PRINCIPES

Journal of The International Palm Society

January 1993
Vol. 37, No. 1

THE INTERNATIONAL PALM SOCIETY, INC.

THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

Manuscripts for PRINCIPES, including legends for figures and photographs, must be typed double-spaced on one side of 8½ × 11 bond paper and addressed to Dr. Natalie W. Uhl for receipt not later than 90 days before date of publication. Authors of two pages or more of print are entitled to six copies of the issue in which their article appears. Additional copies of reprints can be furnished only at cost and by advance arrangement.

THIS PUBLICATION IS PRINTED ON ACID-FREE PAPER.

Contents for January

Cover Picture

The huge tristichous palm—which later turned out to be *Chrysalidocarpus fibrosus*. See pp. 4–11. Photo by H. Beentje.

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JOURNAL OF THE INTERNATIONAL PALM SOCIETY

(ISSN 0032-8480)

An illustrated quarterly devoted to information about palms and published in January, April, July and October by The International Palm Society, Inc.

Annual membership dues of $25.00 in USA and $30.00 to other countries include a subscription to the journal. Dues outside USA include airlift delivery. Single copies $8.00 each or $32.00 per volume. The business office is located at **P.O. Box 1897, Lawrence, Kansas 66044-8897.** Changes of address, undeliverable copies, orders for subscriptions, and membership dues are to be sent to the business office.

Second class postage paid at Lawrence, Kansas

Mailed at Lawrence, Kansas March 10, 1993

Principes, 37(1), 1993, p. 3

Editorial

All who attended the very successful 1992 Biennial in Florida in November will have been impressed by the tremendous spirit of optimism that pervades in Fairchild Tropical Garden. Despite the appalling damage done to the collection by Hurricane Andrew (see *Principes* 36(4) we saw many signs of hope—new leaves sprouting from palms that had been propped upright, the amazing survival of many of the small palms in the understory of parts of the garden, and the remarkable percentage of survival of native Caribbean palms. Above all we were impressed by the dedication of the Director, Dr. Bill Klein, and his staff, to work toward rehabilitating and developing the garden. Let us hope for a reasonably mild winter and good growing conditions so that the Garden and its unique palm collection can recover. We must also thank the South Florida Chapter members for their courage to persist in holding the Biennial when so easily they could have been preoccupied in repairing their own homes and palm collections.

We begin a new year with a wide range of papers. Henk Beentje and Martin Gibbons, in their separate papers, describe the hunt for poorly known palms that have not been seen for many years. In Madagascar Henk has searched and searched for the elusive *Louvelia lakatra*, a species that is vital for understanding the relationships between *Louvelia* and *Ravenea*. His article perfectly encapsulates the delights and despair of palm hunting in Madagascar. Martin Gibbons, dedicated to his favorite genus *Trachycarpus*, describes a hunt for *T. takil*, originally described as occurring in countless numbers in the Himalayan foothills. We expect more on *Trachycarpus* from Martin later this year.

Peter Pritchard, in his entertaining article, describes the palm delights of Georgetown, Guyana, and discusses the flowering of *Corypha* there.

Roger Orellana and Nancy Ayora have written a paper about the population structure of *Coccothrinax readii* and *Thrinax radiata* in sand dune scrub on the Yucatán Peninsula in México. This is an area that is under severe pressure from human activities such as the development of tourist resorts, expansion of agriculture and industrial development. Their study is of basic importance in developing guidelines for the conservation of these two species in their natural habitat.

Cold hardiness is always of interest. Joe Hebert's experiences with *Rhapidophyllum* in Massachusetts make interesting and instructive reading.

Two articles deal with insects that feed on palms. James Tsai and Jack Fisher have added to the basic information concerning the plant- and leaf-hopper insects that are thought to be involved with the transmission of lethal-yellowing disease in Florida. Using careful anatomical techniques they have investigated precisely where in the palm leaf these insects feed. We have reprinted, from The Food Insects Newsletter, a stimulating and entertaining article by Gene DeFoliart on the larvae of the Palm Weevil and the Rhinoceros Beetle. In some parts of the world these larvae are prized as a valuable food resource and the author speculates how husbanding the insect larvae as a food source might be integrated with control of the damage that the beetles inflict on palms. This article comes complete with two mouthwatering recipes for beetle larvae—recipes that we cannot wait to try!

JOHN DRANSFIELD
NATALIE W. UHL

Principes, 37(1), 1993, pp. 4–11

The Days I Didn't Find Lakatra

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In 1991 I spent several months in Madagascar, doing fieldwork in connection with a forthcoming revision of the genera *Ravenea* and *Louvelia*. Fieldwork in the Great Red Island can be exhilarating, exasperating, exciting, and boring almost at the same time; and this story illustrates how this strange combination of feelings can come about.

The genus *Louvelia* is generally thought to consist of only three species: *L. albicans*, a squat palm only known from the type, consisting of a leaf and a male inflorescence collected over 50 years ago in lowland forest in the Masoala Peninsula; *L. madagascariensis*, a squat undergrowth palm known from a single population in Andasibe (Perinet); and *L. lakatra*, a large tree palm only known from the type, a fruiting collection made over 70 years ago near Andasibe. John Dransfield had collected excellent material of *L. madagascariensis* at Andasibe, but reported that *L. lakatra* was suffering from continuous pruning; young leaves are used in the manufacture of the high-quality "*lakatra* hats," and every single known individual was pruned down to a juvenile form. No mature tree of this species has been found since 1914.

In February 1991 I was having a beer some 300 kilometers from Andasibe, after a long day of work in the forest. I was discussing palms with the waiter, in the rather desultory way caused by Madagascar's excellent "Three Horses Beer," and I told him the local names of the palms found so far in this area. This waiter was a wily old bird who knew his region well, and he told me the names of several species I had missed so far; and then he added, casually, "and a bit further down there is some *lakatra*." This is the stuff that botanists' dreams are made of!

The next day I set off with my Malagasy companion for the site the waiter had described. A small village off the beaten track called "Good Hand" was reached about noon; the car could go no further. I inquired about *lakatra*. "Oh no," said the locals, "that's too far away"; but there was one old man who said he could take me to one. We set off at a spanking pace, and quite soon a juvenile plant was proudly shown to me. No, I said, this was not exactly what I was looking for—I wanted a *big* one, if possible with a large trunk, flowers and/or fruits. "No problem," said the old man, "I know one of those; that one is a bit further on." And so it proved. It was a tough, hot, long walk over endless hills, with most of the vegetation secondary and without any shade, with some remnants of forest, with logs to crawl under or dense undergrowth to slide through, with flies, thorny lantana, and heat. After about an hour I inquired politely if it was still far? "Oh no," said the old man, "do you see that *raffia* in the valley over there? Well, it's just past that." We reached the raffia half an hour later, and it was bliss to wade a small river and sprinkle some water over wrists and forehead. Half an hour later I had asked twice more if it was still far, and received the usual answer—"not very far." At long last the old man slowed down for the first time (by this time my muscles were aching) and said that the next valley was the one, and indeed I could see some remnant forest. We went down

1. *Ravenea madagascariensis* var. *monticola*, habit, in a southern/central Madagascar forest.

into the valley and the old man's son was summoned to tell where the *lakatra* stood. "Oh," he said smiling, "that one? I cut that down last month, to plant more hill rice." I asked if I could at least see the remnants, but he informed me he had burned those.

This was the first day I did not find *lakatra*, but insult was to be heaped on injury; the walk in had taken more than two and a half hours, but when the old man saw I was very disappointed, and not in the mood for extremely fat tips, he took me back to the car in less than forty-five minutes. He had obviously thought to make the find more interesting by providing a difficult route; a real PR artist, this one!

Two days later I was back in Good Hand village to continue the search. This time I found two guides who, again, knew of *lakatra*; yes, trunked specimens of *lakatra*; no, it wasn't very far. This time the "not very far" meant three hours, with a wide stream to wade through, several extremely rickety bridges across other streams (generally consisting of a slippery tree-trunk, or two narrow logs which move alarmingly when one steps on them), much mud, many steep slopes, both up and down, and a group of gentlemen hauling illegal rum; these insisted that I should drink a tot, to prove that I was not a government agent—since I'm not the right color for that, I believe it was more to have a communal drink paid for by me! And so my accounts for that month show the entry "illegal rum, 350 FMG" (some $ 0.20). And again, we failed to find *lakatra*: the tree which my guides said was a *lakatra* turned out to be a *Ravenea madagascariensis* var. *monticola* (Fig. 1). But since this was my first collection of this variety, it was still a good day for me; I also found *Phloga nodifera* (Fig. 3) and something resembling *Neophloga lanceolata*; and it became even better when we started walking back by a slightly different route and my Malagasy companion pointed out a squat undergrowth tree with litter-accumulating leaves. Talk about serendipity—we had found a new *Marojejya*, I thought; later on, back at Kew, John Dransfield told me he believes it to be an intermediate between *Marojejya* and *Masoala*, since it combines the characters of the two genera (Figs. 4–6). It had by now started to pour with rain, but this could not dampen my exhilaration. Exhausted and filthy, but with a singing heart, I slogged back to the village and the car, and in the next village with a fridge we celebrated with a long cool drink.

Two days after the *Marojejya* I was back in the general *lakatra* area—the pull of the unknown flowers was still there. In a sizable town we enquired after *lakatra* hats, which were indeed for sale; the palm supplying the leaves was said to come from somewhere down the road. After a lot of driving around, and much talking, the site was pinned down to a village some two

2. *Ravenea madagascariensis* var. *monticola*, showing the multiple female inflorescences, 3–6 per axil.

hours walk from the road, and again we obtained a guide and set off—as usual, in the hotter time of the day. This time there was a difference in the route: the meandering path followed a meandering river valley, which is not that uncommon, but the meanders of the path and of the river had different phases, and so we had to wade the same river *seventeen* times. The first man we met at the village was the local policeman (I think unofficial, since he was dressed in clothes mainly consisting of holes), who inquired the purpose of our visit. *Lakatra*? he said, but we have no *lakatra* here! My temper, which was already slightly frayed by the heat and the endless river crossings, and by the absolute absence of any forest (and therefore shade, and/or palms, definitely in that order that day) rose to danger levels, and I was thinking hard about how to say nasty things to the guides in French. By then a very old man had joined us, and an endless discussion in Malgache started, with everybody obviously being very respectful to this gentleman. It turned out he was the "king of the village," and with much interpreting the following facts became more or less clear:

—there was *lakatra*, both young plants and old trees, and this village had the only *lakatra* left in a wide area; all the rest had been cleared, and because of this monopoly they were very cagey with the locality of the remaining trees (which was why the policeman had said there were none).
—the king would have to discuss my request to visit the palms with his council of ministers.

By now it was 14:15, and it was clear permission would not be forthcoming today.

3. My companions on the first walk, with the infructescence of *Phloga nodifera*.

Since I was flying out of Madagascar a few days later, this was the last field day of this visit, and I asked if I could come back later in the year to hear about their decision, and, if possible, see and maybe climb the trees. This was fine with the king, and I begged him not to have the large trees cut down in the meantime (there was clearing and burning of land going on everywhere) which he said was okay, though they only used the young trees. My remark that without the parents there would be no more children was obviously a new viewpoint in relation to palms, but I was fairly worked up over all this slash-and-burning in the region, and I believe my meaning came over clearly.

So on my last day of fieldwork I started walking back, to cross that river another seventeen times—with no palms in my collection bags, but still with that gleam of a chance of collecting *Louvelia lakatra*—on my next visit.

Five months after my first visit to Madagascar, I was back, and I was still keen to collect *Louvelia lakatra*, that elusive palm. After several false starts, one of which included getting arrested (I might tell that story another time) we drove back to the village called Blackwater, where the trail started to the one and only reported *lakatra* population. This time I failed before I could even start walking: it was rice-planting season, and everybody who was able to guide a stranger to far-away hamlets was out in the fields, planting. If we'd come back in a few days, maybe. . . . I felt thwarted, but also had to laugh wryly

4. The intermediate between *Masoala* and *Marojejya*.

5. The intermediate between *Masoala* and *Marojejya*, with its discoverer (after whom it will be named).

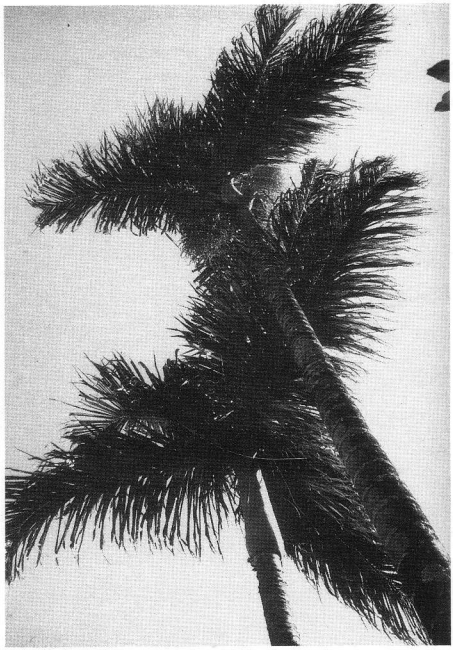
at this familiar feeling which seemed to be allied with anything to do with *lakatra*. We drove off, and on the way back stopped off at a small hamlet hostelry for a drink. I got talking with the proprietress, but she laughed at my tale of woe: in the very forest next to the village there was some *lakatra*! Amazed at this piece of luck we hired a guide on the spot and set off for the hillside with its long-awaited palms. It was a bit further than I had been led to believe, but when we eventually reached the forest, we found the palms all right—the only problem was that they were too young to be identified with any certainty, although they certainly *looked* as if they might be the ones. Luckily, to comfort me, serendipity struck again, and I staggered back with a bag full of *Ravenea madagascariensis* var. *monticola* with multiple female inflorescences (Fig. 2) and a slender, 3 m tall palm with grouped leaflets which did not key out to any of the species of *Neophloga* or *Dypsis* known to me (Fig. 7). Back in the hamlet it was the familiar story all over again: oh, I wanted the large ones? Well, they were there, just a bit further away, and if I'd come back tomorrow, I'd be sure to find them; they were even in full flower at the moment.

This sounded juicy, but petrol was running low, and due to the strikes going on at that time we did not have enough to drive back to this place again; my petrol would take me back to the capital Tana, and not much else. They assured me that the petrol truck would pass by that afternoon; if we'd wait in the hamlet, we could see it pass, follow it to the next pump, and buy a full tank. In the meantime they would send out two people to search for the nearest *lakatra*. This was agreed upon, and for several hours I sat around reading Barbara Tuchman; no petrol tanker passed, but one guide came back clutching a few leaflets (unidentifiable, of course) and saying he'd found a small group, two hours walk away.

6. The intermediate between *Masoala* and *Marojejya*: inflorescence (note the litter collected between the petioles).

7. *Neophloga* or *Dypsis*?

By now it was evening, and I was in a quandary. To solve my problem, I decided on drastic measures; first we checked at the basecamp (no petrol yet) and then, the next morning early, drove the 60 km on lousy roads to the nearest big town, where we luckily found petrol. We then drove back 60 km, plus the 40 km to the hamlet, and announced that I was ready to depart on the Final Hunt. Naturally, there were a few hitches; my Malagasy companion felt unwell and was to stay in the hamlet, and I had to wait an hour for the guide to come back from the fields, but at last we set off. I felt quite cynical, but there was still this spark of hope. . . . It was rather dry forest we walked through, very hilly, and quite soon I spotted more *Ravenea madagascariensis* var. *monticola*, the ubiquitous *Phloga nodifera*, and a large palm I identified at the time as *Neodypsis tanalensis*, which I had collected a week before—although this one was tristichous (Fig. 8). After a long slog we reached the site, and after some looking around I was brought to a palm. "There you are, *lakatra*!" It was certainly a *Louvelia*, but did not look like how I expected *lakatra* to look: it was some 6 m tall and quite slender, rather than the size and shape of *Ravenea robustior* that Jumelle says it should be. It also did not have any petiole, and when I started to climb the trunk, the final argument—*lakatra* is supposed to have soft wood, while this one had wood like rock. I had a hard time getting up, and my climbing spikes kept on slipping; much as I tried, they would not enter the bark more than a few millimeters, and it was not long before I fell out of the tree. The guide, who had looked on in amazement when I donned my safety harness, spikes, gloves and belt, shinned up a neighboring liana, and within two minutes was sawing away at the leaves. Luckily, before I fell, I had managed to saw off the basal part of a sheath, so I was quite satisfied with the



8. The huge tristichous palm—which later turned out to be *Chrysalidocarpus fibrosus*.

10. *Marojejya ? pinnata*—litter-collecting leafbases with, in the middle of the photo, the male inflorescence just peeping out.

9. *Marojejya ? pinnata* with my guides.

leaves he cut off; the inflorescence gave a few more problems, since his French was as restricted as my Malagasy, but with mime I managed to get across that the lower bracts of the inflorescence were of extreme importance in palm taxonomy. What came out of all this was an old, dead male inflorescence ("in full flower," forsooth!) branched to one order, just as a good *Louvelia* should, with three peduncular bracts; the prophyll was too deep in the sheath to obtain. But what I had in my hands was enough to identify the palm as a new species of *Louvelia*, found once before by John Dransfield in the Masoala Peninsula, almost on the other side of the country. The *lakatra* mystery had been solved: *lakatra* was a generic local name rather than a specific one. The real *Louvelia lakatra* was still uncollected, but I was quite happy to have finished this endless quest with a nice find at the end! Things got even better when on the way

back I spotted yet another *Marojejya*, a squat undergrowth palm with half-hidden inflorescences and litter-collecting leaves (Figs. 9,10) which I suspect to be the unpublished "*M. pinnata*," yet another new species previously only known from the Masoala Peninsula.

A fitting motto for all this could well be the song which I came across on a casette on the way home: "You can't always get what you want . . . but if you try sometimes, you just might find, you get what you need . . ." (Jagger/Richard).

Postscript: about a month later I was collecting in Mantady Park, not far from Andasibe, when the guide casually mentioned that he knew of a *lakatra* stand, "not very far away." He seemed quite taken aback when I started laughing hysterically. But one of these days I might go back and investigate this rumor. . . .

Acknowledgments

I wish to thank McDonald's Restaurants (UK) Ltd. for funding the Madagascar Palm Project; Dr. Voara Randrianasolo and M. Armand Rakotozafy of the Parc de Tsimbazaza for logistical support; H. R. "Riry" Andriampaniry for field assistance, endless jokes and excellent companionship; and John Dransfield for instigating the project, and for giving much needed back-up on the home front.

(*Continued on p. 59*)

Principes, 37(1), 1993, pp. 12–18

Thoughts on Hapaxanthy in Guyana

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Georgetown, the capital of Guyana, is not an ancient city, but it is an old one; a wooden city; and a rainy, watery one. Situated in the moist tropics, it is not merely a lowland city, it is actually below sea level, the placid, cafe-au-lait ocean kept at bay by dint of Dutch-built fortifications, dykes, kokers, canals, ditches, dams, and the famous, massive sea wall, built between 1858 and 1892.

The city has some fine examples of European colonial architecture. The cathedral is allegedly the highest wooden building in the world, although well-travelled visitors occasionally raise obscure challenges to this claim. Its neighbor, the City Hall, is almost as high, and to my eye a far nobler edifice, with its fairy-tale turrets and lavish Victorian gingerbread (Fig. 1).

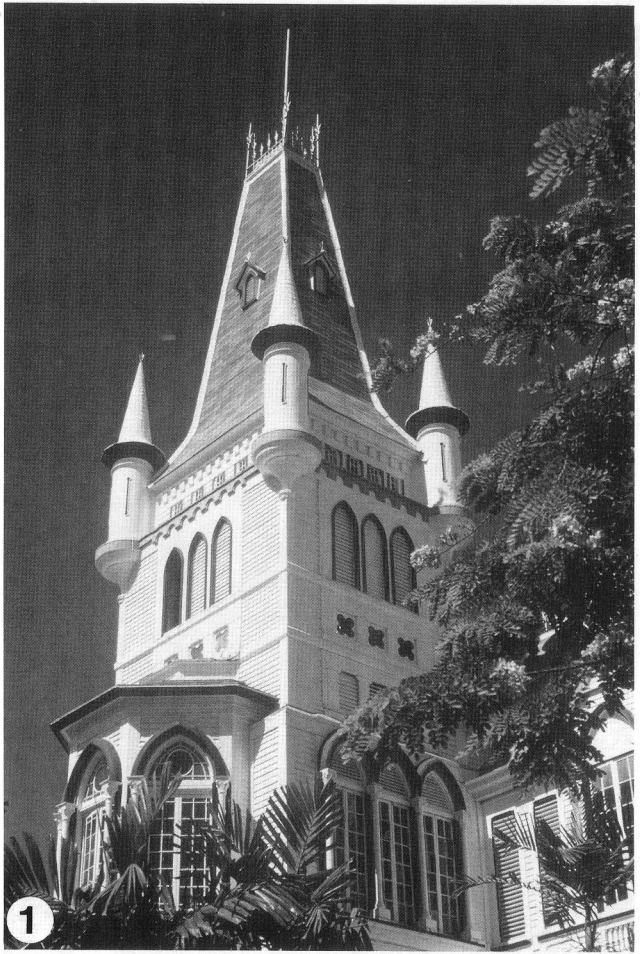
There are other fine and well-maintained old buildings in the city. Some of the best are on High Street in Kingston, many occupied nowadays by government departments, embassies, or international organizations. But for the most part Georgetown is in slow decay, the economy too strictured to permit most people to repair or replace their homes as the old fretwork ornamentation comes adrift, or as the very underpinnings of the house decay, victims of age and moisture. It could easily be a depressing place.

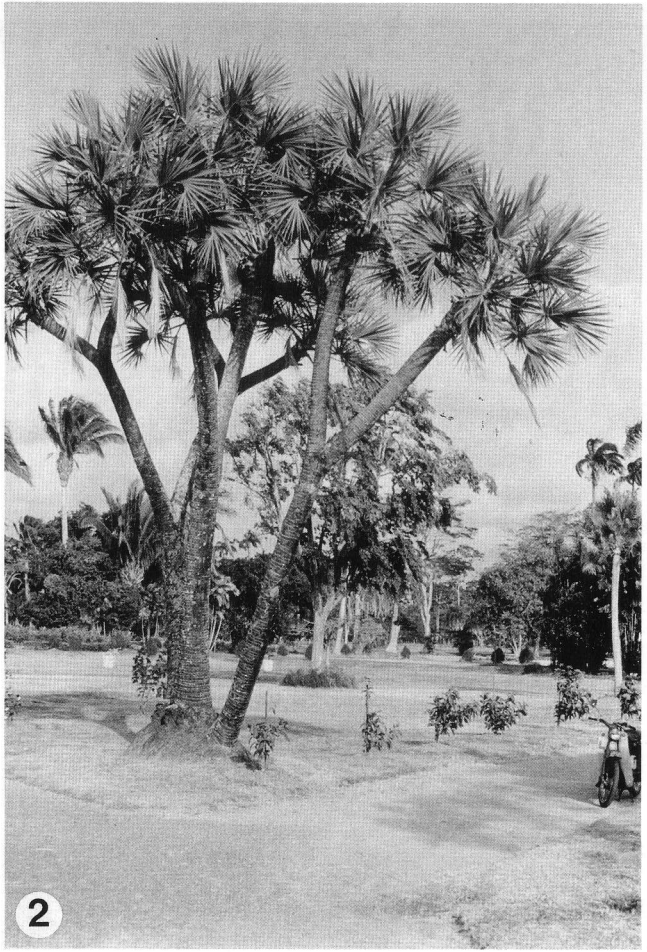
But it is not. The same year-round humid-tropical climate, with intense rain for the greater part of the year and a temperature in the city never very far from 85 degrees, may wreak havoc on man-made structures but it makes for wonderful vegetation. The flowering trees in the city—the Bougainvillea, Oleander, Flamboyant (as the Poinciana is locally called), the spectacular golden-flowered Tabebuia, and others give the place a festive air. Something or other is always in bloom.

Fruit trees flourish in the city with little attention—breadfruit, mangoes, oranges (sweet even when green), cashews, pawpaws, star apples, and others. In a land where a laborer's wage is the equivalent of less than one U.S. dollar a day, the availability of such fruit from city trees is an important consideration. Larger-scale urban fruit tree cultivation is encouraged by the government, and is limited only by what the Caribbean Fruit Growers Handbook archly describes as "a high level of praedial larceny"—a sociological rather than a horticultural difficulty for which it offered no solution.

But best of all are the palms. Of course, the interior of Guyana is full of palms, and as one flies over this largely forested land of 83,000 square miles, one sees coconut palms in abundance in the coastal areas, and in the dense forest the troolie or *Manicaria*, with its huge leaves widely used for roofing thatch, or the graceful *Euterpe* or palmiste palms, an important source of heart-of-palm salad, are seen in their thousands, emerging from the lumpy green carpet of the forest canopy. In the open wet savannahs, the *Mauritia*, with their broad, tapering petioles and robust fan leaves, stand like sentinels as they drop their curious, scaled fruit, each like a miniature coiled pangolin.

Miles and miles of mud-banked waterways in the North-West District of Guyana





1. City Hall, Georgetown, Guyana. 2. *Hyphaene* sp. in the Botanic Gardens, Georgetown.

3. *Nypa fruticans* is common along waterways. 4. Rolls of *Nypa* leaves ready to be shipped.

are lined with the trunkless, huge-leaved *Nypa* (Figs. 3,4), a species that seems to compete successfully with the several mangrove species in the area, even though palm experts (at least before 1991) would have assured you that *Nypa* is restricted to the Indo-Australian region and the western Pacific. Actually, *Nypa* was reportedly introduced to Calabar, Nigeria, in 1906, where it has subsequently flourished, and Norman Duke (*Principes*, 1991, 35(3): 127–132) reported the first documented *Nypa* stand in the Americas, a group of about 100 mature palms and numerous immature specimens on the Rio Majugual in Caribbean Panama.

In Guyana, *Nypa* have for decades formed the backdrop to the manatee pool in the Botanic Gardens, and this may have been the source stock for the *Nypa* that has colonized the North-West District. Some *Nypa* may be seen along the Pomeroon River downstream from Charity, but the species reaches its maximal development along the Mora Passage and the Barima River near Morawhanna. I have seen *Nypa* right up to the Venezuelan border on the Barima, and doubtless it reaches well into Venezuela. But when I cut one of the distinctive fruiting stalks and showed it to villagers in Morawhanna and Mabaruma, they had never seen such a thing before, and could offer no insight into the history or possible uses of the species in the area.

But for maximal palm species per acre, the city itself is the place. The city fathers—the British Colonial administrators who ran Guyana from 1831 to 1966—saw to that. The Botanic Garden itself is remarkably rich in palms, and the Promenade Gardens in Carmichael Street and the grounds of Government House itself—the old residence of the British Governors, now empty—are thick with palms from all over the world.

Palms grow slowly, but many of those in Georgetown were planted so long ago that they are now in full maturity. *Pritchardia* from Samoa—perhaps the most graceful of the fan palms—are abundant; so are *Ptychosperma*, with their curious, torn-tipped leaflets. Some ancient, tree-size fishtail palms stand in a colonnade in front of the Supreme Court building. Originally they flanked a fine white marble statue of Queen Victoria—standard issue for each colony a century ago—but this was damaged during the civil unrest preceding independence in 1966, and the old lady, noseless and missing a hand, was moved to a concrete plinth at the back of the Botanic Gardens, where she held dignified sway over a huge egret colony and a few manatees and caiman. Recently she was moved back to a rather prominent position in front of the City Engineer's Office in downtown Georgetown—a move whose political significance I am still trying to evaluate.

Also in the Botanic Gardens, one sees such unusual palms as the scarlet-trunked sealing wax palm (*Cyrtostachys*), the strange, geometrically-branching trunks of the African doum palms (*Hyphaene* [Fig. 2]), and the tall Brazilian wax palms (*Copernicia cerifera*), with the scars of old leaf-bases retained only on the lower part of the trunk, the leaves seeming to fall off more cleanly once a certain height is reached.

And inside and outside the Botanic Gardens, the trunks of the Royal Palms, like concrete columns, reach almost to the sky, while the Veitchias, like scaled-down versions of the Royal Palm, scatter their scarlet seed in exuberant abundance. Here and there the heavy, spiky, grey-green leaves of *Latania* rattle in the breeze, and the elegant *Licuala* appear also, each leaf either radiating like a sunburst or knit into a pleated disc, depending on the species.

This plethora of palms produces an astonishing diversity of fruit. Small yellow, red, brown, or black nuts; the huge, soft bowling balls of the *Borassus* palm, like fragrant elephant droppings; dates themselves; the pear-shaped (but not pear-tasting) fruits of the doum palm; the afore-

mentioned scaled, reptilian seeds of the *Mauritia*; the brilliant scarlet seeds of the *Veitchia*; and coconuts themselves, the archetypal palm fruit—all develop on cornucopious infructescenses from below or amid the leaves of the different species.

The citizens of Guyana may be in for a spectacular surprise some generations from now when the single specimen of the coco-de-mer in the Botanic Gardens—still young and virtually trunkless, but sporting huge leaves—eventually reaches maturitty. One of the few specimens in existence outside the Seychelles, this species yields the world's largest seed, a massive, thirty-pound production looking weirdly like a human female pelvis, complete with details. But I said "may be," not "will"—the plant may turn out to be a male, in which case it will produce dangling three foot long spikes instead of seeds; and even if it is a female, a male will still be needed for the seeds to develop.

Actually, the history of the coco-de-mer in Georgetown is somewhat enigmatic. Dennis Johnson kindly drew my attention to the Georgetown Botanic Gardens Illustrated Guide of 1934, which alludes to three mature coco-de-mer specimens (two female and one male), the only survivors of three dozen nuts imported from the Seychelles in 1893. One of the female plants apparently produced its first inflorescence when only 13 years old. The failure of the majority of the seeds to produce mature palms is understandable, but it is odd that nothing remains (or even remained in the mid-sixties when I first visited Guyana) of these three mature trees. The present specimen has made little visible progress in the last couple of decades.

The coco-de-mer is estimated by some to live as long as a thousand years. Perhaps, to a jingoistic botanist, the British Empire will have indeed reached its finest hour when this gift from a sister crown colony on the far side of the world reaches its full height and maturity.

But there is one genus of palm in Georgetown, one of just a few in the world, that attains great, even spectacular, stature without putting out a single seed. Palms of the Asiatic genus *Corypha* were planted in Georgetown in good numbers many decades ago. There are a few individuals of the colossal species *Corypha umbraculifera*, the Talipot Palm—I have seen four or five—whose leaves are so massive they could be used to make a well-strutted vehicular highway bridge if one were so inclined. But there are hundreds of the slightly smaller species *Corypha utan*, still a sizeable tree with a trunk two feet thick and reaching fifty or sixty feet tall.

These palms reserve their reproductive effort for a single stupendous episode at the end of their life. Other plants may do this too—bamboos and century plants are the most familiar—but it is a rare habit among palms. This unusual reproductive procedure is known as hapaxanthy (I owed you an explanation of the word in the title), a term introduced by Professor E. J. H. Corner in his 1966 book *The Natural History of Palms*. After perhaps half a century of growth, monotonously producing one leaf after another, each corresponding to the lengthening of the trunk by an inch or two, the leaf production hesitates and stops. Instead, a great spike slowly emerges vertically from the apex of the palm, like a huge sword, or a narrow church steeple. It grows and grows, reaching 12 to 15 feet, and then sends out side branches, each of which in turn develops secondary branches, until the whole thing looks like a live deciduous tree balanced on top of a dead palm—for by now the green foliage has collapsed into a dangling brown thatch of dead leaves, soon to fall off altogether.

But the terminal panicle, as it is called, continues to develop. First, thousands—perhaps millions—of tiny flowers are produced, and these mature into a colossal production of seed. The seeds are small, and doubtless are scattered by birds and winds; but thousands fall and germinate at the foot of the parent.

Meanwhile, the substance of the trunk of the palm has been commandeered for a literally higher purpose, and its withdrawal is clearly visible. The trunk starts to shrink, and takes on an exhausted, detumescent look, with curious spiral flutings from top to bottom. Finally, the fruiting is over, the panicle collapses, and the trunk starts to rot, and falls within a year or two.

It is normally a rare thing to see the final reproductive extravagance of a *Corypha*. (As I stared in open-mouthed admiration at a *Corypha* at such a stage in Georgetown, a coal-black uniformed schoolgirl, about eight years old, approached me with the comment "So you like our trees, white man?".) Members of the Palm Society make long pilgrimages when they hear of a case, and careful measurements are taken, seed counted and weighed, and the stages documented as the months pass. But in Georgetown, as I write, it seems all the *Corypha* are fruiting. There are isolated palms here and there throughout the city, but beyond the end of the Botanic Garden, in the d'Urban Backlands and near the old d'Urban Racetrack, there are hundreds. Not in perfect synchrony, but close to it, one sees panicles starting to shoot up, others branching, still others fruiting, and here and there the dead hulk of a spent tree, to be felled by a high wind this year or next.

Meanwhile the seeds are germinating. The lawn under some of the trees has become *Corypha* seedlings instead of grass, although the thin-legged East Indian women gardeners continue to cut it to lawn-length with their cutlasses. They can't cut all, and a second generation of *Corypha* in Georgetown is well under way.

Actually, I suspect the adult trees of today may already be the second generation. There are too many, and their arrangement too haphazard, for them to have been planted one-by-one. I suppose every half century or so Georgetown citizens interested in such things will have the rare treat of this slow-motion botanical pyrotechnic show in their city, until eventually the tree generations become blurred and some trees reach their spectacular finale every year.

Hapaxanthy, this prodigious end-of-life reproductive outburst, is not unknown within the Animal Kingdom where it is termed semelparity. Salmon, for example, are semelparous. But hapaxanthy is a daunting prospect for parents who like to see their children grow up, and it seems biologically dicey also—why reproduce just once when you could do it many times?

Yet modern Western man may not be too far from semelparity of a sort. With postponed reproduction and higher education extending expensively well into a child's third decade, the parents' job of providing nurture and economic support may not be over until near the close of life itself. Cheer up, I often tell new parents; in thirty years you can go back to a normal life. But they are justifiably unconvinced.

But hapaxanthy, biologically speaking, does have its advantages. Instead of reproducing modestly every year, whether or not prevailing conditions favor the survival of offspring, one can save everything for a "good" year, and flood the neighborhood with seeds or offspring at a time calculated for maximal survival. And there is no holding back if the parent does not need to survive. It can literally give its all, rather than having to share its resources carefully, allocating some to its offspring to give them a start in life, but holding some back to provide for its own needs for survival to the next season. Meaningful biological success is not measured by individual longevity (ultimately, death—failure of the individual—is inevitable), but by reproductive success, or by genetic contribution to the next generation, or, potentially, to posterity. My great-grandmother died while giving birth to twins over a century ago, a tragic end to a short life. But both twins survived. Biologically, she was more successful than any Pope (well, any recent

Pope). Had she lived but the twins died, much (including one Peter Pritchard) would not have happened.

My musing on hapaxanthy were sharpened as I pursued my professional justification for my presence in Guyana—the conservation of sea turtles. Turtles, as even the general public well knows, are potentially very long-lived creatures, taking many years to reach first maturity, and then, under ideal circumstances, enjoying decades of adult life, during which (and this the general public may *not* realize) they nest only every second or third (or even fourth) year. But when they do enter a reproductive season they may produce as many as eight to ten nests of a hundred or more eggs each time. This is semelparity of a kind—delayed maturity, then massive reproductive output, followed by either the ultimate rest of death itself, or at least the rest of one or more non-breeding years. A green turtle, leaving Guyana waters after depositing a hundred pounds of eggs in a few months, must feel somewhat like an exhausted *Corypha*, vastly diminished after the prodigious feat of its ultimate reproductive extravagance.

Yet, one may argue, the turtle is fundamentally different in that it may ultimately have many more breeding seasons; its physical diminution is reversible. But the operative word is "may." The potential is there, but in the real world, it is extraordinary how many nesting sea turtles, tagged by researchers on the beach, are never seen again. There is a profound difference between potential and ecological longevity for such creatures. The sea is dangerous, and so, for a creature as heavy and aquatically-specialized as a sea turtle, is the land. Moreover, in Guyana, for many years, the Arawak Indians have been in the habit of slaughtering the nesting sea turtles of all four local species for their meat. Egg collection also occurs, but is casual. And somehow the species have all survived to today—the leatherback abundantly, the olive ridley in very reduced numbers, the green and hawksbill somewhat in between. Perhaps even the great sea turtles, potential centenarians perhaps, still have the flexibility to survive when hapaxanthy, although certainly not programmed into their genes as it is with the *Corypha*, is violently visited upon them by the hand of man.

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Principes, 37(1), 1993, pp. 19–25

Trekking on the Trachycarpus Trail

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The genus *Trachycarpus* needs much work to determine the precise number of species it contains. Everyone knows *T. fortunei*—the Chusan Palm—its popularity largely due to its legendary cold hardiness. Less well known is "*T. wagnerianus*," now regarded as a variant of *T. fortunei*, despite its distinctive appearance. The beautiful *T. martianus*, though extremely rare in cultivation is at least grown in some botanic gardens in America and Europe and is there for all to see. But what of *T. nanus*, the dwarf, stemless species from south-west China, of which no photograph has ever been published? And *Trachycarpus takil*, a name often mis-used, but in reality referring to a palm not seen in the wild for 100 years and represented in cultivation by but a single plant in the Beccari garden in Florence? Indeed, is it a distinct species at all, or just another variant of *T. fortunei*, as the experts are inclined to believe?

With these questions in mind, Wilko Karmelk, of Holland, and I had, independently, become interested in the genus *Trachycarpus* over a number of years. Finding we had this strong interest in common, we resolved to attempt to solve part of the puzzle, and to go in search of *T. takil*, and try and shine some light into this dark corner of the genus.

We began by spending an interesting day in the library of the Royal Botanic Gardens at Kew. This is a treasure trove for those with the joint interests of plants and travel. Aided by Dr. John Dransfield we located several old references to *T. takil* in hundred-year-old books and journals. They all seemed to quote each other, using the same words about its location: "grows in great numbers, forming clumps and rows, on the Thakil Mountain in Eastern Kumaon, India, in the fork between the Sarju and Kali rivers, between 6,500 ft and 7,800 ft, where snow generally covers the ground from November to March . . . in damp shady glens . . . chiefly on the north-west side."

On a trekking map we located the two rivers, in Kumaon Province, Uttar Pradesh, about 300 miles north-east of New Delhi, near a village called Pithoragarh. There, in the fork between them was a mountain, not named, but with a height of 8,166 feet above sea level. As there were no others in the vicinity this had to be Mount Thakil. This then was our goal.

We left London Heathrow airport on October 14th for the flight to New Delhi, India, and by 6:30 the following morning we had landed, left the airport and were on a slow moving eastbound train. Indian trains leave much to be desired and they are certainly not for the squeamish. After a very long 8 hours we arrived at the town of Bareilly and had had enough. We left the train there and, hoping we didn't look too much like rich Americans abroad, attempted to find a taxi to take us the rest of the way. In this we succeeded and found a mini-bus whose driver agreed to take us to Pithoragarh, some 9 hours drive away, for a mere 1,000 rupees ($50). From central London this would just about get you to Heathrow airport.

We left Bareilly at about 3 pm. The landscape continued flat and uninteresting until we reached a town called Tanakpur when it changed dramatically, and we began

to climb. We had left the interminable Indian plains and were at last in the hills. As the landscape changed, so did the vegetation. Endless fields gave way to forests, farms to wooded hillsides. We began to see the Deodar (*Cedrus deodara*) and the beautiful *Pinus longifolia*, and the air smelt cooler and fresher after the stifling heat of the plains. We saw rushing rivers and deep, deep gorges and drove carefully round one hairpin bend after another, on a good, modern road.

We drove till midnight, parked up and slept for some hours in the mini-bus, and finally at 9 am we reached Pithoragarh. It is set in a wide, low valley, surrounded by mountain ranges and is a very attractive village. We located a small local hotel and checked in. A glance through the thick and ancient register revealed not a single European name. The rate, incidentally, was just $3 per night.

We knew from our trekking map that the mountain that we were looking for lay due south of the town, and from the flat roof of the hotel we had a good view of the range of which it formed a part, some 15 km distant. One peak, somewhat higher than the others, was obviously our goal, and although the locals knew it as "Thalkedar" rather than "Thakil" there could be no doubt as to its identity. Looking through binoculars we could just make out a temple on its summit.

We spent the rest of that day, and the next, in and around the town. We were impatient to be on our way of course, but there were arrangements to be made and formalities to be attended to. We did make one excursion with some newly made friends out to look at some *Phoenix sylvestris* palms a few miles distant. One was a most attractive glaucous blue color.

The next morning found us up and ready to leave by 7:30, when the jeep we had arranged to borrow arrived at the hotel. We left the village behind us and drove due south along quite a reasonable tarred road, across the floor of the valley, towards our destination, which we now knew as Mount Thalkedar, the name "Thakil" not having been used in living memory. After some miles, we began climbing. Up and up we went, with the view improving by the minute. We soon saw the snow-covered peaks of the Himalayas, miles away on the far side of the town we had just left. The highest, called Nanda Devi, was the first to appear, and others came into view as we ascended.

The road deteriorated and tar became dirt. It became ever narrower, with hairpin bends and a drop of perhaps 500 feet, inches away from the wheels of the jeep. It was terrifying. We stopped once or twice for photos and to admire the now stunning view. The entire visible horizon from east to west was snow-covered peaks.

Eventually and with much relief we arrived at a small village. The inevitable cluster of locals gathered to see what was going on and we showed round photos of *Trachycarpus*, to see if anyone recognized them. Depressingly no one did. We were disappointed and confused. All the old accounts we had read said these palms were here, on this mountain, in great numbers, but nobody appeared to have seen them. Were they extinct? Had there simply been a mistake made and two accounts been transposed a hundred years ago? Had all the trees perished in some severe winter beyond living memory?

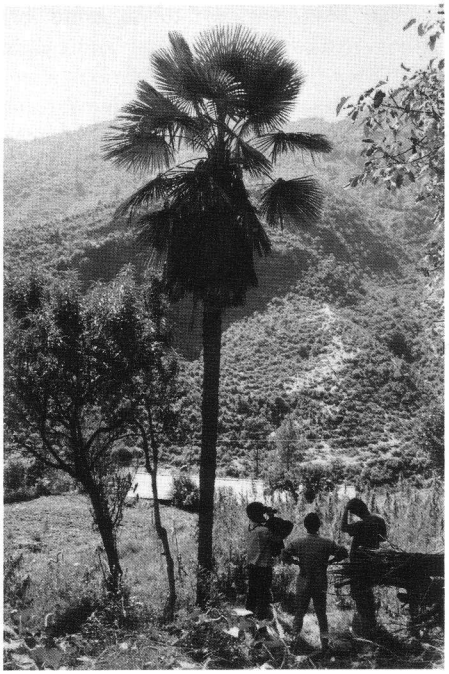
At any event we were determined not to give up until we had been to the actual valley mentioned in the old reports. It was on the far side of the peak with the temple, just a couple of miles away, but involved some serious climbing, up hill and down dale. A young man called Hareesh then appeared who said he would act as our guide and take us up there. We showed him the photo expecting the familiar response, but to our surprise and disbelief he said he knew of such a tree some 10 or 15 minutes away, in the direction we wanted to go. Our excitement can only be imagined.

He donned our rucksack and we set off at a brisk pace, some of the villagers following, Wilko and I hardly daring to hope. We climbed up through a steep and pretty forest, and on emerging from its far side saw a tall and beautiful *Trachycarpus* palm, about 30 feet high, growing on a steep slope, about 30 yards away from us (Fig. 1). We were absolutely thrilled to find it, and our excitement attracted the attention of 10 or 15 villagers who came over to see what the commotion was about. We all shook hands. It was a most wonderful sight, but could we see any difference between it and *T. fortunei*? To be honest, no. Much as we wanted it to be distinct, we couldn't legitimately claim a single unique characteristic.

We took lots of photos, and after about half an hour we were on our way again, just four of us, Hareesh and a second guide whose name was Karen, Wilko and I. We continued climbing, with the temple at the summit as our initial destination. At first we passed through open forest and cultivated land, noting occasional *Quercus incana* (Grey Oak) and other trees. As we ascended the forest closed in, with just occasional clear areas. We saw a *Rhododendron* bush—the first of many—and lots of other English garden plants: *Berberis*, *Cotoneaster*, Roses, Ferns and anemones. As we climbed ever upwards the *Rhododendrons* increased in number and size, eventually becoming giant trees with trunks so thick that two men could not encircle them.

Every so often we caught a glimpse of the summit and its temple through the thickening forest. Nearer and nearer and then suddenly there we were, at the top. More handshakes with each other and the guides.

The temple itself was an open stone cabin, and inside was a small statue of the goddess Shiva to whom it was dedicated. We stayed here for an hour, prepared and ate a meal and took a long drink of water from our canteens—nectar—even though the purification tablets made it taste of swimming pools.



1. Tall individual of *Trachycarpus*.

We set off down the same path but soon broke off and began descending the north side of the mountain. It was noticeably cooler, and damper, as the sun doesn't shine much on this face. The vegetation also was different. It grew in thick, rich, moist humus, and generally looked more green and lush. We came across a pretty species of bamboo with many tiny leaflets giving it a fox-tail appearance.

We had been descending for only a few minutes when Hareesh spotted a tiny palm seedling growing by the side of the track—definitely *Trachycarpus*. Then we saw another and another, and we left the path, more or less following their direction. They became more numerous and larger, up to about 4 ft tall. Our excitement knew no bounds as we slipped and slithered down from one plant to another, they getting bigger by the minute. There were hundreds

of them. We attempted to dig some up, not easy because of their long and tough roots. They grew in a really curious manner, the underground part being in the shape almost of a saxophone, a U-shape, one arm growing up out of the ground and supporting the leaves, but no roots, and the other from the side of which grew the roots (Fig. 2). But the bottom of it was quite rounded and smooth, and had no roots growing from it. Whether this was an adaptation to the steep slope on which they grew it was difficult to determine.

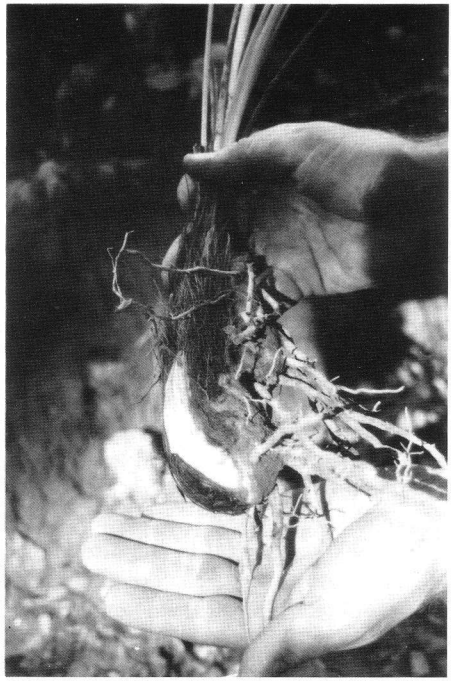
It was apparent that they were growing in just this one valley, narrow and steep. If we strayed too far from its floor, the plants diminished both in size and number.

We just had to find the adult trees that produced the seeds from which the young plants we were looking at grew. We could see down into the valley to an extent but much of the view was obscured by vegetation.

Unfortunately, the time was getting on and soon we had to leave to meet the jeep at a prearranged location. We made our way back to the path where the descent was of course considerably easier than the ascent but even so it took 2 hours of quite fast work to get to the village where the driver said he would wait.

We had had a wonderful day and were quite elated by our findings. However we were disappointed not to have found any mature trees in the valley. We were convinced that these were lower down. We decided to rest for the next day, and set off late in the afternoon, taking provisions and equipment for a two day stay on the mountain. This, we felt, would give us plenty of time for a full and thorough examination of the valley, where we would certainly find the adult specimens.

After a lazy day in Pithoragarh we again took the jeep up the narrow mountain road (terrifying) to the village, where we spent the night and set off early the following morning just as the sun was peeping over the distant horizon, at 6:20 am.



2. 'Saxophone' seedling of *Trachycarpus*.

There were four of us: Wilko and I, Hareesh and another porter. We set off up a different track this time, and after a couple of hours' stiff climb came to a small house, where we were offered *chai*, a kind of sweet tea, served in a glass. One of the men there said he knew of some mature palm trees and agreed to take us to them. In fact three or four of them accompanied us and we set off up the same track. After a tough ascent of an hour or so, we came upon 5 big trees of *Trachycarpus* (Fig. 3), which had been left standing when the surrounding land had been cleared for cultivation. They were on an exposed hill top and looked quite stunning with the snow covered Himalayas as a backdrop (Fig. 4). The man who farmed here chatted to us as we took photos. His house was on one of the three summits of the Thalkedar mountain, the temple was on another and a third was the highest at 8,200 ft above sea level.

3. A group of *Trachycarpus*.

4. The Himalayas form a backdrop to *Trachycarpus*.

At length we took our departure and headed off down the hill in the direction of the valley we wanted to explore. We had some adventures descending its steep, sometimes precipitous sides in search of the larger palm trees which we felt must be here somewhere. Small plants up to 4 or 5 ft tall we saw by the hundred, but no large ones. Hareesh kept on saying "No big, no big." With sketches and mimes we tried to explain that these small plants came from larger trees, mummies and daddies in fact, and we asked him, "Where Mummy? Where Daddy?" He understood, but insisted, "No Mummy, no Daddy."

During a rest stop he got around to explaining why there were no mature plants or big trees, and it was with sinking hearts that we realized the awful truth: the young plants *are cut off at the base* when they have 18″ of trunk, to provide fibres for ropes. "All cut?," we asked, incredulous. "All cut," confirmed Hareesh. The stupidity of it is that no seeds are produced by the palms before they are cut, the natives believing that new plants spring up from the stumps of the old one, which of course they do not. One of the 100-year-old accounts we had read in the library at Kew spoke of "hundreds of palm trees" in this very valley. Presumably they have been cutting them smaller and smaller ever since, and now they are gone.

As time was getting on we asked Hareesh to take us to the temple. It wasn't too bad a climb and we reached it at about 4 pm. when, after a rest and some tea, Hareesh and his colleague left us, to return to the village.

The solitude was wonderful then, on the roof of the world, no one around for miles, the snow-capped Himalayan peaks on the horizon, and only a few ravens for company. We lit a fire and cooked a surprisingly good meal: potatoes, lentils and some packets of soup, all mixed into a kind of stew. We watched the sun sink lower and lower and finally dip below the horizon at precisely 5:40 pm. The Himalayan peaks were the last things to see the sun and it shone on fewer and fewer, Nanda Devi being the last to remain illuminated by its now pink rays.

We woke to the sound of the ravens. The sun was over the horizon already, and it was time to be up. We made a cup of tea and sorted ourselves out. On our max/min thermometer we saw that the temperature had dropped to 8° C during the night. This was October; it must get considerably colder in mid-winter. We left the summit and the temple at 8:30 am and decided the best way down to the valley. Then, taking our last look at the fabulous view, descended into the forest.

We went down some way, and, as before, saw hundreds of small *Trachycarpus* palms, but of course no large ones. It then became too steep for us to continue without great danger, so we went, crab-fashion, across to where the slope was more gentle. Even so, it was quite steep and much of the descent was accomplished in a sitting position.

We continued down, in all some 3,000 ft, by sliding, scrambling, slithering, climbing, and by lowering ourselves using the plants for support. One way or another down we came. We stopped for lunch, cooking some very welcome soup. The vegetation was spectacular: huge incana oaks, massive rhododendron trees, ferns, bamboos, and of course, palms by the hundred. Fortunately the temperature was quite cool, at around 11.5° C, otherwise it would have been unbearable. The rucksacks were heavy, and often became entangled in the roses and briars which grew in profusion. Thorns tore at our arms and faces. Sometimes it was so dense that we just had to force our way through. It was incredible to look back up and see where we had come down from, and at the sheer rock faces we had circled round.

As we came down, the palms became smaller and less frequent, their place seemingly taken by ferns. Horse chestnut trees

beginning to show their autumn colors made it look like an English woodland. Soon we saw our last palm, as we reached the valley bottom. We picked up a track, and followed it down a gentle slope for perhaps a mile when we began to see signs of human habitation. Eventually the path widened, and led us through a veritable forest of *Pinus longifolia*. Soon we came to a small village where we had the inevitable glass of chai, and from here made our way to the road, where we waved down a truck to give us a lift back to Pithoragarh.

So that, more or less, was that. We returned to New Delhi, spending a day or two as tourists, but we had been spoiled by the beauty and grandeur of the mountains, and nothing, not even the beautiful Taj Mahal itself, could compare.

And what of *Trachycarpus takil*? Well, if it exists, then we had certainly re-discovered it. But whether it is in fact a distinct species, to my mind, is dubious. More likely, it is a population of *Trachycarpus fortunei*, separated and isolated aeons ago by perhaps the Himalayan upheaval itself. The photographs and specimens we brought back will be looked at and examined by experts in due course, but I feel confident they will reach a similar conclusion.

For our part, we had had a wonderful expedition, going to the very edge of civilization, and testing our abilities and resolution at the same time. Whether *Trachycarpus takil* turns out to be just another variant of *T. fortunei*, seems to matter less now, somehow, than it did before we set off.

U.S. Postal Service

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Required by 39 U.S.C. 3685)

1A. Title of Publication	1B. PUBLICATION NO.	2. Date of Filing
PRINCIPES	7 8 2 7 8 0	9-25-92
3. Frequency of Issue	3A. No. of Issues Published Annually	3B. Annual Subscription Price
Quarterly	4	$20.00

4. Complete Mailing Address of Known Office of Publication (*Street, City, County, State and ZIP+4 Code) (Not printers)*

810 E. 10th St., PO Box 1897, Lawrence, KS 66044-8897

5. Complete Mailing Address of the Headquarters of General Business Offices of the Publisher *(Not printer)*

same as 4

6. Full Names and Complete Mailing Address of Publisher, Editor, and Managing Editor *(This item MUST NOT be blank)*

Publisher *(Name and Complete Mailing Address)*

The International Palm Society, Inc., 810 E. 10th St., PO Box 1897, Lawrence, KS 66044-8897

Editor *(Name and Complete Mailing Address)*

Dr. Natalie Uhl, 467 Mann Library, Ithaca, NY 14853

Managing Editor *(Name and Complete Mailing Address)*

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The International Palm Society	810 E. 10th St., Lawrence, KS 66044-8897

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10. Extent and Nature of Circulation *(See instructions on reverse side)*	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies *(Net Press Run)*	3600	3500
B. Paid and/or Requested Circulation 1. Sales through dealers and carriers, street vendors and counter sales		
2. Mail Subscription *(Paid and/or requested)*	2849	2622
C. Total Paid and/or Requested Circulation *(Sum of 10B1 and 10B2)*	2849	2622
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E. Total Distribution *(Sum of C and D)*	2871	2638
F. Copies Not Distributed 1. Office use, left over, unaccounted, spoiled after printing	729	862
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G. TOTAL *(Sum of E, F1 and 2—should equal net press run shown in A)*	3600	3500

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Principes, 37(1), 1993, pp. 26–34

Population Structure of Two Palm Species in a Community of Sand Dune Scrub in the Yucatán Peninsula, México

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The sand dune scrub of the coast of Yucatán, México has only been studied for the last ten years (e.g., Espejel 1984, 1986, Rodríguez 1984, Ayora 1988). The vegetation is composed of species that have several phytogeographical origins such as Antillean, Neotropical, and Lesser North American.

Two species of palms with Antillean affinity form an important part of the sand dune coastal ecosystems of Yucatan. They are *Thrinax radiata* Lodd ex J. A. & J. M. Schult. and *Coccothrinax readii* Quero. *T. radiata* (Figs. 1,3) is widely distributed in Cuba, Jamaica, Hispaniola, Florida, Yucatán Peninsula and Belize (Read 1975, Quero 1989). Read (1975) gave a detailed description of its habitat in Jamaica and to a lesser extent, in the previously mentioned areas. *Coccothrinax readii* (Figs. 2,4) was originally confused with a variety of *T. radiata* until Quero (1980) described it as a new species that grows exclusively in the Yucatán Peninsula.

C. readii and *T. radiata* grow preferentially in alkaline limestone soils (rendzinas) and also with high saline concentrations (Bailey 1938, 1949; Hammer 1985; Leon and Alain 1974; Read 1975; Quero 1980, 1989). The height of adult individuals depends on microclimatic and edaphic conditions. They reach a maximum height of 2–3 m for adults in the driest zone of the Peninsula (northwest). In contrast, they can be as tall as 8 m on average in the tropical forest of the same region ('selva mediana subperennifolia' according to the Miranda (1958) classification of vegetation units).

The distribution of *C. readii* and *T. radiata* in Mexico is restricted to the Yucatán Peninsula (Figs. 3,4). Also, there is not enough information up to date about these taxa in relation to the sand dune scrub ecosystem structure. *C. readii* has been included in the IUCN (1988) and BGCS (1989) checklist of rare and threatened palms of the New World. *T. radiata*, although not included, we can also consider as a threatened species of the sand dune scrub of Yucatán. Olmsted and Ercilla (1988) studied the natural history of both palms in Quintana Roo State, México and gave a first approximation of their habits, distribution and native management. There is tremendous pressure on the sand dune coastal ecosystem due to: i) the expansion of touristic areas, ii) preparation of land for coconut grove agriculture, iii) new settlements, and iv) local industries that disturb the ecosystem with the establishment of salt extraction areas and harbor activities.

Therefore, it is imperative to study the population structure of *C. readii* and *T. radiata* in the sand dune scrub ecosystem of Yucatán in order to propose strategies for their conservation.

1. *Thrinax radiata* growing in the sand dune scrub of Uaymitun, Yucatan. 2. *Coccothrinax readii* growing in the sand dune scrub of Uaymitun, Yucatan.

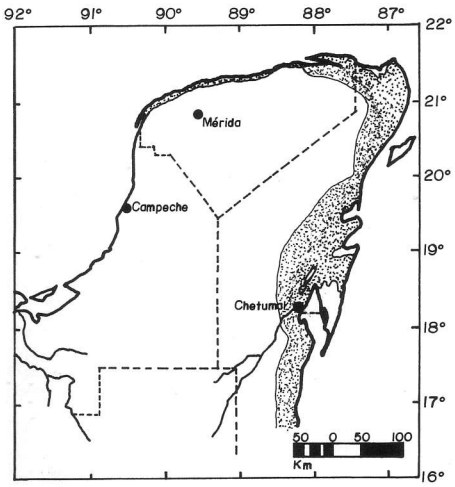
Description of the Area

The study area is located in Uaymitún, Yucatán, 89°30′ latitude, 21°19′ longitude, 14 km from Progreso city (Figs. 5,6). The soils are composed of a mixture of sand of marine-calcareous origin with organic material (mainly litter). The climate according to the modified Köppen classification (García 1974) is BS_1 (h′)w(i)g, "semiarid warm with a rainfall period during the summer season, with an intrasummer dry period, low temperature oscillation and maximum temperature before the summer solstice."

The vegetation is composed of sand dune scrub with a dominance of *Coccothrinax readii*. This community is also the main habitat of the rare endemic member of the Euphorbiaceae *Enriquebeltrania crenatifolia* (Miranda) Rzedowski (see Table 1). The selected community is characterized by different spatial patterns of the two palm species. We chose the presence of disturbed areas with summer houses and coconut groves as the eastern and western limits of the study site. The mobile sand dunes with pioneer vegetation consisting of *Sesuvium portulacastrum*, *Cakile lanceolata*, *Ipomoea pes-caprae*, *Suriana maritima*, *Tournefortia gnaphalodes* and *Scaevola plumieri* form the northern limit. Marshes whose edges are colonized by mangroves (*Rhizophora mangle*, *Avicennia germinans* and *Laguncularia racemosa*) form the southern limit.

Materials and Methods

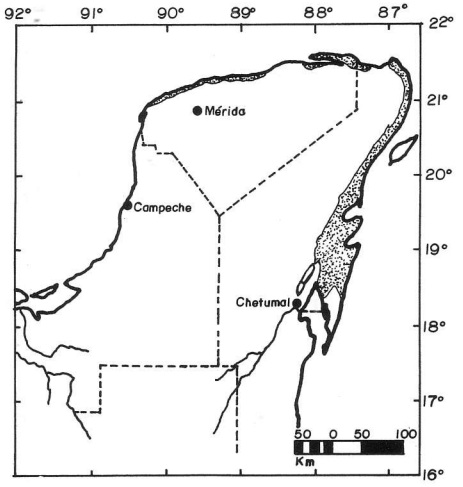
The study area measured 1,000 m^2 divided into ten plots of 10 × 10 m. In order to know if the size of the plots was adequate, the minimum area was determined (Mueller-Dombois and Ellenberg



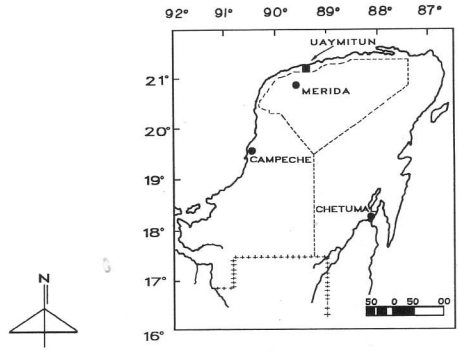
3. *Thrinax radiata* distribution on the Yucatán Peninsula.

1974, Pianka 1982). A 25 m² plot was statistically significant to represent the community and species number, so we exceeded this value by 75%.

Data included inventories with presence/absence of species, number of individuals of each species and their abundance. With this information, diversity, dominance and uniformity indices of Shannon-Wiener and Simpson (Zar 1974) were calculated for



4. *Coccothrinax readii* distribution on the Yucatán Peninsula.



5. Location of the study site on the northwest of the Yucatán Peninsula.

the whole area. Statistical importance values of the two species of palms and the other that constitute the community were calculated with the initial inventories. We considered as density the number of individuals in the 1,000 m²; relative frequency was determined following the formula:

$$Rf = \frac{ni}{N}$$

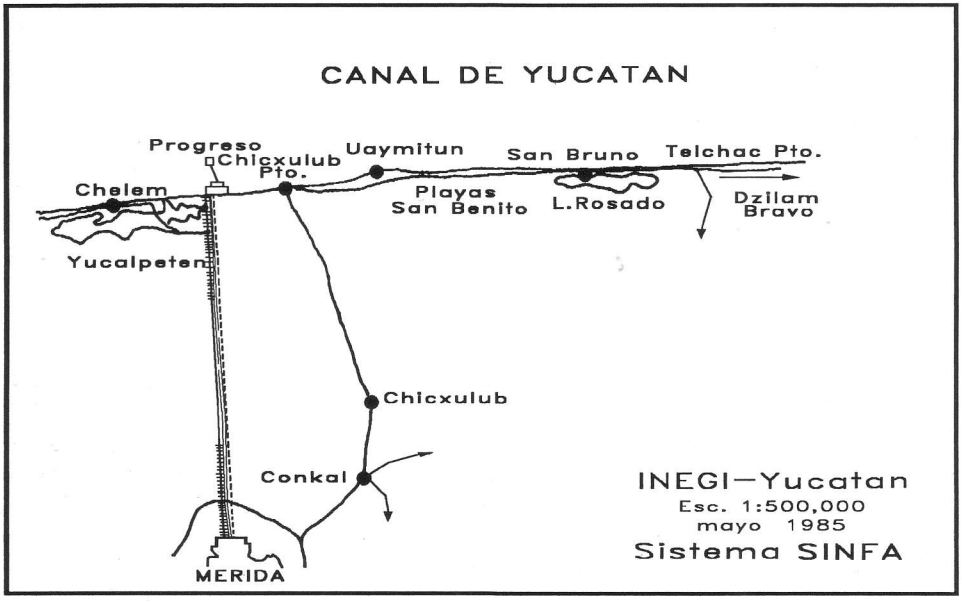
where ni is the number of individuals in which the Spi is present and N is the total number of studied squares (Mueller-Dombois and Ellenberg 1974).

The population data from *C. readii* and *T. radiata* were used to determine density (individuals per area), size, structure by stages, and survival per stage. All individuals of the two species found in the plots were divided into stages: seedling, early juvenile, juvenile and adult (See Fig. 7).

Results

Minimum Area. Figure 8 shows the size of the minimum area curve. The inflection point on the curve was registered approximately at 25 m² in each plot. This means that there were 75 m² of additional information about the described community, although our results were strictly significant with the minimum area of 25 m².

Density and Diversity. The community from Uaymitún was basically composed of



6. Detailed location of the study site showing touristic and harbor settlements.

6,181 individuals of vascular plants (6.181/m²). The average height of the dominant vegetation was of 1.5 m with a cover estimation of approximately 80%. Thirty one families were represented by 50 species.

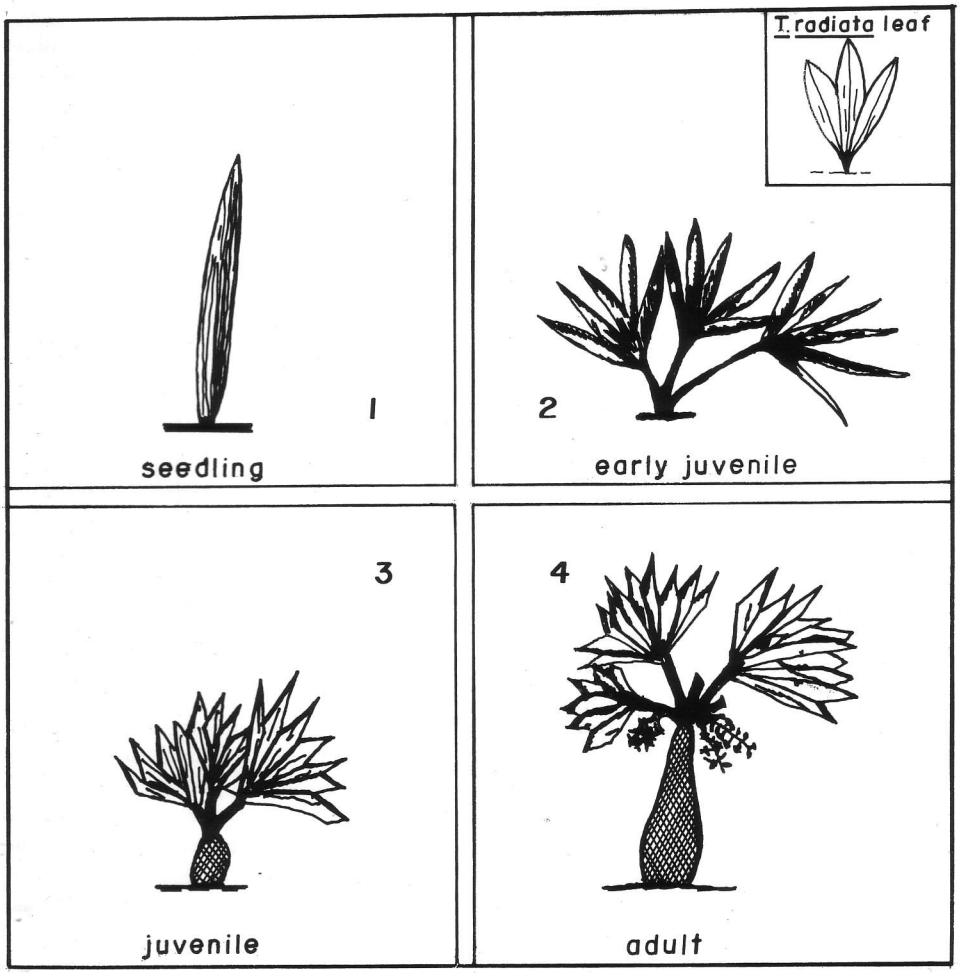
Table 1 shows the results of density (number of individual per species) and relative density of the dominants, common "A," common "B," and "scarce" species. Groups were separated arbitrarily following the inflection points of the curve representing their hierarchical positions as in Figure 9 which shows the distribution of all the species in the community, based on the number of individuals per species. The dominant ones correspond to the three more abundant species (higher than 350 individuals), *C. readii* was the main species. The common "A" group had a density lower than 350 individuals per 1,000 m², but higher than 200. The common "B" species had a density lower than 200 individuals and higher than 75 per 1,000 m². In the latter category *T. radiata* was less abundant than the other palm species, being located closer to the marshes. The community is also composed of 31 "scarce" or "rare" species, the presence of which depends on particular spatial patterns in the broad area.

Table 2 shows the community diversity parameter values. Although diversity (Shannon) and uniformity values were considerable, the concentration of major individuals (42.4%) consisted of the three dominant species: a) *Coccothrinax readii* which was dominant over the other species with 14,570 individuals/ha forming a real palm scrub; *Bravaisia tubiflora* (Acanthaceae) with 7,810 individuals/ha; and *Agave angustifolia* (Agavaceae) with 5,810 individuals/ha. *T. radiata* represented 1,550 individuals/ha occupying the eleventh position in importance value, and one order of magnitude smaller than the first species (see Table 1).

Structure by Ages. This analysis is shown in Table 3. *C. readii* is predominant in the juvenile stage (41.5%) with a stable population because of its low percentage of seedlings (4.5%). Adult and juvenile

Table 1. Density and relative density of the species found in the sand dune scrub studied in Uaymitun, Yucatán.

Family	Species	Density	Relative Density
Dominants			
Palmae	*Coccothrinax readii* Quero	1,457	0.2254
Acanthaceae	*Bravaisia tubiflora* Hemsl.	781	0.1233
Agavaceae	*Agave angustifolia* Haw.	381	0.1233
"A" Common			
Anacardiaceae	*Metopium brownei* (Jacq.) Urban	348	5.5×10^{-2}
Orchidaceae	*Mirmecophyla tibicinis* Batem.	301	4.8×10^{-2}
Polygonaceae	*Coccoloba uvifera* L.	272	4.3×10^{-2}
Gramineae	*Bouteloua repens* (H.B.K.) Scribn. & Merr.	270	4.2×10^{-2}
Araceae	*Anthurium tetragonum* (Hook.) Schott	249	4.0×10^{-2}
Celastraceae	*Rhacoma gaumeri* Loes.	237	3.7×10^{-2}
"B" Common			
Bromeliaceae	*Tillandsia dasylirifolia* Baker	178	3.0×10^{-2}
Palmae	*Thrinax radiata* Lodd. ex J. A. & J. M. Schult.	152	2.4×10^{-2}
Compositae	*Porophyllum punctatum* (Miller) Blake	118	2.0×10^{-2}
Ebenaceae	*Diospyros cuneata* Standley	108	1.7×10^{-2}
Cyperaceae	*Cyperus* sp.	96	1.5×10^{-2}
Rubiaceae	*Ernodea littoralis* Sw.	96	1.5×10^{-2}
Nyctaginaceae	*Neea psychotrioides* Donn. Smith	96	1.5×10^{-2}
Cactaceae	*Mammillaria gaumeri* Orcutt	95	1.5×10^{-2}
Commelinaceae	*Commelina erecta* L.	86	1.3×10^{-2}
Rubiaceae	*Chiococca alba* (L.) Hitch.	80	1.2×10^{-2}
Scarce			
Amaranthaceae	*Iresine paniculata* (L.) Kuntze	73	1.5×10^{-2}
Orchidaceae	*Cirtopodium punctatum* (L.) Lindl.	68	1.07×10^{-2}
Theophrastaceae	*Jacquinia aurantiaca* Aiton	67	1.05×10^{-2}
Sapotaceae	*Bumelia retusa* Swartz	59	9.3×10^{-3}
Compositae	*Ambrosia hispida* Pursh	55	8.7×10^{-3}
Cactaceae	*Acanthocereus pentagonus* (L.) Br. & R.	47	7.4×10^{-3}
Apocynaceae	*Thevetia gaumeri* Hemlsey	42	6.7×10^{-3}
Capparidaceae	*Capparis incana* (H., B. & K.)	41	6.4×10^{-3}
Leguminosae	*Pithecellobium keyense* Brit. ex Benth.	40	6.3×10^{-3}
Zygophyllaceae	*Tribulus cistoides* L.	40	6.3×10^{-3}
Euphorbiaceae	*Enriquebeltrania crenatifolia* (Mir.) Rz.	35	5.5×10^{-3}
Cactaceae	*Selenicereus donkelaarii* Brit. & Rose	30	4.7×10^{-3}
Portulacaceae	*Portulaca* L. sp. cf *Cyperus* sp. *Cuscuta* sp.	26	4.1×10^{-3}
Leguminosae	*Canavalia maritima* (Aubl.) Urban	23	3.6×10^{-3}
Passifloraceae	*Passiflora foetida* L.	16	2.5×10^{-3}
Malvaceae	*Malvaviscus arboreus* Cov.	14	2.2×10^{-3}
Compositae	*Melanthera nivea* Small	14	2.2×10^{-3}
Gramineae	No. 2	12	1.8×10^{-3}
Gramineae	No. 3	10	1.5×10^{-3}
Apocynaceae	No. 2	9	1.4×10^{-3}
Apocynaceae	No. 3	9	1.4×10^{-3}
Euphorbiaceae	*Chamaesyce hypericifolia* (L.) Millsp.	9	1.4×10^{-3}
Polygonaceae	*Gymnopodium floribundum* Rolfe	9	1.4×10^{-3}
Cactaceae	*Cephalocereus gaumeri* Britt. & Rose	6	9.4×10^{-4}
Zygophyllaceae	*Kallstroemia maxima* (L.) Torr. & Gray	6	9.4×10^{-4}
Apocynaceae	*Echites umbellata* Jacq.	5	7.8×10^{-4}
Cactaceae	*Opuntia stricta* Haworth	5	7.8×10^{-4}
Leguminosae	*Chamaecrista glandulosa* (L.) Greene	4	6.3×10^{-4}
Acanthaceae	*Justicia carthaginensis* Jacq.	2	3.2×10^{-4}
Sterculiaceae	*Waltheria americana* L.	2	3.2×10^{-4}
Convolvulaceae	*Cuscuta* sp.	2	3.2×10^{-4}

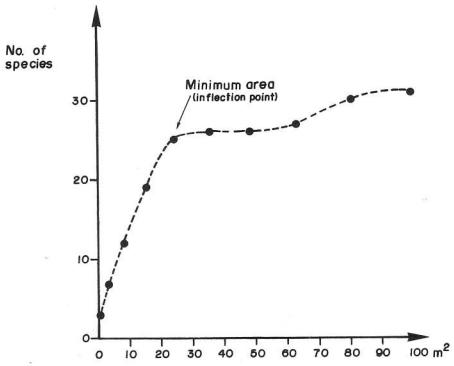


7. Growth stages of *Thrinax radiata* and *Coccothrinax readii*: 1) seedling, 2) early juvenile, 4) juvenile and 5) adult.

individuals constitute most of the population in this location (80%). In contrast, *T. radiata* showed a different behavior in comparison to *C. readii*. The juvenile stage was prevalent and no seedlings were found in the study area; however, we found mature and viable seeds in the first soil layer.

Table 2. Diversity parameter values obtained on the 1,000 m^2 studied at Uaymitún. Values were calculated with base 2 logarithm (in BITS).

Index	Formula	Value
Diversity (Shannon-Wiener)	$H = -\Sigma$ pi log pi	4.28
Dominance (1-Simpson)	$S = 1 - \Sigma$ pi^2	0.09
Maximum diversity	M = log N (number of species)	5.64
Uniformity	J = H/M	0.76



8. Size of the minimum area reached in the studied community.

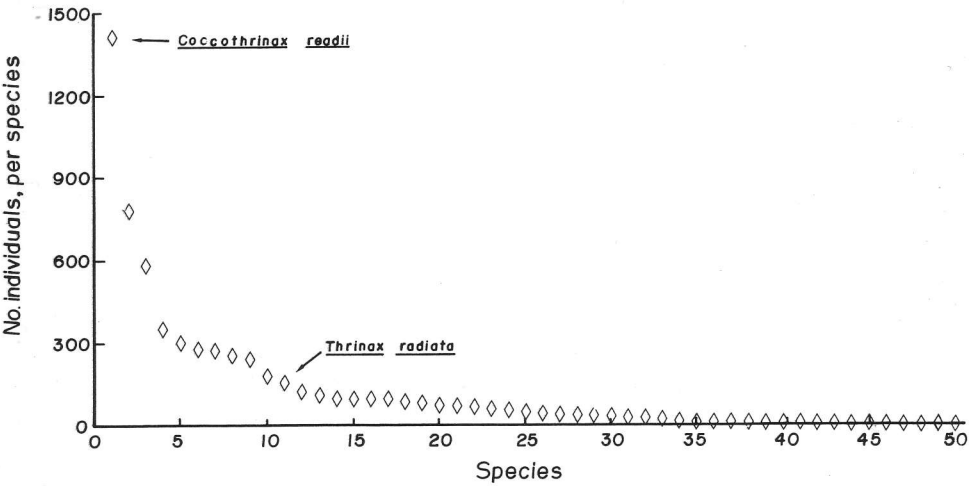
The population structure and survival curve for the two species are shown in Figure 10. A linear relationship with a negative slope for *T. radiata* confirmed field observations of higher mortality in relation to early stages. In contrast, the survival curve of *C. readii* increases directly with age. In other words, there are more individuals that pass from one stage to the next than in *T. radiata*. In the extreme of the survival curve there was a low decrease that represented older individuals that die by aging.

Table 3. Structure by ages (stages) reached in the C. readii *and* T. radiata *population studies in the Uaymitún community.*

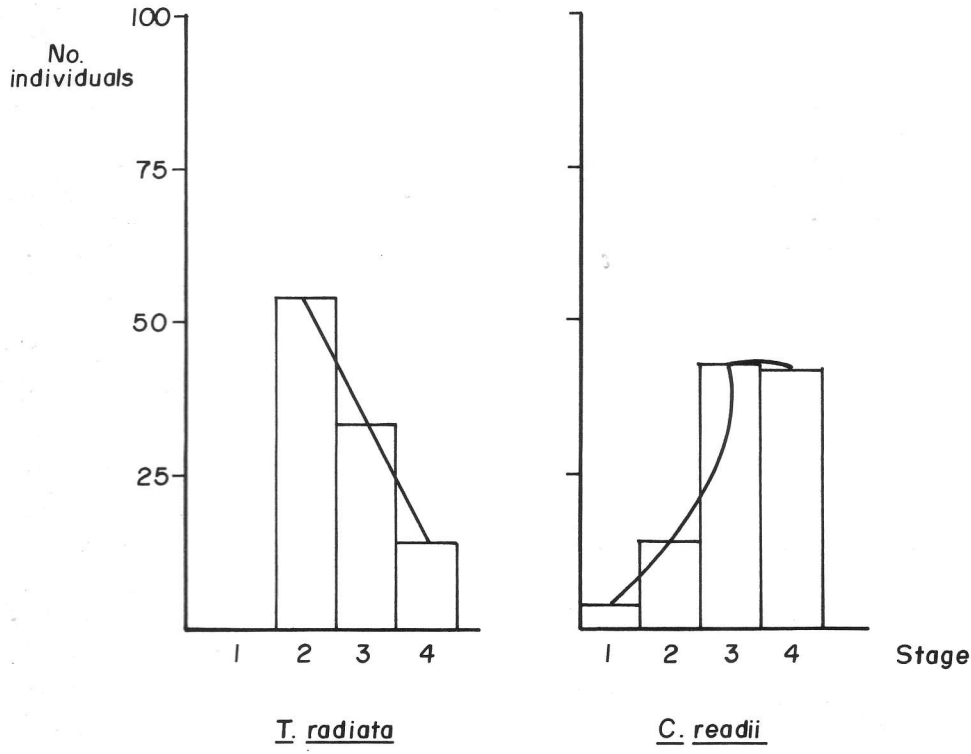
Stage	Height (x)	No. Individuals	%
Coccothrinax readii			
plantlet	10.15	65	4.5
early juvenile	19.19	202	14.0
juvenile	29.08	601	41.5
adult	88.37	589	41.0
maximum height	1.51 m		
sum 1,457 ind/1,000 m²			
Thrinax radiata			
plantlet	—	—	—
early juvenile	19.26	84	54
juvenile	36.41	50	32
adult	190.22	21	14
maximum height	2.25 m		
sum 155 ind/1,000 m²			

Discussion and Conclusions

The studied community is a palm scrub grove of mainly *C. readii* whose population establishment we suppose reflects the distinct conditions of the site, in contrast to *T. radiata*. The latter species presents quite



9. Hierarchical position of *Coccothrinax readii* and *Thrinax radiata* in relation to other species of the community.



10. Population structure and survival curves of *Thrinax radiata* and *Coccothrinax readii* in Uaymitun, Yucatan.

a different population behavior in number, age distribution, and survival by stages. The results suggest that the distribution pattern of *T. radiata* in the area depends either on some microenvironmental differences or on very high mortality in the seedling stage due to predation and other external causes. In the other stages, mortality is even higher. Thus, its settlement in the ecosystem is due to random conditions rather than to the adaptability and resistance to the environment that affect the taxa in the community. Consequently, we inferred that its settlement in the ecosystem some years ago, was favored by some particular environmental conditions. These natural conditions are more difficult to reach day by day due to the continuous transformation of the landscape in this important tropical semiarid region.

It is important to mention that *C. readii* and *T. radiata* in the Yucatán Peninsula also grow in other environmental conditions, such as, more humid climates and, consequently, with other vegetation types. In the particular case of the northern semiarid peninsular climate, *C. readii* predominates all along the littoral sand dune scrub. On the other hand, in some localities of the Caribbean in Quintana Roo, this situation is reversed due to quite different climatic and edaphic conditions, according to Olmsted and Ercilla (1988).

The results obtained suggest that the *C. readii* populations have been more stable than the ones of *T. radiata* in the community. This community is in dynamic equilibrium which has reached its maximum charge capacity.

On the basis of this study, we are inter-

ested in proposing the conservation of some parts of this kind of palm sand dune scrub. To support our proposal we planned this research some years ago (1985–1986) and reported some important aspects (Ayora 1988, Orellana et al. 1988). This research represents the only basis to analyze other environmental conditions that influence the particular distribution of these species. Further reports will determine the physicochemical soil factors that influence the distribution of the two palm species in this ecosystem.

Acknowledgments

The study was supported by a grant to N. Ayora of CONACyT and CICY. We are indebted to Marco A. Villanueva and J. Armando Escamilla for their helpful assistance on the English manuscript. We also want to thank Ingrid Olmsted and Rafael Durán who reviewed and gave helpful suggestions on the original manuscript. We also appreciate the help of Patricia Alonzo who made the figures and Leonardo Gus for the photographs.

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Feeding Sites of Some Leaf- and Planthopper Insects (Homoptera: Auchenorrhyncha) Associated with Coconut Palms[1]

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In the past three decades more than 50% of Florida's estimated one million coconut palms (*Cocos nucifera* L.) and over 80% of Jamaica's 4.3 million coconut palms have been killed by a pandemic disease called lethal yellowing (LY) (McCoy et al. 1983). Another economically important palm, the date (*Phoenix dactylifera* L.), has also been affected by LY. In all, more than 32 species of palms have been affected by LY (McCoy et al. 1983). These susceptible species represent 22 genera from eight tribes in three subfamilies of the palm family according to the classification of Uhl and Dransfield (1987). The disease is caused by mycoplasma-like organisms (MLO), microbes that cannot be cultured (McCoy et al. 1983). The MLO reside in the phloem, that part of the plant's vascular tissue which transports carbohydrates. The MLO are presumably transmitted by a planthopper insect, the American palm cixiid, *Myndus crudus* Van Duzee (Howard and Thomas 1980) which feeds on the phloem. However, unequivocal evidence that proves *M. crudus* is the sole vector of LY is lacking (Tsai 1980). Some leafhoppers and planthoppers (insects belonging to the order Homoptera: Suborder Auchenorrhyncha) feed on the MLO harboring phloem. Other related species feed on the xylem, the water-conducting vascular tissue in the palm. Our study was designed to document the feeding sites of seven species of leafhoppers and planthoppers, which are associated with palm groves in south Florida, in order to further identify possible vectors of LY. We examined feeding on coconut and Veitchia palms [*Veitchia merrillii* (Becc.) H. E. Moore], which are susceptible to LY, and also periwinkle [*Catharanthus roseus* (L.) Nees] and St. Augustine grass [*Stenotaphrum secundatum* (Walt.) Kuntze], which are alternative food sources for the same insects.

Materials and Methods

Leafhoppers included in this study were:

Spangbergiella vulnerata (Uhler) [Homoptera: Cicadellidae]
Graminella sonorus (Ball) [Homoptera: Cicadellidae]
Macrosteles fascifrons (Stal) [Homoptera: Cicadellidae]
Oncometopia nigricans (Walker) [Homoptera: Cicadellidae]

Planthoppers tested in this study were:

Myndus crudus (Van Duzee) [Homoptera: Cixiidae]
Peregrinus maidis (Ashmead) [Homoptera: Delphacidae]

[1] Florida Agricultural Experiment Station Journal Series No. R-01907.

Treehopper tested in this study was:

Idioderma virescens (Van Duzee) [Homoptera: Membracidae]

Spangbergiella vulnerata was collected from the St. Augustine grass. Both nymphs and adults of *Myndus crudus* (=*Haplaxius crudus*) were reared in the laboratory as described previously (Tsai et al. 1976); *Peregrinus maidis* adults were reared in the laboratory (Tsai 1975); *Graminella sonorus* adults were reared on rye (*Secale cereale* L.) (Bradfute et al. 1981); *Macrosteles fascifrons* adults were reared on rye and oats (*Avena sativa* L.) (Smith et al. 1981); *Oncometopia nigricans* adults were reared on leaf lettuce (*Lactuca sativa* L.) (Tsai and Anwar 1977); and *Idioderma virescens* adults were reared on the saw palmetto [*Seronoa repens* (Bartram) Small] (Kopp and Tsai 1983). Test insects were placed in cages containing the leaves and roots of St. Augustine grass, coconut palm, and leaves of Veitchia palm and periwinkle.

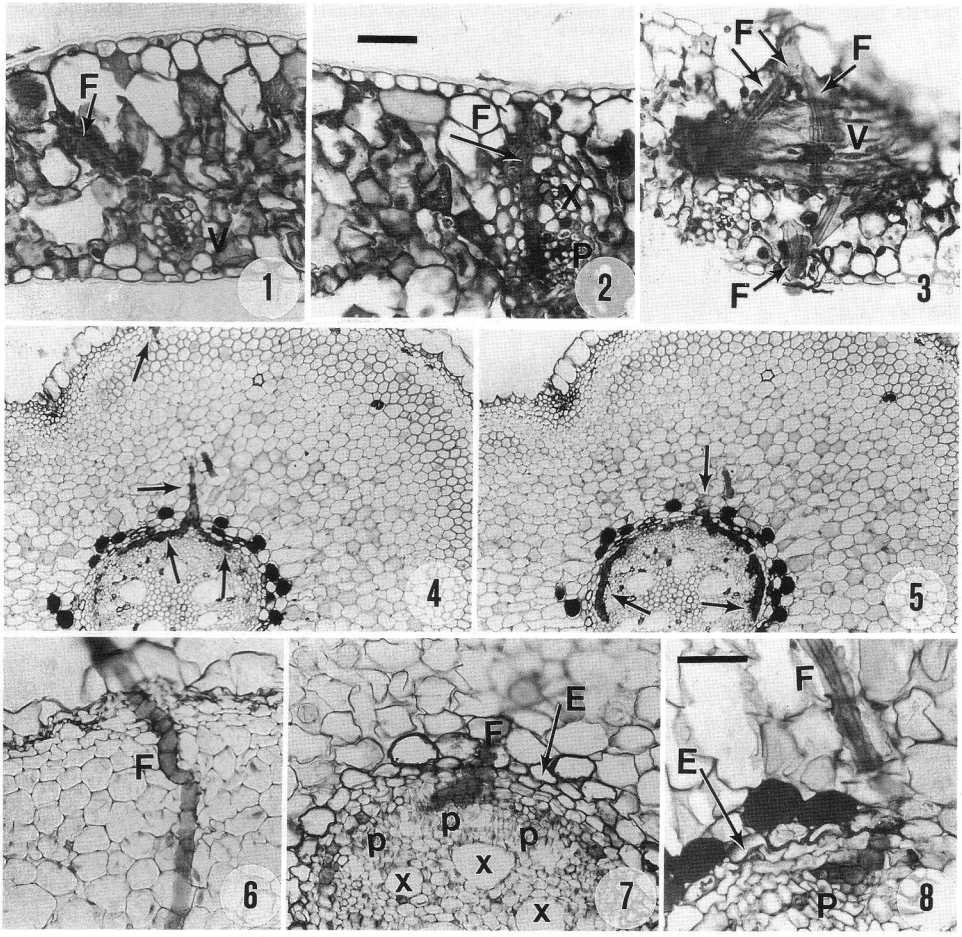
Plant parts fed on by the test insects were marked and excised. The excised tissues were fixed in FAA (formalin-alcohol-acetic acid), embedded in paraffin, serially sectioned at 10 μm increments, and stained with safranin and fast green (Sass 1958). The salivary sheaths secreted by the leafhoppers and planthoppers during feeding were examined under a light microscope and photographed using a green filter.

Results and Discussion

When leaf- and planthoppers feed on plant tissues, they puncture the leaf, stem, or root with their delicate sucking mouth parts. An elongated stylet is pushed into the plant, and the insect probes the internal tissues of the plant seeking the appropriate vascular tissue to feed on. During the process of probing and feeding, the insect secretes a proteinaceous gel, called the sheath, around the stylet. The sheath remains after feeding is terminated forming a visible feeding track (Houston et al. 1947, Day et al. 1952, Smith 1933). The surface of the feeding puncture is marked by a raised droplet of sheath material on the plant surface known as the labial imprint (see Figs. 6,9,12) (Waters 1977). The sheath stains with safranin so that the labial imprint and feeding track can easily be seen in stained sections of the plant tissue.

The insect can sense the proximity of the vascular tissue from which water and nutrients are sucked (Sogawa 1973). Xylem feeders tend to feed on the water conducting part of the plant's vascular system. Phloem feeders make use of the carbohydrate or food conducting region. In small veins of a leaf, the phloem is oriented toward the lower surface (abaxial), and the xylem is toward the upper surface (adaxial). All figures are shown with the upper leaf surface toward the top of the page. The midrib vein is more complex with xylem and phloem in several separate regions (see X and P in Fig. 13). In a root, xylem and phloem strands alternate around the periphery of the vascular core or stele, just inside a distinct, thick-walled layer, the endodermis (see X and P in Figs. 4,5).

By following the feeding track in serial sections, the pathway of the insect's stylet can be reconstructed, and the plant tissues that are affected can be distinguished by microscopic examination. However, the course of the feeding track only shows where the stylet was positioned and not necessarily where the insect fed. The actual site of feeding could not be distinguished from test probes (for example, Fig. 10). Feeding tracks often show that stylet probes never reach vascular tissues and, therefore, mark unsuccessful attempts by the insect to locate a feeding site. Insects were fed on the upper and lower surfaces of the leaf in these cage experiments. Such artificial environments do not necessarily reflect the natural, preferred feeding orientation of an insect. Brief descriptions of the feeding tracks for seven insects are given below.



1. Coconut leaf blade with feeding track of *Myndus crudus* ending in phloem of a small vein. 2. Coconut leaf with feeding track of *M. crudus* passing through xylem and ending in phloem of a large vein. 3. Coconut leaf with several feeding tracks of *M. crudus* from both surfaces ending in a large, longitudinally cut vein. 4,5. Adjacent sections of a coconut root with feeding track of *M. crudus* that branches after entering the vascular core; limits of the feeding track are shown by arrows. 6. Detail of same feeding track entering root surface. 7,8. Details of other feeding tracks entering phloem region of root. E, endodermis layer; F, feeding track; L, labial imprint; P, phloem; V, vein; X, xylem. Scale bar = 40 μm for Figs. 1–3, 6, 7; and 100 μm for Figs. 4, 5. Scale bar = 30 μm in Fig. 8.

Myndus crudus. On coconut leaves, many tracks ended in the smallest veins of the leaf which contained mostly or only phloem tissue (Fig. 1). The diameter of the feeding track often equaled that of the narrowest veins so that all vascular regions of those veins were included within the sheath boundary. In a few larger veins, the track clearly terminated in the phloem region, either bypassing or traversing the xylem (Fig. 2). There were often multiple feeding tracks originating from a single epidermal puncture marked by a lone labial imprint. Sometimes a track went all the way through the leaf to the opposite surface. In one case, a single vein was reached by separate

tracks from either surface of the leaf (Fig. 3).

In coconut roots, feeding tracks went directly from the surface (Fig. 6), through the fleshy cortex, and either ended blindly or reached the lignified endodermis. In some cases several probes branched out from this point to follow the outer surface of the endodermal layer or, in one case, the pericycle layer immediately within the endodermis (Figs. 4,5), with one probe bent inward and terminated at one or more of the peripheral phloem sites (Fig. 8). In one case, the feeding track went in a straight line directly to a phloem site (Fig. 7).

In periwinkle leaves, the veins were about half as narrow as those of coconut so that the diameter of the feeding track was larger than the veins. Feeding tracks passed through veins, but it was not possible to determine which vascular tissue was at their termini.

In all *M. crudus* feeding tracks, the sheath material either filled the cell lumen or, in large parenchyma cells, formed a tube within the cell. The feeding track passed through cells (intracellular) and not between cells (intercellular).

Peregrinus maidis. In coconut leaves, many tracks ended without reaching vascular tissue. In the smallest veins, the sheath material completely filled the veins which consisted of mostly phloem and perhaps one or two narrow xylem elements. In larger veins, feeding tracks ended in the phloem and often passed through the xylem (Fig. 9). In one large vein, feeding tracks clearly terminated in defined phloem sites. In another vein, a feeding track had multiple short probes at its tip in which the sheath material filled some xylem vessels and xylem parenchyma and terminated in the phloem (Fig. 10). The sheath material was intracellular.

Graminella sonorus. In coconut leaves, feeding tracks reached small veins and often entered from the side of the vein. The sheath material ended either in the phloem of the smallest veins or in the phloem/xylem boundary of larger veins. In this latter case, both xylem and phloem contained sheath material. Many feeding tracks ended in the intervascular leaf mesophyll. The sheath material was intracellular.

Macrosteles fascifrons. In coconut leaves, the feeding tracks followed the same pattern as in *G. sonorus*. One large vein had a branched track that terminated in three distinct phloem sites. Conversely, some tracks terminated in the xylem of smaller veins or at the xylem/phloem boundary in larger leaf veins (Fig. 11). The sheath material was intracellular.

Oncometopia nigricans. In coconut leaves, the feeding track was relatively massive and disrupted much of the mesophyll tissue. The sheath diameter was larger than the largest hypodermal parenchyma cells and the small veins. Many smaller veins were completely cut by probes that continued through the leaf (Fig. 12). There was often a cavity present in the center of the track. Feeding tracks commonly

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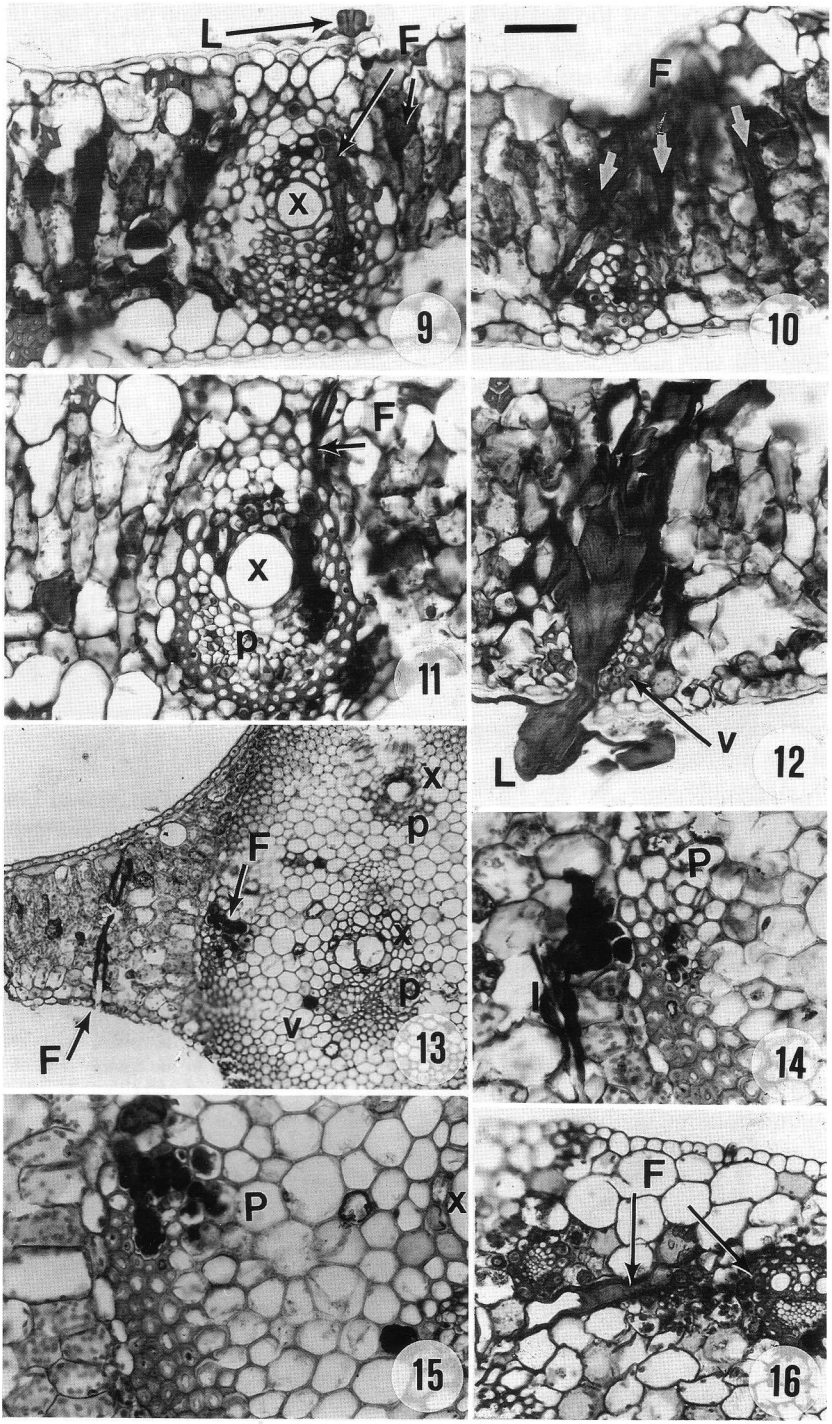
9. Coconut leaf blade with feeding track of *Peregrinus maidis* passing by xylem vessel and ending in phloem of a large vein. 10. Coconut leaf with multiple feeding tracks of *P. maidis*, one of which ends in phloem of small vein. 11. Coconut leaf with feeding track of *Macrosteles fascifrons* passing by xylem vessel and ending at the xylem/phloem boundary of a large vein. 12. Coconut leaf with feeding track of *Oncometopia nigricans* which passes through a small vein. 13. *Veitchia* leaf at midrib with feeding tracks of *Idioderma virescens*; one passing through blade and another (arrow) entering midrib. 14,15. Details of dark feeding track filling phloem cells in the midrib; these are adjacent sections. 16. St. Augustine grass leaf with feeding track of *Spangbergiella vulnerata* entering the side of a vein at the xylem/phloem boundary. F, feeding track; L, labial imprint; P, phloem; V, vein; X, xylem. Scale bar = 10 μm for Figs. 9–12, 14–16; and 100 μm for Fig. 13.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went from one surface of the leaf to the other. In large veins, the track entered laterally at the xylem/phloem junction. Although this insect is known to be a xylem feeder, the tissue in which the sheath terminated was unclear. These large feeding tracks were clearly intracellular.

Idioderma virescens. In *Veitchia* leaves, there were many random feeding tracks in the mesophyll. Feeding tracks were relatively narrow, and many lacked stained sheath material and appeared as tunnels in the leaf (Fig. 13). One track approached the edge of the largest vein or midrib, penetrated the fibrous sheath, and ended in a phloem region (Figs. 14,15). The feeding track was intracellular.

Spangbergiella vulnerata. On coconut leaves, feeding tracks were similar to *G. sonorus*. Most tracks that reached a vein terminated either at xylem/phloem boundaries of larger veins or within the phloem core of the smallest veins. One track to a large vein ended in the phloem. Sheath material was intercellular.

In St. Augustine grass leaves, feeding tracks terminated in small veins which contained mostly phloem but also had one to several small tracheary elements in the xylem. Feeding tracks sometimes ended at the xylem/phloem boundary in large veins (Fig. 16). When the upper epidermis was punctured, the feeding track terminated in either the phloem and xylem, or only in the xylem alone. The sheath material was intercellular.

Conclusions

Our study has shown that the courses of salivary sheaths' passage into the phloem were mostly intracellular with the exception of intercellular feeding by *S. vulnerata*. In general, the Auchenorrhyncha insects (leafhoppers, planthoppers, and treehoppers) mostly probe intracellularly to phloem as compared to intercellular penetration by Sternorrhyncha insects (aphids, whiteflies and mealybugs) (Pollard 1973, Kennedy et al. 1978). In this study, we have noted that the points of entry of the stylet and the pathways through different tissues varied not only with test insects but also with plant species. Only *O. nigricans* was found to cause massive disruption of cells near the sheaths, a probable result of the extremely large size of this insect (15–18 mm long). We have observed the efficient feeding by *M. fascifrons* which fed on multiple phloem sites with only one stylet penetration. Test insects made many unsuccessful short probes as indicated by sheaths ending blindly in the mesophyll cells.

Of seven species of insects tested, only *O. nigricans* is known to be a xylem feeder and a vector of xylem limited pathogen (McCoy et al. 1978). Although phloem feeders can acquire LY MLO during the process of ingesting phloem sap, not all phloem feeders transmit the LY pathogen (Tsai 1979).

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Hypothesizing About Palm Weevil and Palm Rhinoceros Beetle Larvae as Traditional Cuisine, Tropical Waste Recycling, and Pest and Disease Control on Coconut and Other Palms—Can They Be Integrated?

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In their book on Cameroon cuisine, Grimaldi and Bikia (1985) describe their recipe for "coconut larvae" as a "favorite dish offered only to good friends" (see recipe, page 44). The flavor of "palmworms" (fat, legless larvae of the weevil genus *Rhynchophorus*) has been appreciated throughout the tropical world for centuries. There are a number of species, but the major ones from the standpoint of wide distribution and use as food are *Rhynchophorus palmarum* in the Western Hemisphere, *R. phoenicis* in Africa, and *R. ferrugineus* in Asia.

Newcomers to the Caribbean region were particularly effusive about palmworms. Bancroft (1769:239), in his "Natural History of Guiana," wrote that the larvae are "esteemed a delicate morsel, not only by the aboriginal Natives, but by many of the White Inhabitants, particularly the *French*, who roast them before the fire, and mix them with crumbs of bread, salt, and pepper." Smeathman (1781:167–69), who was working in West Africa at the time and had taken a particular fancy to the taste of the termite, *Macrotermes bellicosus*, said of the termites, "they are something sweeter, but not so fat and cloying as the [palmworm] which is served up at all the luxurious tables of West Indian epicures, particularly of the French, as the greatest dainty of the Western world." And Stedman (1796:22–23) in Suriname, remarked that, "However disgusting to appearance, these worms are a delicious treat to many people, and they are regularly sold at Paramaribo." Stedman later related (p. 115) that: "We here found concealed near the trunk of an old tree a case-bottle filled with excellent butter, which the rangers told me they made by melting and clarifying the fat of the palm-tree worms: this fully answers all the purposes of European butter, and I found it in fact even more delicious to my taste."

Indigenous populations throughout the tropics have prized palmworms no less than have Europeans, and in the case of *R. palmarum*, Chagnon (1968:30–32) in Venezuela/Brazil, Clastres (1972:160–61) in Paraguay, and Beckerman (1977) and Dufour (1987) in Colombia have reported primitive cultivation systems for the larvae. Chagnon reports: "The Yanomamo come very close to practising 'animal domestication' in their techniques of exploiting this food. They deliberately cut the palm tree down in order to provide fodder for the insect. When they cut the tree, they also eat the heart of the palm, a very delicious, crunchy vegetable that slightly resembles the taste of celery hearts. One palm we cut yielded an edible heart of about 50 pounds. After the pith has been allowed to decay for several months, it contains numerous large, fat, white grubs. The pith is dug out of the tree with sticks, broken open by hand, and the grubs extracted. . . . A fair-sized palm tree will

yield three or four pounds of grubs, some of them as large as a mouse. The grubs are wrapped in small packages of leaves and placed in the hot coals to roast." Chagnon was told by a missionary that the grubs taste very much like bacon.

The Guayaki of Paraguay, according to Clastres, consider the palm larvae as "more than a food gathered by chance in the forest; rather, it is the product of a sort of cultivation. The Indians knock down the palm tree, leaving a stump about 3 feet high. They then generally cut the fallen trunk into sections 10 or 12 feet long, preparing the wood for the insects. . . . Each man is the owner of his larvae bed. . . . This private property is almost always respected and no one touches the larvae of another. Later, the harvest is divided and eaten collectively. Thus the Guayaki distribute a relatively abundant supply of food. . . . It is of great interest to see that the Guayaki, despite their being nomads, establish a fixed source of food to be gathered much later. In doing so, they are obliged to return to the cultivation area after many months of travelling. . . . This cultivation of *guchu* therefore exerts a profound influence upon the wandering habits of the Guayaki in that it gives an order to their travels."

In Colombia, Beckerman (1977) reported that the Bari Indians use only *Jessenia* palm as a "grub farm." The trees are cut down and the logs left lying in the forest. "In two or three months the whole trunk is infested with the edible larvae. . . . Several hundred grams of larvae can be extracted from a single trunk. . . ." Dufour (1987) reported that "The Tatuyo felled palms to harvest the fruits, and often returned at a later date to harvest the larvae which subsequently developed in the pith. Palms were also cut specifically with the expectation that they would be invaded by weevils and the larvae ready to harvest in two or three months. Thus, the larvae were both a by-product of the harvesting of palm fruits and 'cultivated.'" Dufour reported a live weight of 3–16 grams for the grubs and a maximum acquisition rate of 2,000 g/hour.

With this gustatory background, let us look at another dimension of palm weevils, restricting ourselves temporarily to the Western Hemisphere. *Rhynchophorus palmarum* is one of the most serious pests of coconut and oil palms in Latin America and the Caribbean, mining the trunks of the trees and transmitting the nematode, *Rhadinaphelenchus cocophilus*, which is the causal agent of red-ring disease (RRD) (Morin et al. 1986, and others). The weevil infests many other species of palms, both wild and cultivated, as well as sugarcane and several root and fruit crops (Hagley 1965, and others). Hill (1983) describes the damage from the weevils as follows: "The larvae burrow in the crown of the palm, feeding on the young tissues, and sometimes destroy the growing point, when the palm will die. The leaves turn chlorotic and die, and the trunk becomes tunnelled and weakened, and may break in a storm."

Schuiling and van Dinther (1981) provide a good entry to the extensive literature on RRD. The coconut palm may die within 3–4 months after the appearance of external symptoms which include yellowing of leaves and premature nutfall. Internally the stem tissue is discolored and necrotic. There is evidence that only the adult weevils are involved in the transmission of the RRD nematode.

Hill (1983) lists recommended insecticides and several cultural control methods that are applied against *R. palmarum*, including elimination of breeding sites by restricting physical injury to palms, control of *Oryctes* beetles, destruction of infested palms, and trapping of adult weevils. Morin et al. (1986) describe procedures that have been successfully used in Para and Bahia, Brazil, since 1975. As adults are attracted for feeding and reproduction to the odor of fermentation emanating from wounds in healthy palms or from the decay of dead or diseased palms, all injured or decaying

Cameroon cuisine - larves de palmier

(From: *La Cuisine Camerounaise*, by Jean Grimaldi and Alexandrine Bikia, p. 136. Thanks to Dr. Jane Homan, UW International Agricultural Programs, for providing a copy, and to Diane Landry for a translation from the French.)

The larvae of certain coleoptera harvested from the oil palm and from the palm of genus *Raphia* are eaten in Cameroon. These larvae, called "Fos" in Ewondo, are white (oil palm) or yellow (raphia palm). They are sometimes reared. Before any preparation, the larvae are washed in a lot of water and pierced in the abdomen with a sharp piece of bamboo between each washing to let a white, fatty liquid escape. In all regions they are prepared either by stewing, frying in oil with salt and pepper, adding to squash seed paste, or putting on brochettes grilled over coals.

Coconut larvae recipe

Larvae coming from oil palms or raphia palms, salt, pepper, onion, coconut.

Preparation: Larvae washed and cut in half are mixed with all the condiments cited. The coconuts are chosen at half-hard stage, so that the inside, completely globular, can be taken out of the husk without being broken. The most pointed end of the nut is cut in a way that forms a cap. The nuts are emptied of their milk, then refilled with the larvae and condiments and closed by attaching the caps firmly.

The nuts are stood straight up by some banana leaves in a pot containing water. The amount of water should be such that, during the course of cooking, it cannot penetrate the nuts. The cooking is rather long. After cooking, the nuts are cut into slices.

This favorite dish is only offered to good friends and is served with manioc sticks.

Bamoun preparation

Among the Bamoun, the larvae are strung up and left to dry hanging under the trellis that is found above the foyer. After they are well-smoked, they can be incorporated, after being washed, into the squash seed paste.

trees are removed and traps are constructed along the edge of a plantation from cut pieces of thinning, wild palms or uninfested parts of damaged or diseased trees. Whole trunks of oil-palms, which are very thick, can be cut into cubes and left in small heaps; but only the tender apical 1–2 meters of the thinner but tougher trunks of wild and coconut palms are used. They are split into longitudinal sections and intercrossed into piles with the bud on top. Trap heaps should be renewed weekly, either by replacement with other palm pieces and burning of the old infested ones, or by spraying with palm sap to maintain attractiveness and also with 0.15% methomyl to prevent the piles from becoming a source of infestation.

At the Paricatuba oilpalm estate in Para, Brazil, according to Schuiling and van Dinther (1981), palm losses from RRD were held to 1.14% of palms in the susceptible age group through the program of phytosanitation, i.e., preventing wounds and early elimination of palms showing distinct growth disorders by felling and transporting the trunks to the oil factory where they were sawed into blocks and steam sterilized at 130°C for 1 hour, which kills the nematodes. This program was considered much more effective than insecticides, the efficacy of which, according to the authors, is open to question.

In Africa and Asia, *Rhynchophorus phoenicis* and *R. ferrugineus*, respectively, damage palms as does *R. palmarum* in Latin America and the Caribbean. RRD, however, is apparently not found outside the Western Hemisphere.

The hypothetical scenario that can be created from the foregoing has long intrigued this writer. Palmworms would certainly seem worthy of wider publicizing as traditional cuisine of gourmet quality, the kind of delicacy that could be promoted as tourist and urban fare by the best restaurants throughout the tropics and subtropics, and eventually, maybe, even as an

item for export. Could such wider promotion and use create more opportunities for employment and entrepreneurship in the rural countryside? Could, in fact, expanded markets provide a basis for attempting to combine increased palmworm production with more efficient recycling of dead and diseased palms, and as part of reduced-pesticide integrated pest management (IPM) programs and disease control on coconut and other palm species?

Taking a cue from how indigenous populations have done it for centuries, could the trap logs recommended for pest and disease control, through a simple modification in procedure, be used simultaneously for palmworm production? The desired harvest stage is the late-instar larva. Studies in Trinidad (Hagley 1965), Brazil (Morin et al. 1986) and Mexico (Gonzalez and Camino 1974) have shown that the egg and larval stages of *R. palmarum* last 2–4 days and 40–61 days, respectively, at essentially ambient temperatures. Instead of burning trap logs at the end of a week or spraying them with methomyl to kill the larvae, as suggested by Morin et al., if left in place for approximately 45–50 days, the larvae would be ready for harvest. All would be large-sized, few would have pupated and no adults would have yet emerged. Possibly, logs could be reused if desired by spraying with palm sap to renew attractiveness. If not, they could at that point be burned or otherwise disposed of.

Greater efficiency might be achieved by additionally seeding new trap logs with eggs from adult weevils caught in traps baited with coconut tissue. This should exert additional control pressure within the plantation, while producing a higher density of developing larvae in the logs, thus producing more larvae per unit of substrate, more efficient recycling of the logs and a reduced mass of material left for burning. Maharaj (1973), in Trinidad, described a simple aluminum trap that catches more than twice as many weevils as the conventional split-log trap and uses only about one-fifth as much coconut tissue as bait. To incorporate food production as part of weevil IPM as hypothesized, trap logs would have to remain in place about 7 weeks instead of one, and thus would occupy 7 times as much ground surface, but that should not be a huge problem in palm plantations.

The writer has not seen reports of "cultivation" for either *R. phoenicis* or *R. ferrugineus*, but the latter is attracted to dying or damaged parts of palms, cut or split palm trunks, and even decaying sugarcane (Kalshoven and van der Laan 1981). The larval period, normally 2 months or longer, has been reported as only 24 days when feeding on the nutritious palm "cabbage." So, enriching the larval diet might have a place in increasing production as food.

A fourth species, *Rhynchophorus bilineatus*, the famous sago grub which is the subject of feast and ritual among certain Melanesians in Papua New Guinea, is also "semi-cultivated" (Townsend 1970). In the opinion of at least one European, however, "the taste of the grub is fatty and oily and is no delicacy for the palate of a European" (Meyer-Rochow 1973).

Rhynchophorus larvae rank with winged termites as among the richest sources of animal fat, a frequently scarce and needed commodity among tropical rural populations. And insect fatty acids, in general, are highly unsaturated. The high fat content of *R. phoenicis* is reflected in its high energy value of 561 kcal/100 g of insect (Oliveira et al. 1976). It is also high in thiamine, riboflavin, and zinc and fairly high in iron.

For U.S. gourmets, it should be known that one species of *Rhynchophorus*, *R. cruentatus*, extends into the southeastern states where its larval-feeding damage to the terminal bud is a lethal problem in transplanting mature cabbage palmettos (*Sabal palmetto*) and Canary Island date palms (*Phoenix canariensis*) (Giblin-Davis

and Howard 1989). At a length of 24–33 mm, it is the largest known weevil in the United States.

In even a brief discussion of major pests of palms, the giant palm rhinoceros beetles, primarily of the genus *Oryctes* (Scarabaeidae: Dynastinae), must be mentioned. The larvae of these beetles have also been widely used as food in Africa and Asia. In this case, it is the adult beetles that do the serious damage, while the larvae are found in all sorts of refuse (Bedford 1980). Of the three species reported as food in Africa, *Oryctes monoceros* breeds in dead standing coconut and oil palms in western Africa and in decaying coconut logs in eastern Africa, *O. boas* breeds in rotting vegetation and manure heaps (but not in rotting wood), and *O. owariensis* in dead standing oil palm, coconut and *Raphia* trunks. *Oryctes rhinoceros*, in Asia and the western Pacific, breeds in a wide variety of dead but not yet decomposed plant material, including the tops of dead standing coconut palms, coconut stumps and logs on the ground, and other types of decaying wood, as well as compost, dung heaps, rotting straw, rotting coconut husks, coffee and cacao pulp waste, and refuse from sugar cane factories, ricemills, sawmills, and various other types of agricultural products processing. Larvae attain a length of 6–8 cm (Hill 1983) and Kalshoven and van der Laan (1981:463–68), citing Leefmans in 1920, note that up to 50 grubs/m^3 may be found in refuse dumps adjacent to towns and larger villages. Although insecticides and a promising baculovirus, *Rhabdionvirus oryctes*, are available, control of rhinoceros beetles is based on sanitation and cultural practices similar to those recommended for *Rhynchophorus* weevils. Thus, it seems hypothetically possible that *Oryctes* could also be incorporated into palm IPM programs, recycling an endless variety of tropical wastes into animal protein and fat.

Having a recipe from Cameroon was a rather flimsy excuse for writing this article, and I have done so with some trepidation. The main problem is that I haven't been in a palm plantation since becoming interested in insects as food, and have never seen a palm grub or rhinoceros beetle larva *in situ*. Many of our readers, however, are surrounded by palms, and some are no doubt knowledgeable about palm culture. Maybe we can hear from some of you as to the current situation and future possibilities with palm weevils and rhinoceros beetles.

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Principes, 37(1), 1993, pp. 47–49

A Needle Palm in the Northern Landscape

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Even among cold-tolerant palms, *Rhapidophyllum hystrix* is legendary for its hardiness. Like most legends, this one is part fact and part fallacy.

Reports of the needle palm surviving temperatures of −15° F or even −20° F have led some mail order nurseries to rate the plant hardy to USDA zone 6. A South Carolina nursery listed a zone 6 rating for the needle palm as recently as last year, but their latest catalog says the palm is hardy to Washington, D.C., inside zone 7.

Why? For one thing, northerners who bought the plant often lost it during the crucial first winter. I've noticed that marginal trees and shrubs nearly always perform better their second and third winters in our soil, even when those winters are more severe than the initial one. According to what I've read in horticultural books and articles—and later affirmed by experimenting—a plant requires at least a year to acquaint itself with new soil. Until it becomes acclimated an ornamental is sensitive to winter injury, drought stress, and the limitations of its particular site (incompatible soil types, lack of drainage, etc.). Of course plants grown at the edge of their hardiness limit are especially at risk.

Though it is especially hardy, the needle palm is a southern, heat-loving plant. Scattered populations may endure a night or two of abnormal cold in their native situation, but that cold spell is usually short lived. In the North, cold lingers, sometimes until April.

I first tried needle palms at a northern exposure because I'd had some success there with broadleaved evergreens. Since the northern side of the house is always shady, problems with winter sunscald are eliminated. My first needle palm, planted ten feet from the house, showed only a little green by spring. It was alive when I dug it up, but died soon afterward. The second needle palm I tried, this one planted

close to the northern foundation, fared better. About half its foliage remained green through winter, and stayed that way through spring. But the spot was so cool and shady that the palm never commenced growing.

Watching those needle palms battle the New England winter showed how repeated bombardments of frigid weather weaken a plant, each cold spell sapping a little more of its vigor. Cactophiles are familiar with this problem. They try plants from cold desert areas where below zero temperatures occur, and are disappointed when the cactus doesn't stand up to the same temperatures in the East. Sometimes the problem is the soil type they've used, but often it's because their site is just too cold. Daytime temperatures in the East and Midwest don't climb as high as they do in the cold deserts—even where nighttime temperatures are similar. In the deserts, afternoon warming gives plants a break from having to fight off the cold. Similar conditions prevail in the southeastern United States, though daytime fluctuations there are not as pronounced as they are in the Southwest.

Working on the theory that the needle palm might benefit from warm daytime temperatures, I offered a new plant (about one foot tall) a spot along the southern side of my house, on ground that slopes to the southeast. I planted this palm just a foot or so from the foundation. The soil here doesn't freeze more than a few inches, and with a generous mulch it doesn't freeze at all. The sloping ground, which catches more sunlight, enhances the warm microclimate. I mulched the plant up to its two inch trunk and applied Wilt-Pruf, an anti-dessicant spray, three times during the winter.

In late November of 1989 the earliest zero degree reading ever recorded here ushered in a six week spell of frigid weather, damaging ornamental plants throughout the region. By early December, morning temperatures started falling below zero. Each afternoon wind devils frolicked in our back yard, churning up dry leaves and robbing plants of moisture. I watched this scene from a kitchen window, reflecting on the vagaries of a New England winter, and thinking that perhaps this wasn't the best year to plant a palm in Massachusetts.

Shortly after that zero degree reading, one of the fronds on the needle palm showed about 50 percent frost burn. But the damage—a reddish color rather than the usual dark brown—looked unusual. I noticed that the frond had been crushed, and that the damage was limited to the area of this bruise.

Three weeks later, we were still in the midst of the cold spell (with a 19° daily average over a six week period), when a new front arrived, bringing temperatures of −10° F. The following morning it was −10° F again.

The edges on all of the fronds showed slight damage a few days after these coldest days of winter. In late February, we had another −10° F night. Except for the minor damage at the fronds' edges (which is no longer noticeable), and the damage to the bruised area, the needle palm came through our abnormally cold zone 6 winter looking much like it did when I planted it. In May, after daytime temperatures warmed to the seventies and eighties, the small palm began growing again, with two and a half new fronds by summer's end.

Having one palm survive for one winter does not warrantee its hardiness, but this plant was purchased from the same source (Woodlanders Nursery) as the others, and I have no reason to believe it is any hardier than they were. Based on its performance last year, I expect the needle palm will sail through this winter unaffected by the New England cold. Two factors now enter into its favor for continued survival. First, last winter was about the worst we've had here in ten years; chances are the next few will be milder. Second, the needle palm is now established—and so somewhat hardier—established in our soil, and becomes more each year.

A needle palm might survive out in the open yard here at a southern exposure, but considering the palm's performance on the north side of our house, I doubt it would fare well without the added warmth coming from the foundation. In climates a bit warmer than mine—zone 6b, for example—the needle palm may survive in several types of planting situations, but that would probably depend on winter conditions during the plant's first year.

With a little luck, and good strategy by the planter, the needle palm, *Rhapidophyllum hystrix*, can make a strong showing in zone 6 (and no doubt in parts of zone 5). Gardeners who try the plant once and discard it as unsuitable for their climate do *Rhapidophyllum* a disservice by not taking advantage of its incredible hardiness—not to mention its beauty and worth in the landscape. Large boulders, outbuildings, and conifer screens may work in place of foundation planting in some sites, giving the palmophile more landscaping options and strategies. You can always place a polyethylene or burlap cover on the needle palm in its first year, or mulch it over with fallen leaves, straw, or even shredded newspaper. In the second, hardier year, the palm may surprise you by living up to its best reputation for cold-tolerance.

When I told a friend that I'd planted a palm in my yard, he looked at me incredulously. "You planted a palm tree? he asked. "Not a palm *tree*," I told him. "Just a palm. A shrubby palm native to the South." "Yeah, but a palm," he said. "How hardy can a palm be?" I looked at him blankly, and thought a moment. "Hardy enough," I said.

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CHAPTER NEWS AND EVENTS

Alain Moinié of France

The IPS joins our French Chapter, Fous de Palmiers, in mourning the loss of Alain Moinié, member of their Administration Council and Founding Member. Alain Moinié, author of *Palmiers pour les climats tempérés*, died on October 10, 1992. (*Palms for Temperate Climates*, an excellent book for on Palms for French-speaking people, is available through Fous de Palmiers.) The presence of Alain Moinié will be much missed. Those who knew and appreciated him plan to plant a palm to his memory in July 1993 and Fous de Palmiers president Alain Hervé solicits contributions to that end. All interested in participating, please send donations to the Fous de Palmier Secretary, Violette Decugis.

Thanks for the 1992 Biennial to the South Florida Chapter Hosts

Those of you who did not attend the IPS Biennial in Miami in early November missed a fine meeting. Yes, Miami and south Florida had significant damage from Hurricane Andrew which was sometimes staggering. But areas adjacent to Miami to the north seemed untouched by the storm and the gardens there had many beautiful palms to enjoy. Overall the meeting was exciting and educational. There were many well-known speakers who gave informative and entertaining talks. The Wednesday meeting and lunch hosted by Fairchild Tropical Gardens revealed a garden under recovery from Andrew's forces but also committed to using this "opportunity" to refocus the garden on its proper course for the future. This positive attitude permeated from director Bill Klein on down throughout the staff. Also revealed was a

garden which would definitely recover in a short time to again become a thing of beauty.

The IPS owes a tremendous vote of "Thanks" to the members of the Biennial Committee of the South Florida Chapter and the many volunteers who assisted them in putting on a fine meeting. This is particularly impressive in light of the fact that many of the South Florida Chapter Officers, Biennial Committee members, and volunteers personally suffered the effects of Andrew. Thanks also to the Palm Beach and the Broward County groups and individuals who took on increased tour responsibility because of the damage to gardens of the south.

PHIL BERGMAN, Vice President, IPS
JIM CAIN, President, IPS

Palm Beach (Florida) Palm & Cycad Society

The Palm Beach Palm and Cycad Society held their annual election on September 3, 1992. New officers are David Pais (President), Dale Holton (First Vice President in charge of the Sale Committee), Veronica Butler (Second Vice President in charge of the Program Committee), Don Richards (Third Vice President in charge of the Planting Committee), Hank Webb (Treasurer) and Debra Anderson (Secretary). Bill Jones is the Past President.

The group's fourth annual Fall Palm and Cycad Sale was held on October 3–4, 1992, at Morikami Park in Delray Beach from 9 a.m. to 5 p.m. both days. Over 400 species of palms and cycads were available. Alan Meerow was available to autograph his new book *Betrocks Guide to Landscape Palms*, which was available for sale. In addition to the sale, a display of palms and cycads was held and a large specimen Maypan coconut tree, donated by Gemini Gardens, was auctioned off on Sunday, to be planted by Zimmerman Tree Service.

At the IPS Biennial in Miami in November, the Palm Beach Chapter of the Palm and Cycad Society was granted formal chapter affiliation with the IPS, along with the European Palm Society. Welcome and congratulations are in order for both.

A General Meeting was held at Mounts Botanical Gardens on December 2, 1992, at 7:15 p.m., followed by the Annual Holiday Party and Auction. In addition, the chapter has been holding regular work days at Fairchild Tropical Garden to assist the staff in the massive cleanup and restoration required in the aftermath of Hurricane Andrew.

Broward Chapter (Florida) Formed

In July of 1992, an organizational meeting was held at Gertrude Cole's house in Ft. Lauderdale and the Broward Palm and Cycad Society was begun. A general meeting was held on Thursday, September 24th at the Broward County Cooperative in Davie, Florida. Mr. Albert Will spoke on edible palms that will grow in South Florida. Many other activities are being planned including a Spring 1993 Sale at Flamingo Gardens. The group is planning formal affiliation with the IPS as soon as possible and correspondence toward that end is underway. If you have any questions or desire more information, call Mia Keegan at (305) 436-0799.

News from North Queensland

The North Queensland Palm Society held its Annual General Meeting on Sunday, December 6th at 10 a.m., with the Annual General Meeting of the Friends of the Palmetum held the same day, both on the grounds of the Townsville Palmetum. These were followed by the blessing of the foundation stone of the Good Shepherd Hospice, free afternoon tea and cakes, and a guided tour of the Hospice. Tumberton Lodge, relocated from the Railway Estate to the Palmetum, now provides a unique facility for the Friends and the NQPS. Facilities include toilets and a bubbler(!), a palm cultural museum, an interpretive

center, a reference library, a refreshment center and, most importantly of all, a meeting room. Friends' free seed distribution in late 1992 included *Amorphophallus bulbifer* (Anderson Park Conservatory), *Aiphanes lindeniana* (Palmetum), *Rhopaloblaste ceramica* (wild-collected Wasengla PNG), *Heterospathe* sp. 'kembi' (Tomul), *Orania* sp. 'hawa' (kembi), *Gulubia costata* (wild-collected Wesengla PNG), and *Burbidgea schizochiela* (Anderson Park Conservatory). Only limited quantities were available, but additional seed will be distributed in 1993 and a more commercial seed bank will be established. The Friends membership fees are A$25 payable January 1993. For this you receive the journal *Mooreana*, the newsletter, access to the seed bank and the reference library, regular meetings and announcements.

Errata in IPS Roster Concerning the Journal *Mooreana*

John Dowe has taken over the duties as Botanic Collections Officer and Editor of *Mooreana* for the Townsville City Council since the loss of former editor Robert Tucker. John points out that *Mooreana* is in fact published by the Townsville City Council, *not* the Friends of the Palmetum (as stated on page 6 of the recent IPS Roster). The Friends, as one of their benefits, receive the journal, but play no part in its production, editorship or publication.

Current annual subscription rates (for 1993) for *Mooreana* are:

Ordinary (within Australia)—
AUS$20.00
Ordinary (outside Australia)—
AUS$30.00

Friends of the Palmetum annual subscription rates* are:

Ordinary (within Australia)—
AUS$25.00
Ordinary (outside Australia)—
AUS$35.00

As a result of this move to the north, John will no longer serve as Editor of PACSOA's *Palms and Cycads* after this year. Tom Turner and Will Kraa (President and Vice-President of the Southern Queensland Group of PACSOA, respectively) will serve as joint Co-Editors beginning with the first 1993 issue.

Mackay (PACSOA) Activities

The Mackay Palm and Cycad Society (PACSOM) of PACSOA met on September 20th, with sixteen people in attendance. The meeting opened at the "Decaryi Nursery" on the O'Connell River, managed by Mark and Sharon Berryman for Ron Brown of Cairns. The property is 76 acres with much of it hill country. The flat area near the river is utilized to grow in excess of 20 different types of palms. Originally the farm was planted in tropical fruit and many of these remain (e.g., star apple, lychee, 5-corner fruit, etc.), but over 11,000 palms have been planted in the last four years. Goat manure fertilizer and unlimited water from the river have resulted in phenomenal growth of the palms. The *Neodypsis decaryi* have grown 3–4 meters high and everything is very healthy. Palms growing in the ground were *Archontophoenix alexandrae*, *Areca aliceae*, *Cocos nucifera*, *Chrysalidocarpus lucubensis*, *C. lutescens*, *C. madagascariensis*, *Syagrus romanzoffiana*, *Chamaedorea elegans*, *C. seifrizii*, *Elaeis guinensis*, *E. oleifera*, *Hyophorbe lagenicaulis*, *H. verschaffeltii*, *Bismarckia nobilis*, *Licuala grandis*, *Metroxylon sagu*, *Phoenix roebellenii*, *P. rupicola*, *Dictyosperma album*, *Latania lontaroides*, *L. verschaffeltii*, *Neodypsis decaryi*, *N. lastelliana*, *Ptychosperma elegans*, *P. macarthurii*, and *Wodyetia bifurcata*.

* Friends of the Palmetum receive *Mooreana* as well as a Newsletter and access to the Palmetum seedbank and reference library.

Afterward, the group headed to the Jaxut State Forest Park for lunch and then on up the Clarke Range to the lookout (700 meters) before calling it a day. The park lies at the foot of the Clarke Range in the midst of Cathu State Forest that covers 11,000 hectares, and abuts the Eungella National Park to the southwest. Over 90% of the Cathu Forest is native forest consisting of rainforest, wet and dry sclerophyll forest, and maiden hoop pine.

The October 25th PASCOM meeting was held at Stella and Neville Davey's home at Septimus and was attended by 25 people including six guests. A plant competition was held and nice palms were in abundance. The meeting was followed by a luncheon and a stopover at Gary Langford's farmlet enroute to Finch Hatton National Park. The November 29th meeting was held at the home of Gary and Chris March in Mackay.

Another working party was held at the Farleigh Plot on December 6th from 9:00 a.m., followed by a BYO barbecue lunch. The progress at the plot shows the fruit of PASCOM tender loving care.

The Annual General Meeting is scheduled for February 28th at the home of Gwen and Les Shailer at 2 p.m. (address is Lot 7, Muggleton Street, SARINA).

Northern Territory News (PACSOA)

Five people traveled the 1,663 kilometers for the NT Society's long-weekend field trip to Keep River National Park and Gorge on August 1–3. These were Tom Walmsley, Denise Cooke, Blue Bishop and Annette and Master Michael Stacey. The drive in through Gregory National Park provided many hundred *Livistona* sp. "Victoria River". Overnighting in the campground at Gurrandalg (15 km off the Victoria highway) provided close examination of this species, with palms present from seedling through adult stages. It was necessary to cart all required water in to the campsite. Walking the Keep River Gorge wasn't easy, walking for (what seemed like) miles, seeing numerous baobab trees (*Adansonia gregorii*) and one lone *Livistona* 3 meters high. A visit was made to the Nganalam aboriginal art site, then to Lake Argyle, just over the West Australian border to see *Cycas pruinosa* on the rock face. After this the group headed back to Darwin via Katherine and Gary's, stopping to see *Cycas calcicola* just north of Kath.

The Palm Garden at Fred's Pass Reserve continues to flourish under the NTP&CS attentions. In May 1992, eleven members of the group planted about 80 new palms and 100 bales of hay. These included a row of *Crytostachys renda* inserted into the double row of *Carpentaria acuminata* between the dam and roadway. The balance included mainly shade-loving palms tucked under the shelter of existing plantings. Among the species planted were: *Aiphanes* sp., *Sabal bermudana*, *Nenga* sp. 11, *Pinanga subayensis*, *Mauritia flexuosa*, *Areca latiloba*, *Gulubia macrospadix*, *Ptychosperma keinse*, *Caryota* sp. "Mtn Giant", *Cyrtostachys renda*, *Archontophoenix* ssp. "Peach River", *Hyophorbe lagenicaulis*, *Satakentia liukensis*, *Nenga* sp. "Ka hang", *Pinanga* sp. 28, *Veitchia macdanielsii*, *Oenocarpus* sp. "tarampabu", *Arenga porphrycarpa*, *Heterospathe* sp., *Synechanthus* sp. 89-PS-032, *Jessenia* sp. 329, *Gaussia princeps*, *Carpentaria acuminata*. A follow-up inspection showed that one *Mauritia* in poor condition had expired but the other two were healthy. They should do well in the swamp near the *Metroxylon sagu*, which have taken to the site extremely well.

At their September 15th meeting, the Fred's Pass Chairman's Report congratulated the NTP&CS on the garden's progress and pointed out that the Board of Management was now using it as a point of interest for all visitors to Fred's Pass. These congratulations were accepted by

the NTP&CS representative, Tom Walmsley.

The NTP&CS had another successful appearance at the Darwin Botanical Garden Fair in August 1992. Membership forms, planting guides, cycad pamphlets, and palm booklets were handed out. Seedling sales went very well. Many members helped with the stall.

News from the Southern Queensland Group (PACSOA)

Highlights of the September 21st (Monday) meeting were two slide presentations. The first was by Shelley and Jim Gage and showed their recent trip to Carnarvon Gorge and to Byfield. Color slides from Carnarvon showed fine examples of *Livistona* sp. "Blackdown Tableland" and *Macrozamia platyrachis*, and those from their detour to Byfield showed native habitat of *Bowenia serrulata* and *Macrozamia miquelli*. From the same region, the group was also shown some magnificent specimens of *Archontophoenix alexandrae* and *Livistona decipiens*.

The main presentation for that evening was given by Dennis Hundscheidt who provided a travelogue which included the Singapore Botanic Gardens, the Florideae plant exhibition in Holland, and both palms and cordylines in Hawaii. The most spectacular part, saved for last, was a photographic tour of Dennis' magnificent garden, a wonderful mixture of palms, cordylines, and many other colorful plants.

The business portion of the meeting focused around some aspects of PACSOA incorporation and executive processes. These were further discussed at a board meeting held on October 8th.

October 25th marked the occasion of a "Sausage Sizzle" at the home of Tony (Group Secretary) and Paula Huntington, where the fruits of his gardening and landscaping labors were shown.

The November meeting was held on Monday, November 16th at 7:30 p.m. at Bread House, Gregory Terrace (opposite Brisbane Grammar). As a special feature, Mr. Donald Scotts, Executive Officer of the Queensland Nursery Industry Association (Q.N.I.A.) spoke of a recent Fauna Squad seizure order placed on a large number of Foxtail Palm (*Wodyetia bifurcata*) container plants from a Brisbane nursery; because of their alleged National Park origin as illegally collected seed. Don advised that, whereas most *Wodyetia bifurcata* grown throughout Australia have probably originated from the Cape Melville National Park as illegally collected seeds, there are now huge numbers in circulation and massive seed quantities have been exported. Hence, Don considered any isolated prosecution as unjust and hypocritical since *W. bifurcata* is being specified in public landscaping projects. Don informed the meeting that the Q.N.I.A. and the Department's Director planned to meet with the goal of a common sense resolution of the issue and to reach a practicable and final policy concerning the existence of all *W. bifurcata* growing outside of Cape Melville National Park.

The highlight of the meeting was Part 1 of the long-awaited slide show (by proxy) of the Townsville Palmetum photographed by John Dowe, who took viewers on a tour of species of the savannah and lagoon habitat precincts. Successive habitat species will be covered at a later date. Although still at an early stage of growth, the Palmetum already exhibits great scientific and community value. The large amount of planning put into the Palmetum is evident.

Greg Cuffe also showed some of his excellent slides of the Palmetum, many showing palms from the rainforest habitat. Also included were some superbly crisp shots of *Wodyetia bifurcata* fruiting branches over a meter long with prodigious seed set. Alan Wilson demonstrated a fine specimen of *Macrozamia heteromera* with fruiting cone, and followed up with a slide of a coning male and went on to explain leaf variability of the species within the

localized habitat under study. Will Kraa showed a fine example of a coning male *Ceratozamia kuesteriana* and demonstrated the "horned" cone.

Sunshine Coast (Australia) News (PACSOA)

At the October 5th meeting, Mike Koll brought out his display of Indonesian Palms and gave a very informative and amusing talk on the Bogor Botanical Gardens, Indonesia and Bali. Photos were also passed around.

The October 10th dinner at "Thai Me Kangaroo Down" Restaurant was enjoyed by the nine that attended, including two from the Brisbane area. The group also arranged a recent field trip to Fraser Island, with 14 attendees (including three from outside the Society). There were plenty of *Cycas douglasii* to see, both from the bus and along the 3-km walk into the lovely Lake Wabbie where most had a nice swim. The gregarious March flies made lunch a bit uncomfortable.

Group President, Robbie Kellie, spoke at the December 7th meeting on his two recent trips to New Caledonia, where he collected both palm and cycad seeds. This area promises to be an important seed source for the Sunshine Coast, so was of great interest. Raffle prize at the meeting was a 3-meter *Cycas revoluta*. The Sunshine Coast Palm & Cycad Group's Christmas Party was held at Mike Koll's Palms of the World Nursery on December 13th from 4:00 p.m.

The Annual General Meeting was held on Monday, February 1st, 1993 at 7:30 p.m. at the Nambour Band Hall on Daniel Street.

Sydney Branch of PACSOA Chapter News

The Sydney Branch of PACSOA always meets on the third Tuesday of odd months. Thus the last regular meeting for 1992 was on November 17th and the schedule for 1993 includes January 19th, March 16th, May 18th, July 20th, September 21st, and November 16th. If you are ever in the Sydney area on any of these dates, feel free to attend. Meetings are held at the Maiden Theatre of the Royal Botanic Gardens at 7 p.m.

South African Palm Society (SAPS)

Pretoria members held a beer and sausage evening social on the farm of Robbie Robbertse on the 5th of December 1992 at 3:00 p.m.

The SAPS also recently sent numerous copies of the June 1992 issue of *The Palm Enthusiast* to the IPS Chapter Committee Chairman for distribution to various IPS chapters and affiliates throughout the world. This is an excellent palm journal and is a welcome addition to any palm library. For subscription information, see your latest IPS Roster (July 1992).

News from New Zealand

The Palm and Cycad Society of New Zealand (NZPACS) met at 7:30 p.m. on September 2, 1992, at the Auckland College of Education for a lecture by Dave Anderson on "The Amazing Bromeliads". On October 7th, NZPACS met for a slide presentation and discussion of "The Gardens of Roberto Burle-Marx", an internationally famous Brazilian artist and landscaper. The November 4th meeting featured speakers John and Paulene Isaachsen on "The Kinds, Uses and Care of Bamboo".

An additional field day was held on Sunday, September 20 in association with the dedication of the new Palm Grove in the Auckland Botanic Garden Manurewa. The NZPACS has been involved in an advisory capacity in this Palm Grove.

The NZPACS held its 1992 Christmas Social aboard the trading vessel Te Aroaha. BBQ, wine and non-alcoholic drinks were provided by the society on this six-hour cruise. The Te Aroaha was part of the

large fleet of trading scows plying the New Zealand coastal waters from the latter part of the last century until the mid-1930's. It has been fully restored with a spacious deck. She still makes regular crossings to the Great Barrier Reef.

Southern California News

The 17th Annual Southern California Palm Society Banquet was held on January 16th in the Terrace Room of the Hyatt Newporter, Newport Beach, California. Bill Dickenson conducted a morning tour of the Newporter palm collection. The Hyatt palm collection contains the most mature and varied assortment of palms in a public garden in Orange County. The keynote speaker was Horace Hobbs, President of the Texas chapter of the IPS. Horace, who has been a palm society member for fifteen years, travels around the world in his profession in the oil industry, almost always managing to view palms wherever he goes. His slide presentation featured palms from Venezuela, Thailand, and Australia. Venezuelan palms were of particular interest since this country is the probable location for the next IPS Biennial to be held in 1994. In addition to the tour and slide presentation, there were door prizes, a palm raffle and auction, and a reception/lunch.

The March 27th chapter meeting will also be held in Orange County. This three-garden tour will feature stops in Laguna Beach, Dana Point, and San Clemente. Contact any Southern California officer for additional information.

News from the Pacific Northwest Chapter

The summer of 1992 saw a tour of Seattle (WA) area palms by the Northwest Palm & Exotic Plant Society. About 20 members and guests (seven from the Vancouver area) gathered at the home of Walt and Barbara Rockefellow in Seattle's Green Lake area on June 27th to begin a tour of palm locations in the Seattle area. In addition to their large *Trachycarpus fortunei, Aloifolia*, and mimosa trees, there were many new plants to admire. Young *Sabal mexicana* and *S. minor* as well as several more *Trachycarpus* were in evidence, as was Bas joo Banana brought down from Vancouver several years ago, and a 3–4-year-old *Jubaea chilensis* planted out in the spring of 1992. In the back was a nice 24-inch crated *Brahea edulis*, which has been wintered indoors to date. From the Rockefellow home the group drove to the Ballard Locks, about 10 minutes away. *Chamaerops humilis* and *Trachycarpus fortunei* were planted there years ago for the public enjoyment. The plantings were still there but considerable winter damage was evident. The groups then drove to the home of Barry Powell, via Kirkland where a condominium project (Carillon Point) was featuring rows of New Zealand flax (*Phormium tenax*) alternating between 8–10-foot *Trachycarpus*. The landscaping and overall effect were impressive. At the Powell home, three different *Trachycarpus* species (*T. fortunei, T. wagnerianus*, and *T. martianus*) were present, as well as an impressive collection of agaves and cacti. The day ended with refreshments and snacks provided by Barry and his family.

On August 9, the group's Annual BBQ and Social was held at the Rudi Pinkowski home in North Vancouver, B.C. Rudi has landscaped his mountainside home and offered an even more exotic venue for this popular event.

A General Meeting of the PNWP&EPS was held at the VanDusen Gardens in Vancouver. From August 22 through September 6, the Chapter participated in the Pacific National Exhibition in Vancouver. Roger Richardson and Mel Frank built a water display complete with waterfall to complement the normal plant display at the Palm Society Booth. Volunteers were solicited to man the booth in 4-hour shifts.

The 1992 Annual Elections and General Meeting for the group were held on

November 30th in VanDusen Gardens in Vancouver. Meetings scheduled for 1993 include:

Monday, February 22, 1993: Plant post mortems and plans for Spring
Tuesday, May 18, 1993: Annual Plant Sale
Monday, August 23, 1993: Summer success stories and preparing for Autumn
Monday, November 29, 1993: Annual General Meeting

Hawaii Island Palm Society News

The Hawaii Island Palm Society held a Hamakua and Wainaku Members' Garden Tour on Sunday, November 1st, starting at 12:30 to 1:00 p.m. (staggered to avoid parking congestion). Members visited the gardens of Bob Egge, Charles and Marina Trommer, and Roger Fischer and Grace Kissell. The first stop was Bob Egge's garden in the Wainaku neighborhood of Hilo. Bob's 22,000-square-foot lot borders the Kalaulau Stream on a steep hillside. When Bob purchased his property in the early 1970's the property contained nine *Archontophoenix alexandrae*, eight coconuts, breadfruit trees, banyans and other goodies. Selective clearing was required to let in adequate light. In 1983–1984, Bob had seven terraces cut into the hillside, along with sidewalk installation and about 120 steps cut down to the stream. At that time he started planting seed-grown palms in the terraces. Now there are about 25 species of palms growing in the terraces with four more species near the house. Of special interest are *Metroxylon amicarum*, *Phoenicophorium borsigianum*, and the rare *Pelagodoxa henryana*.

Second stop on the tour was the Trommer's Hamakua home at the 18.6 mile mark on Highway 19. The Trommer's palm collection is quite young, with many plants in containers, but they have many other interesting plants, including 700 varieties of day lilies and 200 named varieties of azaleas. Perhaps the most unusual are the 10–15 species of the tropical vine rhododendrons. Like Bob Egge's place, the Trommer's property contains steep banks and cliffs, with waterfalls, one of which plunges directly into the ocean. There are 102 steps to the bottom, for adventurous souls.

Last tour stop was Roger Fischer and Grace Kissell's home, a couple of miles down the road from the Trommers'. Roger and Grace's 6-acre property slopes down from the highway to a cliff overlooking the ocean. Developed like a forest since 1985, portions are heavily landscaped with palms, featuring a mix of emergent and understory specimens. Several trails wind among the 250 species of palms. There are some good sized specimens, including *Wodyetia bifurcata*, *Cyrtostachys renda*, *Verschaffeltia splendida*, and some outstanding *Clinostigma samoense*. In addition, there are two ponds with lilies.

Western Australia Group Meets

The Western Australia Palm & Cycad Society visited the home of Peter and Lorri Skinner on Saturday, October 17th. In the ground were rows of *Syagrus romanzoffiana*, *Howea forsteriana*, *Phoenix roebellini*, and *Cycas revoluta*. Gifts of oranges and avocados from the orchards were provided to all. The gardens around the house include many species of the genera *Encephalartos*, *Cycas*, *Lepidozamia*, *Macrozamia*, *Pritchardia*, *Jubaea*, *Howea*, *Butia*, *Syagrus*, *Brahea*, *Washingtonia*, *Lytocaryum*, etc. In the atrium, there are many *Rhapis* as well as *Licuala*, *Pinanga*, and others which require warm conditions.

The Society met on November 16th at the Leederville Town Hall at 8:00 p.m. Lee Wishart, winner of the coveted Landscape Award, gave a lecture on landscaping. A copy of *Palms and Cycads Beyond the Tropics* by Keith Boyer was donated by the Society to the November raffle.

"Busy Bee" days were held at Gascoyne Park on October 24th and November 21st. At the October event, 73 palms were planted. These included *Chamaedorea seifrizii* (44), *Oraniopsis appendiculata* (10), *Linospadix monostachya* (11), *Neodypsis decaryi* (2), and *Caryota mitis* (6). The November work day was spent planting 60 young *Roystonea* sp. and cleaning up previous plantings.

A Christmas party was held on December 6th, in the form of an early evening picnic in Gascoyne Park. This enabled the group to invite the local people who have helped with the plantings, as well as Councillors and Members of Parliament in the Wanneroo district.

Texas Meeting and Spring Palm Sale

The Texas Chapter of the IPS held their first 1993 meeting on March 6th at 3:00 p.m. in the Houston Arboretum on Woodway Drive. The meeting reviewed the status of the chapter's Lending Library of Palm Books—both lending policy and planned acquisitions. The library is already quite extensive and a number of new titles will soon be added. The books are housed at the offices of the chapter's new librarian, Alfred Loeblich, at the University of Houston and are available for check out to all chapter members in good standing.

Horace Hobbs also gave a brief review of the Hyatt Newporter palm collection, where he had just attended the Southern California Chapter's Annual Banquet.

Following the business meeting, Jim Cain gave a slide presentation on the Biennial Meeting in southern Florida, including the side trip to the Nassau Retreat, formerly the Langlois garden (author of Supplement to Palms of the World). Although damages due to Andrew were very evident, recovery was already in progress in South Miami. The garden tours set for Miami and south were moved north to other gardens in the Broward and Palm Beach areas, where hurricane effects were quite minimal. Great cooperation by all the Florida palm enthusiasts helped to make this a great meeting. It was interesting to note that the Fall Palm Sale at Fairchild on November 7–8 grossed over US$70,000, with plants reasonably priced. This shows clearly how badly South Florida residents wanted to quickly get lost palms back into their landscapes.

The Annual Palm Sale is scheduled for Saturday, April 17th, at Mercer Arboretum, just northwest of Houston. In addition to the Palm Show and Sale, Gordon Hintz will give a lecture to the public on "Introduction to Palms for Houston" starting at 10:00 a.m. in the Mercer Auditorium. Yaw'l come!

The Palm Journal: Magazine of the Southern California Chapter of the IPS

In the past 25 years, *The Palm Journal*, Magazine of the Southern California Chapter of the IPS, has progressed a long way from its humble beginnings as the typed and mimeographed bulletin, *Western Chapter Newsletter*. The original newsletter was edited by the late Bill Gunther. The current magazine has become an excellent journal on palms, serving not only the western part of the U.S., but with numerous IPS subscribers from around the world. It is now a 28–32-page (5.5 by 8.5-inch size) well-illustrated newsletter with a color cover, published bimonthly.

Under the editorship of Brad Carter over the last three years, a progression of improvements have occurred. Typesetting with a desk-top-publishing system was introduced in May 1990, followed by implementation of proofreading (by volunteers Lynette Wood and Don Hodel). Four-color printed covers were begun with the November 1991 issue. Although this greatly improved the appearance of the magazine, it also increased the publication costs. Subscription rates have risen to

US$15, but this is a great value for such a nice journal.

The Palm Journal features a wide variety of high quality articles in each issue. For example, the November 1992 issue included separate articles on hurricane damage suffered by the National Tropical Botanical Gardens in Kauai (HI) and by the Fairchild Tropical Gardens in Florida written by Susan Essoyan and Paul Craft, respectively. A palm travel article by Don Hodel on "Palms in Amazonian Peru" detailed many interesting palms. Also in this issue is a one-on-one interview of Don Hodel by Don Tollefson. Interesting brief articles focus on "The *Euterpe* Palm" cultivated in California (by Pauleen Sullivan), "Royal Palm Flourishes in San Diego" (by Phil Bergman), "*Archontophoenix alexandrae*" in Fullerton, CA (by Bill Dickenson) and "What's in a (Palm) Name? Have Queen Palms Changed Their Sex?", an amusing and interesting tracking of name changes in *Syagrus romanzoffiana* by Barry Osborne. The full color covers of this issue show *Euterpe*: a wild population of *E. precatoria* in Peru on the front and a cultivated flowering specimen of an unknown species in Ventura, California, on the back cover.

The January 1993 issue includes a description by Don Hodel of a newly named species of *Neodypsis* in cultivation (similar to *N. lastelliana*), a short travel journey through the palms of Italy by Jacques Deleuze, and information on how to make *Butia* palm fruit jelly by Barry Osborne. The front and back covers featured color photographs of the two related *Neodypsis* species covered in this issue. "A Work from the [departing] Editor", Brad Carter, gave appreciation to those who had helped him during his editorship.

In addition, both issues reviewed provide details of future chapter events (banquet and the March meeting) along with such regular features as messages "From the President", bookstore offerings and palm related classified advertisements.

Effective with the March 1993 issue, Bo-Goran Lundkvist from Poway takes over as Editor of *The Palm Journal*, with Don Hodel continuing to serve as Scientific Editor. Also beginning with March 1993, each issue will feature a particular genus for California gardens.

To subscribe to *The Palm Journal*, you must be a paid member of the International Palm Society and a member of the Southern California Chapter. Chapter membership rates for six issues per year are as follows for active IPS members: US$15 chapter dues for residents of the United States, Mexico & Canada, and US$20 for other subscribers (foreign, overseas), plus US$10 additional for optional airmail. Send checks in U.S. funds payable to the Southern California Chapter and mail to Palm Society, S. Cal. Chapter, 1601 Via Sage, San Clemente, CA 92672.

The next issue of *Principes* will feature a review of *The Palm Enthusiast*, journal of the South African Palm Society. To see an example copy, contact any IPS affiliated Chapter; there should be several issues in the chapter library.

JIM CAIN

BOOKSTORE (*Continued from page 11*)

PALEM INDONESIA (in Indonesian) (Sastraprdja, Mogea, Sangat, Afriastini, 1978. 52 illustrations, 120 pp. For English translation add $2.00) 5.50

PALMAS DEL DEPARTMENTO DE ANTIOQUIA (Palms of Colombia, in Spanish; G. Galearno and R. Bernal, 1987, 207 pp.) 18.95

PALMERAS DE BOLIVIA, (in Spanish, H. Balslev and M. Moraes, 1989, 107 pp.) 12.95

***PALMIERS, POUR LES CLIMATS TEMPÉRÉS** (Alain Moinié, 1991. in French, 157 pp. in French, lots of black & white photos.) 45.00

PALMS AND CYCADS AROUND THE WORLD (J. Krempin, 1990, 267 pp., 267 pp. color) 45.00

***PALMS AND CYCADS BEYOND THE TROPICS** (Keith Boyer, 1992, 160 pp. 120 color photos.) 30.00

PALMS OF THE WORLD (Formerly **PALMS,** A. Blombery & T. Rodd, 1982, 192 pp., 212 color photographs) 34.95

PALMS IN AUSTRALIA (David Jones, 1984, 278 pp., over 200 color photographs) 30.00

PALMS IN COLOUR (David Jones, 1985, 93 pp.) 8.95

PALMS OF THE NORTHERN TERRITORY (AUSTRALIA) (A. White, 1988, 41 pp., 21 photographs, some color) 5.95

PALMS FOR THE HOME AND GARDEN (L. Stewart, 1981, 72 pp., some color) 19.95

PALM SAGO (K. Ruddle, D. Johnson, P. K. Townsend, J. D. Rees, 1978, 190 pp.) 10.00

PALMS OF THE SOUTH-WEST PACIFIC (J. L. Dowe, 1989, 198 pp., 33 pp. color) 29.95

PALMS OF SUBEQUATORIAL QUEENSLAND (Robert Tucker, 1988, 91 pp., 12 pp. color, many black and white photographs and maps) 20.00

SECRET OF THE ORIENT DWARF RHAPIS EXCELSA (L. McKamey, 1983, 51 pp.) 5.95

THE GENUS PTYCHOSPERMA LABILL. (F. B. Essig, 1978, 61 pp.) 6.50

THE INDIGENOUS PALMS OF NEW CALEDONIA (H. E. Moore, Jr., N. W. Uhl, 1984, 88 pp.) 12.00

THE STRUCTURAL BIOLOGY OF PALMS (P. B. Tomlinson, 1990, 477 pp.) 120.00

TROPICA (A. Graf, 7000 color photos, 1138 pp.) 165.00

TROPICALS (G. Courtright, 1988, 153 pp., Color Pictorial sourcebook & descriptions, 12 pp. of palms) 34.95

TROPICAL RAINFOREST (A. Newman, 1990, 241 pp., World survey of endangered habitats, all color.) 45.00

PALM PAPERS (Postage Included)

A NEW PRITCHARDIA FROM KAUA'I, HAWAI'I (Reprint from *Principes*, R. W. Read, 1988, 4 pp.) 2.00

FURTHER INFORMATION ON HARDY PALMS (J. Popenoe, 1973, 4 pp.) 2.00

NOTES ON PRITCHARDIA IN HAWAII (D. Hodel, 1980, 16 pp.) 2.50

RARE PALMS IN ARGENTINA (reprint from *Principes*, E. J. Pingitore, 1982, 9 pp., 5 beautiful drawings) 2.75

PALMS FOR SOUTHERN CALIFORNIA (Trish Reynoso, 1990, 11 pp.) 3.00

PALMS FOR TEXAS LANDSCAPES (R. Dewers & T. Keeter, 1972, 3 pp.) 1.25

PINANGA ISSUE OF PACSOA (#16, 1987, 17 pp.) 2.50

THE HARDIEST PALMS (J. Popeñoe, 1973, 4 pp.) 2.00

*New arrival

The palm books listed above may be ordered at the prices indicated plus $2.50 extra per book to cover packaging and postage. (California residents please add 7.25% sales tax.) Foreign checks must be in U.S. dollars and payable on a USA bank. In some countries it is possible to send International Money Orders through the Post Office. No VISA cards. Please include your International Palm Society membership number. Send check payable to The International Palm Society to Pauleen Sullivan, 3616 Mound Avenue, Ventura, CA 93003, U.S.A. ALL SALES FINAL.

Back Cover

Ravenea madagascariensis ver. *monticola* in a south/central forest in Madagascar. See pp. 4–11. Photo by H. Beentje.