pritchardia* with immature fruit, no fruit and certainly little or no mature fruit (Chapin et al. 2002), unless the populations are large enough to outnumber the rats and produce more seeds than the rats can devour. The impact of rats is a major factor in the decline of the species. Wild source mature *Pritchardia* seed consistently show up to 100% germination success in cultivation if ripe and fresh (Chapin et al. 2000, Chapin et al. 2001), making seed viability not an issue in the decline.

One day, I came home to find my prized *P. remota* with all but one of its leaves chewed off and only the heart left (Fig. 1). I gathered up the leaves and discovered that each petiole had been devoured one at a time, probably one a night for the last week (Fig. 2). This last one would have been the death of the tree, as it would have included the palm heart. I immediately created an exclosure around the remaining leaf and stem with fencing wire and I set a live trap thinking I would catch the offending rat and resolve the problem. I did catch a roof rat that night (*R. rattus*). I thought it best to reset the trap just in case there were two violators. The second night revealed another rat capture. This continued and eleven nights later there were eleven more rats. They must have been

2. The remains of the *P. remota* leaves minus the petiole. Notice the age of each leaf as one was removed per night.

eating their *Pritchardia* petioles like celery stalks. After another week and a half of empty traps I figured I had caught the whole family, cousins, nephews and the visiting uncle. I was happy because my palm was saved and recovered from this near-death experience. And the rats – well, it was their last supper!

The impact of rats on palm petioles is not only limited to *Pritchardia*. Cultivated palms in Hawaii have also been fodder for rats. For example I observed three *Ptychosperma macarthurii* growing at Na Aina Kai Botanical Garden, Kauai, Hawaii, that had several petioles chewed away leaving the stem and leaflets untouched.

Although the impact of invasive species on palms in Hawaii and other isolated island includes deer, goats, pigs, insects, and invasive weeds, rats play a major role. As indicated here, they are not just a threat to the palm seed, but can cause death by consuming the palm heart.

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