PRINCIPES

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THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

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Contents for October

Front Cover

Desmoncus orthacanthos, a South American rattan, growing in Belize, CA. Photo by Claudio Pinheiro. See pp. 197–209 for an article about rattans in Africa.

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Principes, 39(4), 1995, p. 175

Editorial

Principes, as the international journal of the IPS, has several goals. These include reporting meetings, special sales, tips on growing, and other information of interest to all members, providing a place where the diverse activities of our many chapters can be summarized, giving an annual introduction to all that is published about palms, and finally publishing articles that will keep our far flung membership abreast of the impact and importance of palms in the many parts of the modern world that they touch upon. There are several different aspects of palms to consider in this final issue of 1955.

Martin Gibbons and Tobias Spanner have written of another palm saga, this time to Pakistan to see *Nannorrhops* in the wild. They provide spectacular photos to accompany an intriguing story. Unfortunately they found the *Nannorrhops* greatly endangered. Much is published today about endangered species—we should be aware of just what this means in the plants which are special to us. Rafael Durán's very well executed and presented study of *Pseudophoenix sargentii* gives us a view of another endangered palm.

One of the rewards of working with palms is the discovery of new ones. Don Hodel with colleagues from Guatemala and Honduras has found two new chamaedoreas in Honduras. We are happy to be able to show them in color.

Two of the articles in this issue are about palms that are found growing in the European area. Rolf Kyburz describes the palms that he saw in Spain—including a most unusual specimen, with the unlikely name of "The Imperial Palm." The large number of palms that can live outside on the Maltese Islands and their importance are nicely discussed by Stefan Mifsud.

The production of branches (technically often referred to as "ramets") is important in some palms both to those harvesting palm heart, and from the standpoint of reproduction of the species. One pertinent question is: how may different environments stimulate branch development? A careful study by Diego Bonilla and Jan P. Feil documents the production of such branches in *Prestoea*.

We have left until last mention of a significant contribution by Andrew Morakinyo who has summarized current knowledge about the rattan industry and its prospects in Nigeria. This new assessment will be useful, both in the development of the rattan industry in Africa and to those interested in palm relationships and biogeography.

We look forward to seeing you at the symposium at Fairchild Tropical Garden and the interim Board Meeting in Sarasota.

NATALIE W. UHL
JOHN DRANSFIELD

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Message from the President

Since our last issue, the IPS has made great progress in setting up expanded electronic services on the InterNet for all members around the world. This is in direct response to requests from our various members for such services in addition to the GEnie subscription PALM roundtable service, which also continues to be available. We have signed and implemented a commercial contract with an InterNet provider for services which include:

World Wide Webb Home Pages related to palms and cycads,
FTP storage of pertinent files, including image and text files, which can be downloaded by palm enthusiasts anywhere,
Private NEWSGROUP services will also be made available to us on this InterNet server.

Each member of the IPS can have a short (<250 word) personal summary and a reasonably sized image file maintained on the WWWeb for interested parties to view and/or download if they wish without charge. Just supply me with such files and summaries and they will be so posted. Short summaries

for each IPS director are already there. The WWW home page can be accessed via the URL http://www.palms.org by anyone on the InterNet, anywhere in the world. The WWW pages currently include information about the society, its affiliates, publications, services, and members who have supplied information for posting. Commercial advertising is also possible. Contact us if you are interested.

The IPS is also maintaining several lists of Email addresses. For a copy of the existing list or any other information about our InterNet services, please contact me directly. Our InterNet contact list has now expanded to Australia, Canada, Chile, Finland, Germany, Greece, Italy, Netherlands, Sweden, U.K., USA (thirteen states), and Venezuela. Are there other InterNet users out there? Let us know how to contact you.

I continue to receive complimentary letters about the format and content of *Principes*—balanced against a single letter of complaint about too much narrow scientific content. The increased color is particularly popular. Again, if you have any ideas or comments, pro or con, please post them to me—all ideas are passed on directly to our editors.

Thanks to each of you who took my request for endowment fund projects to heart. We have received funding requests for a good number of local projects and will do what we can to help at the upcoming Board meeting in Sarasota later in October.

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CHAPTER NEWS AND EVENTS

News from Southern California

Around 105 people attended the July 15th Southern California chapter meeting. We had a tour of three members' gardens. Rick Cirino's garden in Costa Mesa, Robert Cummings' in Garden Grove, and Jim Benzie's garden (JUNGLE) in Villa Park. Rick's garden has one of the best looking *Chrysalidocarpus decipiens* that I've seen. Robert Cummings garden had 8 different *Syagrus* and a *Pritchardia glabrata* that I would have loved to have taken home with me. Jim Benzie's "JUNGLE" had many *Chamaedorea* and a *Phoenix rupicola* with about 20 feet of trunk.

The Southern California Chapter met on 16 September at 11:00 a.m. at the San Diego Zoo. Chuck Coburn, Horticulturalist at the zoo, and his staff hosted us as their guest at the zoo. Because of the great attendance we had five years ago for a zoo meeting, a great crowd was anticipated (and achieved).

Quail Botanical Gardens in Encinitas hosted a "Palm Day" on August 13. Featured was the unveiling of Irina Gronborg's rendition of *Brahea armata* as the eleventh poster in a series created for the Gardens.

John Rees of Cal State University, Los Angeles, spoke at 11 a.m. on economic uses of palms. Jim Wright gave a tour of the palms in the gardens starting at 1 p.m. There was also a palm sale and other palm-related activities.

Ken Foster was our guest speaker. We were indeed fortunate to have Ken speak to us at our San Diego meeting. He was the planned guest speaker at the annual banquet earlier this year but for personal reasons had to cancel. Ken resides in Kalapana, Hawaii; he is a palm-growing consultant with a wholesale seed distribution business. He is also a past president of the IPS (which he joined in 1964), and a member of our chapter. Ken's slide presentation, "Twenty-five years of palm collecting in the jungles of the world," described palms he's seen in more than 30 countries he's visited, along with new, rare palm introductions in which he's been involved. Members were asked to bring a five or fifteen gallon palm if possible as a donation to the zoo, in return for their hospitality.

Mike Maxson via Genie

(*Continued on p. 224*)

Principes, 39(4), 1995, pp. 177–182

Nannorrhops ritchiana, the Mazari Palm, in Pakistan

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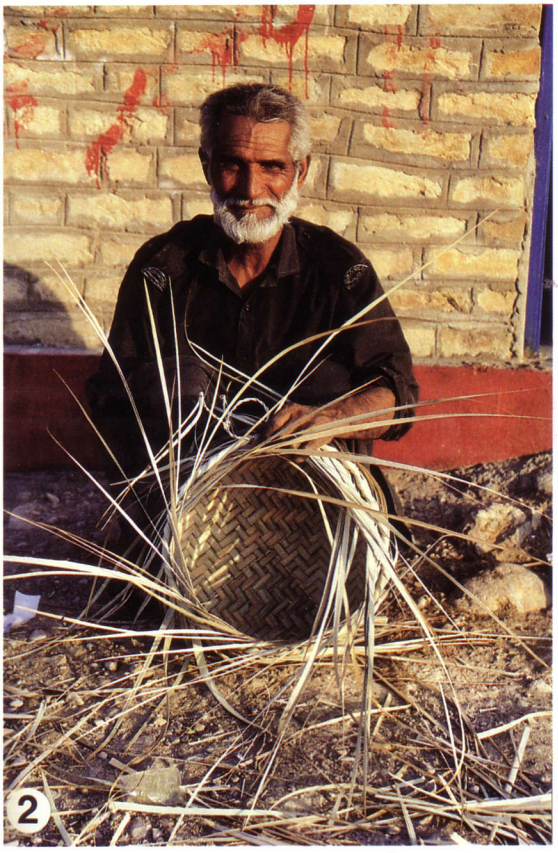
Not many people one knows would consider Pakistan a holiday destination, yet the palm enthusiast is drawn to visit strange places, not by the luxury of the swimming pool, the fancy hotel, the golf, or the scuba diving, but frequently by the strange desire to see some often obscure palm growing in its natural habitat. Thus it was that we decided to visit Pakistan to see *Nannorrhops ritchiana* in the wild.

There are many places recorded as supporting populations of *Nannorrhops* in publications by Beccari, by Blatter, and by Griffith. Indeed, the problem is not where to go but which areas to miss out of the itinerary. After careful study of the available records we made Peshawar our starting point, and arrived there in the middle of November. First on our list of places to visit was the famed Khyber Pass, about 20 miles (32 km) west of the city, which leads into Afghanistan. A permit is necessary to visit this area, and with the permit comes a guard armed with a Kalashnikov who will accompany you in your taxi to the Pass and back. All the authors recorded this palm as common in the Khyber Pass yet we saw none and returned somewhat disappointed.

The following morning we were collected by another taxi for a three day trip which would take us to many of the other locations recorded for the north of the country. We set off at 8 am and drove through Nowshera to the Indus River, thence to Nizampur, Sangina, Attock (where we were also hopeful of finding *Nannorrhops*, but were again disappointed) and Pindi Gheb where we had lunch, then via Talagang to Mianwali where we spent the night. In the morning we took the Khushab road, then turned off at Quaidabad in the direction of Sakesar in the Salt Range of mountains, our first goal. The road was in quite good order and a few miles north of Amdalanwala, we began to climb until we were high above the flat plain below. The Salt Range rises straight out of the plain with very little introduction.

We climbed and climbed, the rocky and arid landscape providing stunning scenery. At an altitude of 2,600 ft (800 m), we came across our first specimens of *Nannorrhops ritchiana* in its natural habitat (Fig. 1). We had spent many hours scanning the countryside so when we finally found them, relief was as much of an emotion as excitement. They were impressive plants, bushy, some to about 6 feet (1.80 m) tall, pale blue/green in color with rather thick trunks and incredibly thick and leathery leaves. They were growing here on the steep slopes in very poor, rocky, limestone soil, together with various evergreen hard-leaved shrubs. We took some photographs and then carried on driving, passing lots more plants. When they seemed to peter out, we had the driver turn around and drive back to where they were at their best. Here we spent a happy hour or two, going from plant to plant, and just doing what palm enthusiasts do. We took some measurements, made on-the-spot field notes, cut some leaves as herbarium specimens, and just simply enjoyed being among these attractive palms.

We then drove on but before too long we were stopped at a police post and told that the area ahead was 'closed' so we had no choice but to turn around. But we really didn't mind driving past all the *Nannorrhops* again. We drove all the way back to Quaidabad and there we turned east and drove to the small town of Khushab where we decided to spend the night. We checked in at a small 'hotel' (rather dirty but very cheap) and had dinner at a 'restaurant' (likewise). In the morning we couldn't wait to leave, heading north towards Naushahra on a good, double-width road. Soon we reached the Salt Range again and began once more to climb but despite a thorough search found no trace of our palms although the habitat seemed identical to yesterday's. The scenery was just as spectacular with red rocks against the cloudless blue sky. After we descended on the far side of the mountain range, but before we reached



1. *Nannorrhops ritchiana* has blue-green leathery leaves. 2. *Nannorrhops ritchiana*. Local people make ropes and baskets from the dried leaves.

the town, we turned off east and soon found ourselves on the main road to Islamabad (Pakistan's capital city) and Rawalpindi. We drove through Nurpur and Chakwal and eventually reached Islamabad at 1 pm. It is a 'new' city having been built from scratch some 30 years ago, with good, wide roads, and lots of greenery, such a difference from other Pakistani cities.

We had the driver drop us off at a cheap hotel and bade him goodbye. That evening we went out for a rather expensive and somewhat disappointing meal at a posh hotel. Pakistan is a dry country in more than one sense of the word. Not only is it extremely arid, it is also 'dry' in the sense that you cannot buy alcohol anywhere, even in western hotels. Not only that, but the day we arrived turned out be a 'meatless' day so we had to put up with a vegetarian meal without even a glass of beer to wash it down!

The next day we caught a plane south to Quetta in Baluchistan. *Nannorrhops* was said by Blatter in 'Palms of British India' (1926) to grow 'everywhere up to 5,000 feet in Balluchistan' so we had high hopes of finding it in some quantities. From the airport we took a taxi to a hotel in town, the Qasr-e-Gul, where we asked if it were possible to rent a jeep-and-driver for three days. After a while, some wild-looking tribesmen arrived, one of whom owned such a vehicle. Some hard bargaining followed but the driver would not drop below US$150 for the three days, definitely not cheap. Reluctantly we agreed, and set off after half an hour, driving first to Urak, where we saw no sign of the promised palms, then back to Quetta and out by another route in the direction of Nakas. The reason that we wanted to go there was that in 'Blatter' there is a photograph of the railway station, surrounded by a sea of palms. If they were anywhere they would be here (Fig. 2).

After passing through more spectacular scenery

3. *Nannorrhops ritchiana* cover vast areas of the plain. 4. In the Bolan Pass, *Nannorrhops ritchiana* grows in unbelievably dry conditions.

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8. *Nannorrhops ritchiana* in Rome Botanic Garden. Note one of its several thick trunks. 9. An oasis of Date Palms, reminiscent of *Phoenix sylvestris*.

we began to see palms, first in ones and twos, then by the dozen and the hundred, covering great areas of the plain. (Fig. 3). This southern area of Pakistan is much more arid than the north of the country. The slopes of the mountains, some of which are over 10,000 feet (3,000 m) high, are mostly bare except for, in some places, a thin cover of grass. *Nannorrhops* grows up to 5,000 feet (1,500 m) mainly in the flood-plains of rivers or in small ravines and depressions in stony limestone soil, but generally in places where the water table is not too low. The only cultivated areas of land are small, irrigated fruit orchards near rivers.

None of the palms was as big as those we'd seen up north and the reason soon became clear: all of these plants had been pruned of most of their leaves. Local people make ropes and baskets from the leaves (Fig. 4) and continually cut them from the living plants. We saw hundreds of cut leaves by the roadside, awaiting collection, and camels laden with bundles containing thousands of them (Fig. 5). Blatter had described the plants as being generally about 6 feet tall, but most of those we saw were less than two feet, most with just one or two leaves left (Fig. 6). Immediately a new leaf grows, it is cut off, and as a consequence

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5. Camels, donkeys, trucks and tractors are used to carry thousands of cut *Nannorrhops* leaves to the villages. 6. Most plants of *Nannorrhops* are reduced to just one or two leaves by repeated and indiscriminate cutting. As a result, they never set seed and are much reduced in size. Ultimately they will die, as hundreds of thousands already have. 7. Nakus Railway Station as it is today, strewn with *Nannorrhops* leaves ready for loading.

the plants are getting smaller and smaller. They appear not to set seed so here was yet another example of plants doomed to extinction because of over-exploitation.

The leaves themselves are worth next to nothing. We bought a 40 ft length of rope made from *Nannorrhops* leaves for just 5 rupees ($0.15). Already one can see vast areas which have been cleared of these palms. If the leaves are continually cut, the plant will eventually die. Many of the areas described in the old literature are now quite devoid of palms and those plants that are left are, almost without exception, mutilated. The further we drove, the smaller the plants became until, when we reached Nakas (now Nakus), they were at their smallest, just a few inches tall. And still they were being harvested! The railway platform itself was strewn with the cut leaves (Fig. 7).

In the Botanic Garden in Rome, Italy, is a huge *Nannorrhops*, perhaps the biggest in the world (Fig. 8). It has several trunks, each about a foot in diameter and up to 10 or 12 feet long. It is quite sad to contemplate the fact that these poor decimated plants in Pakistan are the same species and could get just as big if they were simply left alone.

Depressed, we drove on to Hanai where we stayed the night in a poor hotel. Unfortunately, there was a general power cut in operation when we arrived and the meal, of mutton, which was served in our room, had to be eaten almost in darkness. Probably just as well. We had planned to carry on down to Sibi the following day but apparently the road was blocked so we had to go back up to Quetta again, and once more leave by a different exit. Soon we passed through the spectacular Bolan Pass on the way down to Sibi. The road is built along an arid valley with almost sheer sides, quite biblical in appearance with flocks of goats and groups of camels here and there. A railway accompanied the road—a masterpiece of engineering. Built by the British exactly a hundred years ago, in 1894, all the tunnels (and there were many) had British names: 'Mary Jane', 'Braemar', 'Windy Corner' etc.

We pressed on to Sibi and were again disappointed at not finding any more *Nannorrhops*. Perhaps they had once grown there; it certainly seemed ideal for them. We stayed there the night and the following morning set off back up the same road on the return journey. We stopped at an oasis of date palms (*Phoenix dactylifera*) around a small river (Fig. 9). They showed characteristics suggesting that they had been influenced by *P. sylvestris*, which is distributed in the more humid great plains of India to the east. The whole area was very pretty.

Then, finally, and to our surprise, we did come across more of 'our' palms that we had missed yesterday. They were growing on a steep hillside in unbelievably dry conditions, again on limestone. Perhaps they were the sole survivors of a much larger population. They were the last ones that we were to see. On our return to Quetta, we caught a plane out of this beautiful but arid country, and flew back to Europe.

We had been delighted to find *Nannorrhops* in the wild in Pakistan, but our pleasure was much diminished by sadness at the way entire populations had been wiped out, or at best drastically reduced in numbers, and those, mutilated almost beyond recognition. If you, too, would like to see *Nannorrhops* in the wild, go to Pakistan by all means, but don't leave it too long. There might soon be few left for future generations to enjoy.

1995 Board of Directors' Meeting

The International Palm Society will hold its 1995 Board Meeting on October 26–29, 1995, in the Sarasota and Tampa area of Florida. See CHAPTER NEWS AND EVENTS.

Principes, 39(4), 1995, pp. 183–189

Two New Species of Chamaedorea from Honduras

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Since the publication of the monograph of *Chamaedorea* (Hodel 1992*a*) and subsequent articles adding several new species (Hodel 1992*b*, 1995), field studies in Honduras have enabled us to describe and name two additional new species, both from cool, wet, cloud forest near the Guatemalan border.

Chamaedorea moliniana Hodel, J. J. Castillo & Zúñiga **sp. nov.** (Figs. 1–4).

Subgeneris *Chamaedoropsi* Oerst. inflorescentiis masculis solitariis, floribus masculis solitariis petalis patentibus apicaliter. *C. parvisectae* Burret affinis sed petiolis longioribus, pinnis angustioribus longilanceolatis numerosis bis tot quot, rachillis femineis gracilioribus differt. Typus: Honduras, Cortes, Montaña San Ildefonso, *Hodel et al. 1273* (holotypus BH; isotypi AGUAT, EAP).

Solitary, slender, erect, to 3 m tall (Fig. 1). Stem to 1.75 cm diam., green, ringed, upper portion often clothed in persistent brown, dried leaf sheaths, internodes to 15 cm long, usually first flowering when appearing stemless (Fig. 2), then overall height ca. 1 m and stem abbreviated, subterranean, to 15 cm long, slightly curved, brownish, rough, prominently ringed, nodes congested, internodes 3–15 mm long. Leaves 3–5 (Fig. 1), ascending-spreading, pinnate, bright green; sheaths to 20 cm long, tubular in basal ¾, obliquely long-open in apical ¼, slightly thickened, longitudinally striate especially when dry; petioles to 50 cm long (Fig. 1), slender, slightly grooved or flattened and green adaxially, rounded and lighter green abaxially, finely longitudinally striate when dry; rachis to 65 cm long, bright dark green, strongly attenuate apically, angled adaxially, rounded abaxially; pinnae 17–20 per side, lower middle ones longest, these to 26 × 3 cm, apical pair 10–13 × 0.75–1 cm, basal ones 16–19 × 1–1.5 cm, all pinnae straight, only very slightly falcate, thin-papery, long-acuminate, contracted basally, lower margin briefly decurrent on rachis, lowest pinnae deflexed, each pinna with a conspicuous midrib flanked by 2–4 secondary nerves on either side, tertiary veins numerous, faint, midrib and secondary veins drying green adaxially, shiny yellow abaxially. Inflorescences 1–2 per plant, infrafoliar, ascending, breaking through old persistent sheaths on stemmed plants (Fig. 1), arising from ground or leaf litter when plants appear stemless (Fig. 3), to 65 cm long, shorter than leaves; peduncles ascending, to 62 cm long, straight, to 1 cm wide at base, 1–2 mm diam. at apex, green in flower, orange in fruit where exposed; bracts 8–9, prophyll and 2nd bract to 1 cm long, 3rd to 1.5 cm, 4th to 4 cm, 5th to 8 cm, 6th to 13 cm, 7th to 17 cm, 8th to 19 cm, often a rudimentary 9th bract to 1.5 cm long 3–4 cm below rachis, staminate with uppermost bract not exceeding peduncle, pistillate with uppermost large bract exceeding peduncle and extending well onto rachis, bracts tubular, brown in flower and fruit, thin-papery, longitudinally nerved, lower 7 bifid, acute to acute-acuminate, upper one(s) obliquely long-open, acute-acuminate. Staminate rachis to 3 cm long, 1–2 mm diam., drying flattened, finely longitudinally striate; up to 8 rachillae (Figs. 1–3), these to 15 cm long, slender, 0.75–1

mm diam., drooping, green in flower, drying with fine, thin, ± transparent longitudinal ridges or wings. Staminate flowers in dense spirals, 0.25–0.75 mm distant, ± superficial, leaving narrowly elliptic scars to 2 mm long, flowers at anthesis 2.5 × 2.5 mm, globose, yellowish; calyx 2 × 0.5 mm, low-cupular, scarcely lobed, sepals connate in basal ½–⅔, broadly rounded apically, thin; petals 2.5 × 2 mm, ovate, valvate, distinct, spreading, erect, acute, thin, exceeding pistillode; stamens 1.5 mm high, shorter than pistillode, filaments 0.74 mm long, slender, anthers 0.5–0.75 mm long, oblong, dorsifixed near base; pistillode 1.75–2 mm high, columnar, truncate. Pistillate rachis to 2 cm long, 1.5–2 mm diam., green in flower, orange and drying with faint thin longitudinal ridges in fruit; up to 4 rachillae (Fig. 4), these to 8 cm long, 1–2 mm diam., green in flower,

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1. Old, mature, stemmed plant of *Chamaedorea moliniana*, *Hodel et al. 1273* (holotype); cool, wet, cloud forest, Cortés, Honduras. Note long petioles and drooping staminate rachillae. 2. Stemless but flowering staminate plant of *Chamaedorea moliniana*, *Hodel et al. 1273*, Cortés, Honduras.

orange in fruit, straight or slightly curved in life, drying strongly undulate and with faint thin longitudinal ridges. Pistillate flowers in moderate spirals, 1–4 mm distant, sunken, leaving elliptic depressions 2.5 mm long, flowers 1 × 2 mm, depressed-globose; calyx 0.5 × 2 mm, low-cupular, scarcely lobed, sepals connate and/or imbricate nearly to apex, straight apically; petals 1 × 1.25–1.5 mm, broadly triangular, imbricate in basal ½, erect, acute, faintly nerved adaxially when dry; pistil 0.8 × 1.75 mm, subglobose, stigma lobes long, recurved, thick, acute, just shorter than petals. Fruits 10 mm diam., ± globose, black; seed 8 × 7 mm. Eophyll bifid.

Distribution: HONDURAS. Cool, wet, cloud forest; 1,700 m elevation.

Specimens Examined: HONDURAS. Cortés:

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3. Staminate inflorescence arising from the leaf litter from a stemless plant of *Chamaedorea moliniana*, *Hodel et al. 1273*, Cortés, Honduras. 4. Infructescence of a stemless plant of *Chamaedorea moliniana*, *Hodel et al. 1272*, arising from near the ground; cool, wet, cloud forest, Cortés, Honduras. Note seedling with pinnate leaf to left of fruits.

Montaña San Ildefonso, *Hodel et al. 1272* (AGUAT BH EAP), *1273* (holotype BH; isotypes AGUAT EAP).

The specific epithet of the new species honors Dr. Antonio Molina (1926–) of the Escuela Agrícola Panamericana, long a collector of numerous, significant, and excellent specimens of Central American plants.

Chamaedorea moliniana is closest to *C. parvisecta* but the latter differs in its much fewer (7–10 vs. 17–20) and broader pinnae, shorter petioles, and thicker pistillate rachillae. In the key to subgenus *Chamaedoropsis* (Hodel 1992*a*, p. 120), *C. moliniana* would key out next to *C. parvisecta*.

The habit of *Chamaedorea moliniana* is unusual, but not without parallel in the genus. Seedlings develop pinnate leaves at a very early stage (Fig. 4), perhaps as early as the second leaf. Soon plants develop normal, adult-sized leaves but lack a visible stem. However, plants actually possess a short, curving, rooting, subterranean stem with highly congested nodes, and begin to produce smaller, few-branched inflorescences during this "stemless" phase. Later, after perhaps as many as several years, they produce a visible, elongated stem to several meters tall with larger, much-branched inflorescences.

Plants of the two stages are easily mistaken as distinct species since their habit and inflorescences can differ dramatically. Other species of the genus exhibiting this or a similar phenomenon include *Chamaedorea dammeriana* and *C. macrospadix* from Costa Rica and Panama, *C. anemophila* from Panama, *C. volcanensis* from Guatemala, *C. parvisecta* from Guatemala and Mexico, and *C. queroana*, *C. radicalis*, and *C. whitelockiana* from Mexico (Hodel 1992*a*, 1994).

Chamaedorea frondosa Hodel, J. J. Castillo & Zúñiga **sp. nov.** (Figs. 5–8).

Subgeneris *Chamaedoropsi* Oerst. inflorescentiis masculis solitariis, floribus masculis solitariis petalis patentibus apicaliter. Species insignis habit nano fruticoso, foliis numerosis bifidis obscure nervatis inflorescentiis erectis ramosis, a speciebus nobis notis bene distincta; *C. pumilae* H. A. Wendl. affinis sed rachillis masculis erectis differt. Typus: Honduras, Cortés, Montaña San Ildefonso, *Hodel et al. 1274* (holotype BH; isotypes AGUAT, EAP, F, MO).

Solitary, erect or briefly decumbent then erect, to 70 cm tall (Figs. 5,6,8); stem short, 1.2–1.5 cm diam., prominently ringed, internodes 1.8 cm long. Leaves 12–15(–20), erect-spreading (Figs. 5,6,8), bifid, ± thick, ± coriaceous; sheaths to 10 cm long, long-open, deeply split opposite petiole, tubular and completely encircling stem in basal ⅓ only; petioles to 11 cm long, green and grooved adaxially, pale green and rounded abaxially; blades to 42 × 12 cm, long-oblong, rich forest green, infrequently very slightly mottled, incised apically to ¼–⅛ its length, apical lobes conspicuously toothed on outer margins, rachises of blades to 32 cm long, 10–12 primary nerves on each side of rachis, 1 secondary vein between each pair of 2 primary, tertiary veins numerous and faint, all nerves ± obscure adaxially but raised, pale and more conspicuous abaxially. Inflorescences 3 per plant, interfoliar, erect in flower, sometimes nodding in fruit; peduncles to 40 cm long, 2–5 mm diam. at apex, 4–10 mm wide at base and ± flattened, green, straight and erect in flower, orange where exposed and nodding in fruit; bracts 5, prophyll to 3 cm long, 2nd bract to 8 cm, 3rd to 11 cm, 4th and 5th to 14 cm, 5th one exceeding peduncle, all tubular, tightly sheathing, papery, longitudinally nerved, lower ones acute and obliquely open, upper ones acuminate and long-open, sometimes a thin 6th bract to 3 cm long subtending lowest rachilla; staminate spicate or with up to 5 rachillae, these to 23 cm long, 1–1.5 mm diam., erect (Fig. 7), longitudinally angled when dry, green in flower. Staminate flowers in moderately dense spirals, 0.6–1 mm distant, superficial, leaving elliptic scars 0.5 × 1 mm, flowers at anthesis 4 × 2.5–3 mm, obovoid; calyx 1 × 3 mm, cuplike, shallowly lobed, sepals connate nearly to apex, ± straight or only briefly acute apically; petals 4–4.5 × 2.5 mm, ovate, valvate, spreading, distinct nearly to base and there briefly connate; stamens 2.5–3 mm high, just shorter than pistillode, filaments 1 mm long, flattened, 0.2–.25 mm wide, anthers 1.75 mm long, elliptic, bilobed, dorsifixed near base; pistillode 3 mm high, shorter than petals, columnar. Pistillate inflorescence spicate (Fig. 8), rachis or flower-bearing portion to 14 cm long, orange in fruit and 1.5–2 mm diam. Pistillate flowers in moderate spirals, 2–4 mm distant, superficial or only slightly sunken, leaving elliptic scars 2 mm long, flowers post-anthesis 2 × 2 mm, globose; calyx 1 × 2 mm, moderately lobed, sepals connate and/or imbricate in basal ½–⅓, rounded apically; petals 2 × 2 mm, broadly obovate, cup-shaped, imbricate in basal ¾, faintly nerved abaxially when dry, acute or slightly mucronate and erect api-

cally; pistil 1.75 × 0.75 mm, oblong-globose, stigma lobes short. Fruits 6–7 mm diam., ± globose, black; seeds 5–6 mm diam., globose. Eophyll bifid.

Distribution: HONDURAS. Cool, wet, cloud forest; 1,700 m elevation.

Specimens Examined: HONDURAS. Cortés: Montaña San Ildefonso, *Molina 8192* (EAP); *Hodel et al. 1274* (holotype BH; isotypes AGUAT EAP F MO), *1275* (AGUAT BH EAP).

The epithet of the new species is from the Latin *frondosus*, meaning leafy and refers to the numerous leaves, sometimes as many as 20, in its crown. Indeed, individual plants of *Chamaedorea frondosa* may have more leaves than any other species in the genus. Only *C. tuerckheimii* approaches *C. frondosa* in the number of leaves in its crown. By virtue of its leafy habit, *C. frondosa* is one of the most remarkable and handsome of the numerous,

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5. *Chamaedorea frondosa, Hodel et al. 1275*; cool, wet, cloud forest, Cortés, Honduras. 6. *Chamaedorea frondosa, Hodel et al. 1275*, Cortés, Honduras.

dwarf, bifid-leaved species in the genus. Its numerous leaves and dwarf stature give it an attractive, full, bushy appearance.

Florally, *Chamaedorea frondosa* is probably closest to members of the *C. pumila* complex of species, including *C. pumila*, *C. minima*, and *C. sullivaniorum*. However, the last three differ in their crowns of fewer leaves, the conspicuously nerved and corrugated leaf blades, and the pendulous staminate rachillae. The obscurely nerved, fairly thick blades of *C. frondosa* are not too unlike those of *C. geonomiformis* and *C. tenella* but the last two species have fewer leaves and pendulous staminate rachillae. In the key to subgenus *Chamaedoropsis* (Hodel 1992*a*, p. 120), *C. frondosa* would key out next to *C. rigida*, *C. stricta*, and *C. volcanensis*, which differ in their drooping or pendulous staminate rachillae, and *C. queroana*, which differs in its blades apically incised to more

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7. Erect, staminate rachillae of *Chamaedorea frondosa*, *Hodel et al. 1275*, Cortés, Honduras. 8. Fruiting plant of *Chamaedorea frondosa*, *Hodel et al. 1274* (holotype); cool, wet, cloud forests, Cortés, Honduras.

than one-half their length and its infrafoliar inflorescences.

The publication of these two new species, along with our "rediscovery" of *Chamaedorea donnell-smithii* (Hodel et al. 1994) and the recent discovery of *C. tuerckheimii* in Honduras, brings to 17 the total number of species of the genus in the country. They are:

C. arenbergiana
C. brachypoda
C. costaricana (*C. quezalteca*)
C. seifrizii (*C. donnell-smithii*)
C. elatior
C. ernesti-augusti
C. frondosa
C. geonomiformis
C. moliniana
C. neurochlamys
C. nubium
C. oblongata
C. pinnatifrons
C. sartorii
C. tepejilote
C. tuerckheimii
C. woodsoniana

The restricted distribution of the two new species named and described here may be more apparent than real. Generally, Honduras is poorly collected, and further field work there may prove rather revealing and fruitful, especially for *Chamaedorea*. Several little explored, isolated, mountain-top cloud forests in Honduras (such as the Montaña San Ildefonso), arising from the extensive, seasonally dry pine forest like islands in a sea, could easily harbor their own new species and/or new records for *Chamaedorea*.

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Palms on the Maltese Islands

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The Maltese Archipelago is situated 90 km south of Sicily. It consists of the islands of Malta (250 km²), Gozo (70 km²) and Comino (3 km²) plus a few smaller islets. They have a sunny Mediterranean climate, with hot, dry summers and cool, wet winters. The rocky land may appear to be barren to visitors who arrive during the dry summer months. However, the wild flora is relatively abundant considering the small size of the islands. Most of these plants grow during the winter months, when rain keeps the ground moist and temperatures rarely fall to 0° C. During the summer there is an almost complete absence of rain and ground temperatures are frequently raised over 40° C by the hot desiccating sun. Most of the smaller plants that make up the ground-cover dry up during the summer months and survive as seeds or as underground organs (bulbs, tubers, etc.). They leave behind an arid looking landscape that only turns green again when the autumn rains arrive. Trees, bushes and shrubs survive this drought because their long, penetrating roots are capable of taking up deep underground water. Some plants that live on the coast can utilize salty ground water. Other plants are succulent or have special features like small or hairy leaves, which reduce water loss through transpiration. Most cultivated plants grown during the summer survive the drought only if irrigated.

Quite a number of palm species are capable of living outdoors in Malta. In winter they are able to tolerate our cold weather because freezing temperatures which damage palms in northern European countries do not occur here. They survive the summer drought in different ways. Some species have long roots which can tap natural reservoirs. Those growing near the coast are capable of utilizing salty ground water. Their leaves have to be capable of withstanding both hot summer and cold winter winds. Others survive only if irrigated and protected in gardens. All of them must also like or tolerate the Maltese soils which are calcareous and alkaline in nature. The following is a discussion of the hardier palm species growing here and their relationships with the Maltese Islands.

Chamaerops humilis

The Mediterranean Dwarf Palm (in Maltese 'Ġummar') is the only palm that has been described as a true native of the Maltese Islands. Unfortunately the wild population appears to have become extinct sometime during the turn of the century, mainly as a result of over-collection for horticulture. Apparently the last known wild plants were collected and planted in public gardens (Borġ 1927). Today *C. humilis* is a commonly cultivated plant and although new varieties have been imported, the descendants of the native stock probably still adorn many Maltese gardens.

Goats, bird hunting, and a large human population density must have also contributed to the wild palms' decline even though the literature I could find (Borġ 1927) blames only collectors. Goats and sheep were formerly the main milk producing animals. Large herds were left to graze on our rocky Mediterranean terrain, to which they are highly adapted, and left to eat anything (including any young palms and seedlings) that they could find. Furthermore bird hunting was such an excessively popular 'sport' in Malta and Gozo that many bird populations were drastically reduced. This meant that plants using birds to disperse their seeds lost much of their potential to recolonize distant ground. The human population density on the island is one of the highest in the world with about 1,060 people/km² land. Much of the land is either cultivated or covered with buildings, leaving little space for the remaining wildlife. For palms such as *C. humilis*, the advantage of being good ornamental plants is that they always find a place in the many public and private gardens that arise with urban expansion. However, this is never the same as living in the wild countryside.

Fortunately for our endangered flora most of the goat and sheep population have now been

replaced by cows which are more efficient in producing milk. These are rarely allowed to graze outside and so do not present a danger to wild plants. The new strict hunting laws that have lately come into effect should also allow some birds to recontinue dispersing seed. This means that now *C. humilis* may have a better chance to 'escape' back to what remains of the wild. There is for example a small individual growing in Balluta valley, N.E. Malta (E. Lanfranco), which may be such a 'fugitive.' Individuals of *C. humilis* have also recently been reintroduced to the wild by members of 'Arbor', a local environmental group. Let's hope the palms remain unmolested in their native habitat.

Phoenix dactylifera

The Date palm must have been the first palm to be introduced to Malta by man. Since the first prehistoric settlers arrived ca. 5000 BC, the Maltese Islands have been invaded and colonized by various other peoples and nations. The large natural harbors and the central Mediterranean location of Malta interested the sea-faring Phoenicians who set up a colony here about 2,700 years ago. *Phoenix* was an important food plant for these people in their Middle-Eastern homeland. They also planted it in their new North African colonies such as at Carthage (Hyams 1971). Later the Carthaginians themselves became a powerful nation and it was their turn to take over Malta. The date-palm was also an important food plant for these people and so one can easily assume that dates were eaten in Malta during both the Phoenician and Carthaginian occupations. Date palms were probably also grown here, as ornamental if not for fruit and maybe to remind the colonies of their homeland scenes. The Romans took over Malta in 218 BC after defeating Carthage. The story of the date palm in Malta must have continued when the Arabs invaded and occupied Malta and much of southern Europe during the 9th Century AD. They planted groves of their favorite tree, the date-palm, in much of their new territory (Hyams 1971). While they occupied Malta much of the Arabic language and culture was adopted by the Maltese and in fact today the Maltese name for dates is 'Tamar' which is exactly the same as in Arabic. A succession of Christian-European Nations followed the Arabs and after 1530 the islands were governed by the Knights of the Order of St. John. The first record of *Phoenix dactylifera* in Malta appears to have been written in 1536 by Quintinus, a French monk who described orchards in Malta where 'Palm-trees' were grown and cultivated (Quintin D'Autum 1980). Napoleon's French displaced the knights in 1798. Two years later they were defeated by the British. The islands finally became independent in 1964. Today *P. dactylifera* can still be seen decorating quite a number of old farms and buildings. They can also be seen growing in some cultivated valleys, in gardens, groves, and streets. There are many old place names that include the word 'palma' such as 'Tal-Palma' and 'Triq il-Palma'. They probably refer to date palm(s) which used to grow or are still growing in those areas.

Date production on our islands has never had any significant commercial value. This is not because the trees do not grow well here if properly irrigated, but because their fruit rarely attains complete maturity. Our summers are hot which is good for date production but they usually end abruptly with heavy autumn rains and cold weather, conditions which are very detrimental to date production, and the fruit are only given a chance to develop when it does not rain during early autumn. I have found their taste to be quite good but not as sweet as imported commercial dates. Our dates may be used in sweets and pastries to which sugar may be added (Borġ 1922). Good examples must be the local traditional snacks, 'Mqaret' that are small fried pastries with date filling. The eating value of Maltese dates may be increased in other ways. For example Haslam et al. (1977) state that the fruit ripen completely if the infructescences are covered with polythene bags and Borġ (1922) suggests using an early fruiting variety such as the 'Rhars' of Northern Tunis (to avoid the onset of the autumn rains).

Perhaps the most interesting and mysterious of the palms found in Malta are the *Phoenix* palms growing wild in some coastal regions of Malta and Gozo. They can be found growing on clay slopes which overlook the sea (Fig. 1) and on the sides of valleys that lead down to the sea. A good layer of soil formed on these slopes so that in many cases they have been transformed into a network of terraced fields. The palms are found on both cultivated and wild slopes. On the cultivated slopes, they can be seen growing at the field edges, sometimes right out of the rubble walls which mark the boundaries and hold the terraced fields in place. The palms growing on wild slopes are frequently found near clumps of reed (*Arundo donax* or

Phragmitis australis). Although their distribution at first appears to be haphazard their location can always be correlated with moisture in the ground: The fact that they can be found growing on soil which lies on top of a clay substratum is important. This clay layer is impermeable to water showing that rain water is not lost by draining down into deeper layers of rock. In fact the occurrence of reeds which are water-loving plants shows that there is underground water below them, and if found in a row directed towards the coast they indicate the position of an underground stream. The Arabs have a saying for the date-palm of their homeland; "The king of the oasis bathes his feet in water and his head in heaven's fire". In many cases this saying also applies to the palms growing here, which apparently like our summer sun yet still need sufficient amounts of ground water. They are found next to the reeds also using the water below, and on the edges of fields, where they probably utilize 'lost' water seeping away from irrigation points.

The clay soil found on these slopes is able to retain a lot of water and does not dry up as quickly as other Maltese soils, when the drought begins during the spring. The clay soils continue to hold a considerable amount of water which is very important for any date stones that may have found themselves in this soil, for they can only germinate if provided with both heat and water. Only during late spring are temperatures high enough and soil moisture still available to allow germination of these date seeds to take place. Once germinated, the seedlings of *Phoenix* palms quickly produce long penetrating roots that have to search for water in deeper soil before the summer-sun dries up and cracks the surface layers. I have seen many seedlings from date-stones in a non-clay region dry up and wither away by midsummer, obviously not having found enough moisture to survive. The moisture retaining ability of the soil must be a limiting factor for the germination and survival of the young palms, and is probably one of the main reasons why the palms can be found growing wild mainly in clay regions.

Which species do these *Phoenix* palms belong to? The trunks of wild palms growing on the clay slopes are usually short and frequently obscured by a large number of surrounding suckers giving these palms a bush like appearance rather than that of a tree. Their blue-green new leaves distinguish them from *P. canariensis* which have a brighter green color. Their short, bushy stature resembles that of *P. theophrasti*. Cretan date palms also live in similarly exposed locations on the nearby island of Crete. But our *Phoenix* apparently do not fruit in such exposed locations. The size of the leaflets is also larger than those of the Cretan date palms.

The size, shape and color of the leaves indicate *P. dactylifera*. But in such a case why do their flowers dry up and fall instead of developing into fruit? And why are the trunks usually short? Not far from these slopes, in the bottom of valleys such as at Pwales and Ghadira there are *P. dactylifera* which have 'normal' long trunks, and fruit and seed quite well. There are differences between these two habitats: The coastal slopes are very exposed to sea borne winds and in summer probably contain less ground water than in the valley bottoms. The flowers of coastal plants probably do not continue to the fruiting stage because they are damaged by the moisture and salt laden winds. The lack of ground water may make matters worse.

Trunks are usually short probably because strong winds, which are frequent in Malta, would topple tall exposed trunks. The surrounding suckers take over and give the palms the bushy shapes as observed. These short rounded shapes provide less resistance to the wind and so the plants are not as prone to toppling. When the trunks of the new suckers grow too high they will again be prone to toppling. Such a threat to tall trunks can be observed on the road to Xaghra, in Gozo, where a tall cultivated date-palm, supported by cables, was toppled last January by a strong wind.

Why are the 'wild' palms concentrated along the coast and not inland? And if they are not reproducing, where do the seeds come from? There are four possible sources from where the seeds could have originated:

1. People like palms as ornamental plants and may have planted the seeds or young plants.
2. The fruit (with viable seeds) of local inland palms were carried by some animal vector to the coast (e.g., rodents, birds).
3. People (e.g., hikers, hunters, farmers) could have eaten (imported) dates and discarded the viable stones randomly. These discarded seeds could have then been washed down to places inaccessible to people by rain water, before germinating.
4. Large birds ate the fruit of palms in coastal N. Africa and during migration northwards could have stopped here and deposited the seeds.

1. *Phoenix* along the coast, Malta. 2. Wild *Phoenix canariensis* in the foreground with possible parents in the background as seen below Mdina, Malta.

The first possibility is unlikely since many of the 'wild' palms grow in haphazard locations not characteristic of cultivation; some of the coastal palms can only be reached by climbing up or down steep jagged rocks. Others are found on cliff edges or in the middle of a thick group of reeds. The second possibility is also unlikely because the local fauna is too small to carry the large seeds for any considerable distances, even though I have noted that sparrows eat the fruit. In many cases the third is a likely explanation, but still does not explain why the palms' distribution is concentrated coastally. The last hypothesis is the most interesting as it would explain the coastal distribution. For example Herring gulls are known to eat practically anything and later on regurgitate any large indigestible material. In the Mediterranean they are known to eat olives, which are not much smaller than dates. Is it inconceivable that such birds could have eaten fallen dates of some coastal North African palms and flown less than 200 miles to the Maltese coast before releasing the stones? I have noted that in some cases the palms grow immediately near large boulders, which could have served as landing points for the birds. But of course this may just be a coincidence.

Phoenix canariensis

The Canary Island Date Palm is extensively used as a street and garden plant, and is probably the most popular outdoor palm on the Maltese Islands. It is well adapted to our climate. Several thousand seeds are produced by the local palms each year. These are very easily germinated and the seedlings grow into beautiful statuesque trees ideal for both formal and informal landscaping designs. Once their deep-running roots are established the palms do not require watering and manage very well by themselves. Like *P. dactylifera*, *Chamaerops humilis*, and *Washingtonia* palms they are able to tolerate salt laden winds, a very important advantage here because much of the land is coastal. They must also tolerate some degree of salt in ground water because one can find all these palms growing less than 4 meters away from the sea at Marsascala (on the south coast of Malta). Individuals of *P. canariensis* also appear to be growing very well at Salina's salt marsh.

P. canariensis can be considered to be an economically important plant in Malta for it has its place in the tourist and fishing industries. It also has a number of other uses.

Tourism is the most important money-maker on the islands with most tourists coming from north and central Europe during the summer months. Palms for many people are associated with sunshine and holidays. This pretension must serve the many hotels and holiday resorts on the islands well, for most of them have palms on their premises, and frequently use them in their advertisement photographs.

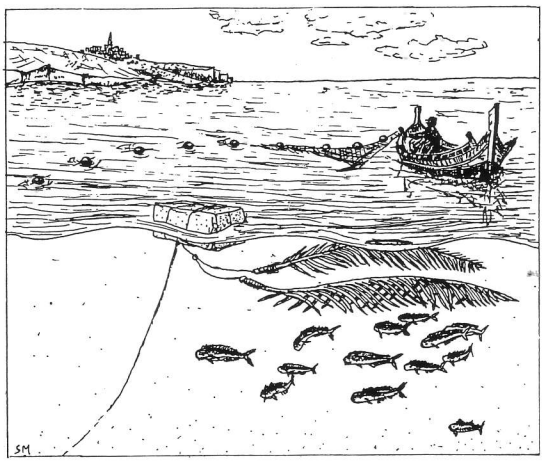
The sea is an important source of food for communities living on small islands such as ours. Between August and January Maltese fishermen concentrate their efforts on catching just two species of pelagic fish which pass round the archipelago during this period. The fish are namely the Dorado or Dolphin Fish, *Coryphaena hippuris* (in Maltese 'Lampuki') and the Pilot Fish, *Naucrates ductor* (in Maltese 'Fanfri'). At this time the 'lampuki' principally and to a lesser extent the 'fanfri' constitute an important and relatively inexpensive fresh food for the Maltese population, so the method used to catch these fish has to be efficient in order to satisfy the islanders' needs.

It has long been known that these fish congregate under floating objects. Until the early 1970's the principal method of catching these fish was to lay floats made of cork known as 'kannizzati' out in the open sea. These were each anchored to the sea bottom so that they would not move with the current and left there to attract any passing 'lampuki'. After a while the fishing boat caught the fish below each float by surrounding them with a purse net. Why these fish should would want to remain under floating objects in the first place has not yet been explained properly, but it seems likely that after having migrated for long periods of time, the fish would prefer to rest in a safe place, which in the open sea may be very hard to come by. Small 'lampuki' would be safe from attacks by sea-birds below a large floating object. Larger individuals may also be safe from any large predatory fish that passes below and fails to register them as single fishes. Their usually easy-to-spot streamlined silhouettes would be overshadowed by the larger silhouette of the object floating above them, so that the predator would notice the large shadow but not the 'lampuki' beneath it. The 'lampuki' rest under the floats even at night, since the moon would still illuminate the surface and so outline their silhouettes. It is ironical that such a defensive behavior which must have evolved to protect the fish in the first place has now allowed man to catch them so easily.

But what has *P. canariensis* got to do with all this? In the early 1970's Maltese fishermen realized that their leaves can be used in their 'kannizzati' (Fig. 3). They float, are durable, and are broad with closely spaced leaflets which offer the fish a large natural looking shelter. Above all they are inexpensive and easily replaced. Each 'kannizzata' was made by two or three large leaves attached to a polystyrene or cork float, that in turn was anchored to the sea bottom. The popularity of this technique grew and in the early days of their use for fishing some street palms were stripped of their foliage. The government realized that the palms were in danger and so introduced a new law with heavy penalties for anybody caught cutting off palm leaves without authorization. At the start of the fishing season, i.e., in August, the lower leaves of palms in street and public gardens were cut off by government employees and sold at a fair price to the fishermen. The government thus saved the palms and at the same time provided the fishermen with a new service. The popularity of *P. canariensis* has rapidly increased since then as witnessed by the many young palms used as street trees and may partly be explained by its value to the fishing industry.

In Gozo one can still find hats and baskets made from palm leaflets woven together. Their durability can be judged from my own hat which has lasted for five years surviving sea water, hot sun, and my sitting on it several times! Today the leaflets used to weave such items are those of *P. canariensis* but before the introduction of this palm to Malta those of the native *C. humilis* were used. Palm leaflets are also used to make crosses for Palm Sunday. The Christian symbolism of the palm can again be seen during the summer 'festas' when palm leaves on tall columns are used to decorate the streets through which the religious processions pass.

The ecological aspect of *P. canariensis* is also interesting. As previously mentioned it is well adapted to our calcareous soil and climate. The fruit of *P. canariensis* ripen early during the summer, then fall on dry ground. The seeds germinate during the following spring when the ground is both warm and moist. However most die during the summer since their roots are not able to find enough water to last them through the drought. Seedlings have relatively short roots and cannot tap the deep water supply which their much larger parents can reach. The few seedlings that do find the necessary moisture face more dangers; those



3. A Maltese 'Luzzu' circles a shoal of 'Lampuki' gathered below a 'kannizzata'.

that germinate on cultivated ground are ploughed up. Others which germinate on roadsides risk hover-mowers and trampling. The shape of the first leaves resembles those of grasses so it is no surprise that they are treated as weeds. Very few of the seedlings thus survive. On the slopes below Mdina (Fig. 2) and Rabat (in central Malta) there are small 'wild' communities of *P. canariensis* ranging from seedlings to 2 meter tall plants. They are obviously the progeny of nearby cultivated adult trees. They are growing on the banks of terraced fields where they are spared being ploughed up. They must also use water trickling away from the crops' irrigation points. I have not yet come across any 'wild' *P. canariensis* on the coastal slopes as with *P. dactylifera*, but this may be due to their relatively recent introduction to Malta. Only time can tell whether the distribution of 'escaped' *P. canariensis* will spread or not.

Washingtonia robusta and W. filifera

These palms are rapidly gaining in popularity as can be noted from the many new *Washingtonia* in streets and gardens. One can also see large numbers of *Washingtonia* palms growing in exotic plant nurseries in Malta and Gozo. This popularity is probably due to their effortless cultivation, their rapid growth and above all to their impressive palmate foliage, which contrasts well with the now familiar pinnate foliage of *Phoenix* species. Being very hardy palms many have been planted by the sea and in some cases actually in beach sand.

Large quantities of small black fruit are produced late in summer. Many of the fallen seeds germinate the following spring but then the seedlings face the same problems as with those of *P. canariensis* (see above). The problem with drought appears to be even more serious for the smaller *Washingtonia* seedlings since they have shorter roots than *P. dactylifera* and *P. canariensis*. Although they are desert palms and prefer hot dry climates they also like to have a lot of ground water much like *P. dactylifera* as seen in San Anton Gardens where there are two large *W. robusta* actually growing in a pond.

Other Palms

I have identified the following palms growing well exposed to the climate in various Maltese gardens: *Brahea armata**, *Livistona chinensis**, *L. australis**, *Trachycarpus fortunei**, *Sabal mauritiiformis**, *Phoenix reclinata*, *Syagrus romanzoffiana*, *Butia capitata*, and *Howea forsterana**. The following are found in slightly more sheltered areas: *Phoenix roebelenii**, *Chamaedorea elegans**, *Chamaedorea seifritzii*, and *Rhapis excelsa*. Those marked with an * include individuals which produce viable seeds each year. The rest are either solitary individuals, single sexes or still too young to produce viable seed.

Although the list is quite short I have no doubt that I have not come across all the species growing outdoors here. In any case more species will probably be introduced in the future. They should hopefully find the Maltese environment to their liking.

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Profiles and Pan-African Distributions of the Rattan Species (Calamoideae) Recorded in Nigeria

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Rattans are climbing palms belonging to the subfamily *Calamoideae*, the scaly fruited palms. Of the 13 genera that make up the rattans, three genera—*Eremospatha*, *Laccosperma* (formerly *Ancistrophyllum*), and *Oncocalamus*—are restricted to the rain forest areas of Africa. The large genus *Calamus* is also represented in Africa by one species (Uhl and Dransfield 1987). The remaining rattans are found in Asia, Malesia, and the western Pacific.

Though rattans play a very important role in the local economies of most West and Central African countries, they have been almost completely neglected by the scientific community, forestry institutions, and official legislation. The taxonomy of African rattans at, and within the species level remains confused and even less is known about their ecology. Little is known about their trade internationally and there have been no large scale attempts at silviculture, in contrast to the situation in S.E. Asia.

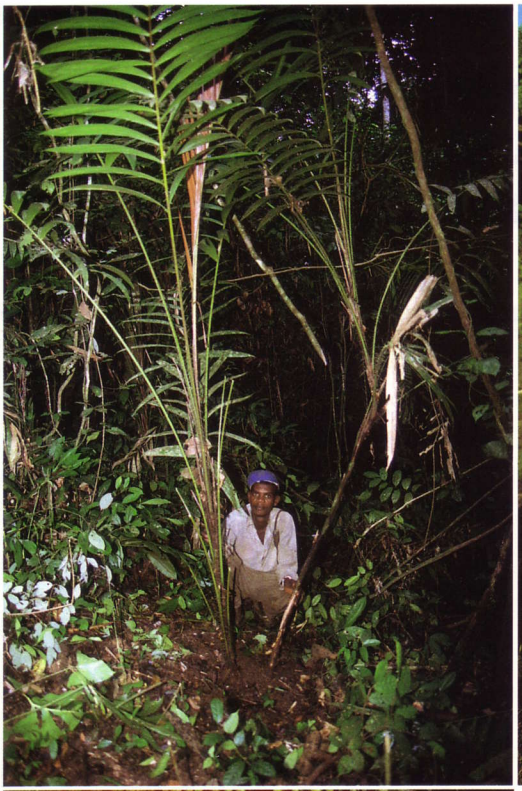
In spite of this neglect, the rattan cottage industry in Africa has thrived due to the escalating demand for rattans domestically and internationally. Cane furniture for sale can be found in most African cities with an unknown amount being exported to countries such as Japan (Komolafe 1992) (Figs. 9,13–15). Raw unprocessed rattan is also being exported from West Africa to Asian countries such as China which have been forced to look further afield for their cane supplies due to over-exploitation in their own countries and the ban on the export of raw cane by Indonesia and Malaysia, their main suppliers before 1987 (Xu 1987).

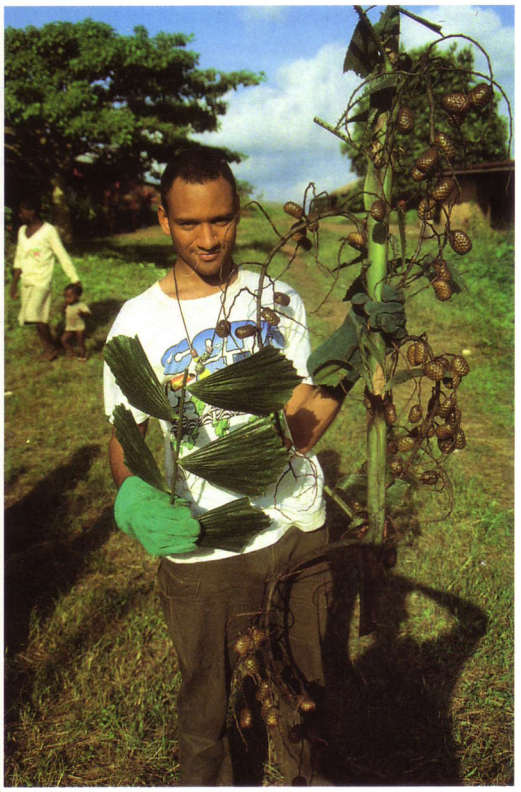
The future of this industry upon which so many rural people depend, now appears to be threatened by the over-exploitation in West Africa (Darko 1981, Pokam-Wadja 1979, Shiembo 1986, Komolafe 1992). The rattan industry in Nigeria is becoming concerned about the increasingly scarce and irregular supply of raw materials. This is a major cause for concern, particularly in view of the paucity of information on African rattans. Several species of rattan are now suspected to be endangered in parts of their ranges, before any framework for conservation can be devised.

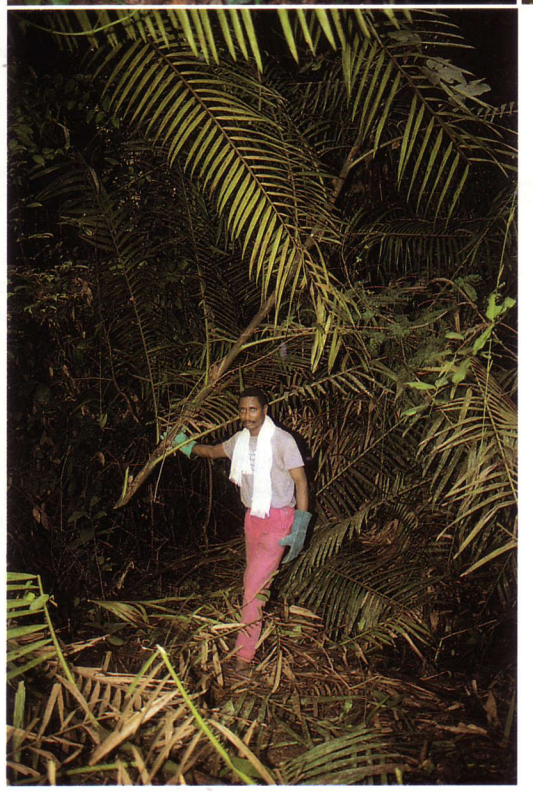
A long term solution to the problem of supply would be large scale planting of rattans through agroforestry, enrichment planting of forest reserves, and effective management of wild rattans growing in natural forest. However, this requires knowledge of the biology, ecology, germination, and growth of the commercial species. At present, due to the scarcity of information on the subject, even the literature about which species are the most important commercially, is largely speculative or anecdotal. Most previous work on African rattans has centered on their taxonomy (e.g., Hutchinson and Dalziel 1972, Dransfield 1982, and Uhl and Dransfield 1987) and even this is rudimentary compared with the work on S.E. Asian rattans and the taxonomy remains confused, particularly for Central Africa (J. Dransfield, pers. comm. 1993).

Taxonomy

At the generic level, the taxonomy of the rattans in Africa is well established; however, at the specific level, the taxonomy is still insufficiently studied and so the exact number of rattan species in Africa is unknown, but is thought to be between 14 and 30. It is relatively simple to distinguish between the rattans at the generic level but at the specific level many specimens have been incorrectly named or sometimes given new names. At present, about 13 species are recognized as being "good" species in the Herbarium at the Royal Botanic Gardens, Kew; however, there are another







17 species which have been named elsewhere, but still remain to be examined for their validity. This does not include the ten African species of *Calamus* that have now been more or less accepted as belonging to one very variable species, *C. deerratus*. Another example concerns the three species *Eremospatha wendlandiana*, *E. rhomboidea*, and *E. korthalsiifolia*, which could be three separate species, but it is now suspected that the latter two are simply varieties of *E. wendlandiana* (P. Tuley, pers. comm. 1993).

This article presents brief profiles of the nine species currently accepted as valid entities and occurring within Nigeria, describing their distribution and ecology across the whole of their ranges in Africa.

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1 (Upper left). *Laccosperma secundiflorum* growing in the forest canopy. 2 (Right). The fruit and leaves of *Eremospatha wendlandiana*. 3 (Lower). *Laccosperma secundiflorum* being pulled down by a villager from Old Ekun, S.E. Nigeria.

The Profiles

The intention is to provide basic information about each species with emphasis on data potentially useful for their silviculture. The morphological descriptions are written as a simple and practical guide to the identification of the species in the field. Certain outstanding features that make the species easily recognizable are highlighted. More detailed morphologies for some of the species can be found in Hutchinson and Dalziel (1958) and Uhl and Dransfield (1987). To describe the distribution and the ecology of the species, the UNESCO vegetation classification system for Africa was used (White 1983).

The uses of the different species were documented during a two month field survey in Nigeria in August 1993. Comments on tolerance of forest disturbance for each species are the result of ecological observations made during the field survey. These observations were augmented by references to phytogeographical accounts from countries across Africa. Figures for mean annual rainfall were derived by super-imposing distribution maps over rainfall maps for Africa.

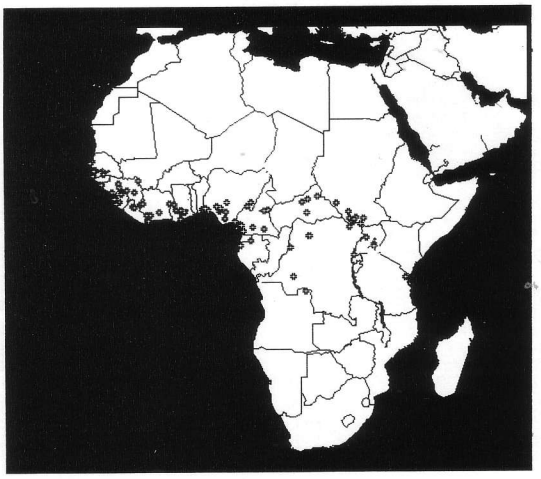
The Maps

Nearly 300 specimens were examined at the Herbarium of the Royal Botanic Gardens, Kew, for information of localities. The longitude and latitude of all the locations were obtained from gazetteers and tabulated using the Quattro Pro computer package.

Large areas in central Africa are still poorly collected, especially in Zaire, south of the Equator, Congo Republic, Equatorial Guinea, Angola, Central African Republic and Gabon. The amount of collecting in West Africa as regards rattans is much greater, apart from Liberia.

Morphology

Medium to large climbing woody palm, up to 30 m or more in length, stems branching sympodially at the base to form a cluster of stems each 7–30 mm diam. Mature leaves, pinnate, almost 2 m long with fine hair-like spines on margins and nerves of the leaflets; lamina long, very narrowly elliptic. Cirri absent. Leaf sheath spiny. A spiny lateral flagellum 2 m long, present partly fused to the stem and sheaths.



Map 1. Distribution of *Calamus deerratus* G. Mann & H. Wendl. Syn: *C. akimensis* Becc., *C. barteri* Becc. ex Drude, *C. falabensis* Becc., *C. heudelotii* Becc. ex Drude, *C. laurentii* De Wild., *C. leprieurii* Becc., *C. perrottetii* Becc., *C. schweinfurthii* Becc.

Reproduction and Phenology

The flowers are yellowish and are borne on lateral inflorescences, the male and female being borne on different plants (dioecious). Fruits, oblong-ellipsoid, 2 cm long covered with vertical rows of yellowish scales. Not distinctly seasonal.

Distribution

C. deerratus is the most widespread African rattan, its longitudinal range extending from Casamance (Senegal), to the Usambara Mts. (Tanzania), where it is probably introduced. In terms of latitude, it ranges from the south of Mali and the Bahr-el-Ghazal province in Sudan to the Dundo province in northern Angola. It is reported to be rare in the Biafran refugium forest area (east of the Cross River) (Letouzey 1978).

Altitude

Below 500 m in most of West Africa but up to 1,500 m in East Africa.

Soils

The species is associated with poorly drained, waterlogged soils.

4 (Upper left). "Cane ropes" made from *Eremospatha wendlandiana* are used to guide the following yam tendrils up the stake centered between four yam mounds. 5 (Upper right). Rattans are used for other things in the village: a basket and a porcupine trap (left), along with two bundles of "cane rope" probably to be used for yam farming as shown above. 6 (Lower left). Regeneration of *Eremospatha macrocarpa* on a farm freshly cleared from the forest the previous dry season. 7 (Lower right). Bundles of *Eremospatha macrocarpa* (left) and *Laccosperma secundiflorum* (right) stacked at the Maryland rattan market in Lagos, for sale to furniture workshops.

Rainfall

C. deerratus tolerates a wider range of rainfall than other rattan species in Africa hence its large range. Its range spreads beyond the limits of the Guineo-Congolian rainforest region (where it grows in swampy areas) to riverine and gallery forest found in the transition zones into Sudanian savanna woodland to the north of the forest area and Zambezian savanna woodland to the south. Mean annual rainfall over its range is from 1,000 mm to 2,500 mm and above. It is notable, though, that *C. deerratus* is most abundant in forest which receives between 1,250 and 1,750 mm. It is less common in wetter areas (Hall and Swaine 1981).

Uses

In areas where *Eremosphatha macrocarpa* is found, it is only used as a substitute for this rattan (Profizi 1986). The cane is split length-ways to make cane rope which is then used for tying fencing poles together, food bundles, scaffolding in house construction and also for weaving baskets (Berhaut 1988, Guinea Lopez 1946, Profizi 1986).

2. Eremospatha hookeri (G. Mann & H. Wendl.) H. Wendl. Syn. *Calamus hookeri* G. Mann & H. Wendl.

Morphology

Grows in clumps of two to three, sometimes five stems (not a very vigorous rattan). Stem tasting extremely bitter when freshly cut, 10–15 m in length (occasionally up to 30 m), circular in cross-section and 1 cm diam. Leaves pinnate, relatively small, 40 cm long not including cirrus at leaf tip. Leaflets obovate or oblancoelate with sev-

8 (Upper left). *Laccosperma secundiflorum* (the large diameter cane) drying in the sun after cleaning. 9 (Upper right). A typical rattan furniture workshop by the roadside in Lagos. 10 (Lower left). *Laccosperma secundiflorum* cane being bent to shape with a kerosene blow-lamp. 11 (Lower right). The frame of the chair made from *L. secundiflorum*. The joints are bound using "cane ropes" peeled from the stem of *E. macrocarpa* (the small diameter cane).

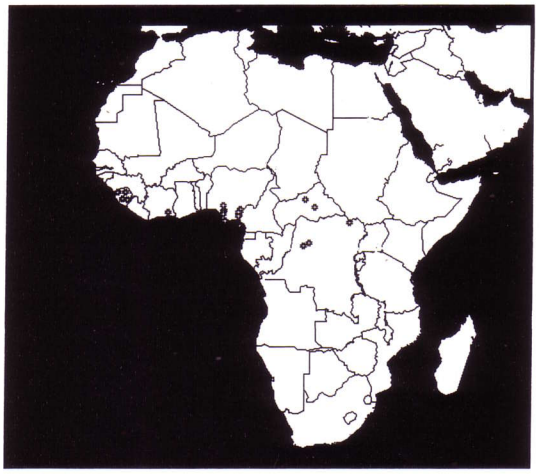
eral tiny sharp spines on the margin. Leaf sheaths unarmed. Rachis produced into a slender cirrus armed with opposite hooks and with many black recurved prickles. Basal modified leaflets present on rachis where it meets the main stem, ovate.

Reproduction and Phenology

Inflorescence lateral, bearing numerous hermaphrodite flowers. Fruit, ovoid, about 2.5 cm long with vertical rows of dark brown rhomboidal scales. One or two seeds. Phenology not known.

Distribution

Known so far to be found in Sierra Leone, Côte d'Ivoire, Nigeria, C.A.R. and Zaire. It is also said to be in Ghana (Hawthorne 1990) and in Cameroon (Letouzey 1978) though no specific locations have been cited.



Map 2. Distribution of *Eremospatha hookeri* H. Wendl. Syn. *Calamus hookeri* G. Mann & H. Wendl. It has also been found in the south western forests of Ghana (Hawthorne 1990) and is also found in Cameroon according to Letouzey (1978) though he gives no locations. It possibly also occurs in Liberia, Equatorial Guinea, Gabon and Congo.

Elevation

Below 500 m.

Soils

Prefers waterlogged, periodically inundated soils except in high rainfall areas receiving more than 2,500 mm per annum where it grows on freely drained soils.

Rainfall

The mean annual rainfall over the range is between 1,400 and 3,000 mm and above. *E. hookeri* seems to be restricted to the wettest areas of Ghana, Nigeria and Côte d'Ivoire but it has also been found in dense, flooded gallery forest in Sierra Leone, C.A.R. and Zaire, where it grows only on the banks of the biggest rivers which can provide sufficiently humid conditions (Lebrun and Gilbert 1954, Sillans 1958).

Forest Disturbance

Associated with gaps in undisturbed, mature forest areas and rare in secondary forest.

Uses

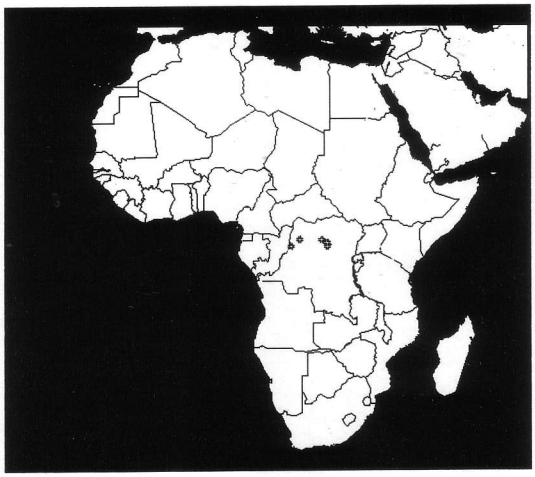
This cane is only used as a chewing stick (native toothbrush). The stem is cut into 15 cm lengths which when chewed, taste *exceedingly* bitter! This is meant to make it medicinal. This is the *only Eremospatha* species (certainly from the species profiled), that tastes bitter.

3. Eremospatha laurentii de Wilde.

This species is very similar to *E. macrocarpa* with which it has often been confused (see below).

Morphology

Similar to that of *E. macrocarpa* with respect to stems and leaves (see description for *E. macrocarpa*). Near the stem there are a cluster of a few narrow strap-like, very spiny leaflets on each side of the rachis, very much smaller than the other leaflets and reflexed across the sheathed stem. These are strap-shaped (long, narrow parallel sided) on *E. laurentii* (whereas on *E. macrocarpa* they are ovate).



Map 3. Distribution of *Eremospatha laurentii*. Apart from Zaire, the species has recently been recorded in southern Nigeria (P. Tuley, pers. comm. 1993), having been previously misidentified as *E. macrocarpa*. Specimens of *E. macrocarpa* from other locations have probably been misidentified, so it may yet be found to occur in the countries in between Nigeria and Zaire.

Distribution

Has been recorded in Nigeria from the Niger Delta eastwards. It has also been found in central Zaire. *E. laurentii* is probably found in the countries in between since many specimens of *E. macrocarpa* have probably been misnamed (P. Tuley, pers. comm. 1994).

4. Eremospatha macrocarpa (G. Mann & H. Wendl.) H. Wendl. Syn. *Calamus macrocarpus* (G. Mann & H. Wendl.).

A very widespread though site-specific rattan found mainly in West Africa. It is one of the most common rattans in West Africa along with *C. deerratus* and *L. secundiflorum* (Fig. 6).

Morphology

Grows in clumps of ten to 20 stems. Each stem, up to 30 m or more in length, 2.5 cm diam. with leaf sheath (adult plant stems), cross-section, sometimes obscurely three-angled. The stems of the juvenile plant are much more slender than the adult. Leaves, pinnate, length including terminal cirrus, up to 1.5 m. Leaf sheaths unarmed. Cirrus bearing neat pairs of opposite hooks but not armed with prickles. Leaflets, long and narrow, with numerous tiny, sharp teeth on the margin. Near

12 (Upper left). To make certain patterns the canes are nailed together before being bound with cane rope. "Cane rope" from *E. macrocarpa* is also used to weave the backing of the chair. 13 (Upper right). Finished furniture outside a workshop for display by the roadside. 14 (Lower left). Craftsmen from the workshop with their furniture. 15 (Lower right). A view of the Maryland rattan market in Lagos, possibly one of the largest rattan markets in Africa. This is the main depot for raw rattan sold in Lagos. Furniture is also made and sold at the market.

the stem there are a few narrow strap-like, very spiny leaflets on each side of the rachis, very much smaller than the other leaflets and reflexed across the sheathed stem.

Reproduction and Phenology

Laterally borne inflorescences with hermaphrodite flowers, buff yellow in color and very fragrant. Fruit pale orange to brownish, one-seeded berry. Not distinctly seasonal.

Distribution

E. macrocarpa has a largely Guinean center of distribution extending to Cameroon and Equatorial Guinea with two records additionally from Kinshasa and Salonga NP. in Zaire.

Altitude

Mostly below 500 m but grows at 1,100 m on the Ndop plain (Cameroon).

Soils

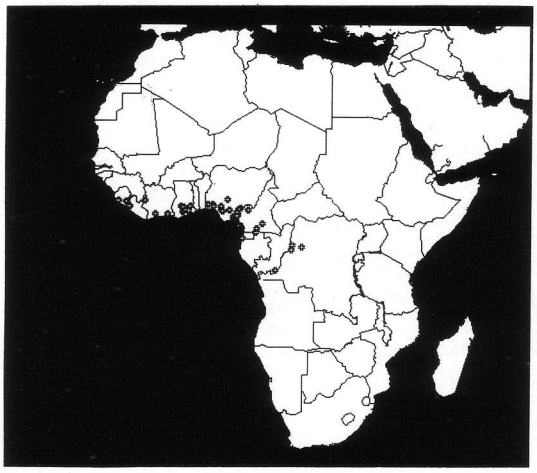
Favors heavy, clayey, waterlogged soils. In areas that receive more than 2,000 mm, it will grow on freely drained sites. Associated with acid soils (Hall and Swaine 1981).

Rainfall

Mean annual rainfall over the range is between 1,100 and 3,000 mm and above in certain locations. It tends to be much more common in areas which receive more than 1,500 mm per annum and becomes especially abundant in the "true wet rain forest" (Letouzey 1978).

Forest Disturbance

E. macrocarpa grows in gaps in dense high forest, hence it benefits from a certain amount of forest disturbance and flourishes in the more open canopy. Thus it can be quite common in secondary forest. The rootstock is easily killed by fire and it



Map 4. Distribution of *Eremospatha macrocarpa* (G. Mann & H. Wendl.) H. Wendl. Syn. *Calamus macrocarpa* G. Mann & H. Wendl. It is probably found in Gabon and Congo Republic as well. Note: It seems to be the West African equivalent of *E. haullevilleana* in terms of being widespread and hence relatively tolerant of a wide range of conditions. *E. haullevilleana* possibly occupies the same niche as *E. macrocarpa* and hence the ranges of the two species are almost mutually exclusive apart from a small overlap in northeast Zaire. Guinea Lopez (1946) states that *E. macrocarpa* becomes substituted by *E. tessmaniana* in the south of Equatorial Guinea.

will not regenerate in areas that have been burnt several times in the past unless a seed source is close-by.

Uses (Figs. 6,7,11,12)

This species is the most sought after for splitting as it makes the strongest and most durable cane ropes. When the stem is split into four, the weak pith is removed leaving the durable outside, which is further split into ropes. The rope is used to tie furniture joints and also to weave the backing and seats for furniture. It is also used to tie house scaffolding, for tying *Raphia* roof thatch, for weaving baskets, for sieves, and to make porcupine traps.

5. **Eremospatha wendlandiana** Dammer ex Becc.

The large fan-like rhomboid-shaped leaflets of this rattan make it instantly recognizable (Fig. 2).

Morphology (Fig. 2)

Stem, up to 30 m or more in length and 2 cm diam. below leaf sheath, cross-section sometimes obscurely three-angled. Grows in clumps of five to 20 stems. Leaves, pinnate, including cirrus, up to 2.5 m in length. Leaf sheaths unarmed and inhabited by fierce red, biting ants. Modified strap-shaped leaflets present on rachis where it meets the main stem. Cirrus with neat pairs or opposite hooks and armed throughout with numerous small recurved green thorns. Leaflets rhomboid or fan shaped, the sides of the cuneate portion, straight, the apex, ovate-triangular, toothed.

Reproduction and Phenology

Inflorescence; branched, growing laterally from leaf sheaths with hermaphrodite flowers, becoming a bunch of over 30 fruits. Fruits, brownish green, one-seeded berry, cylindrical and covered in vertical rows of rhomboid scales. Phenology unknown.

Distribution

The range extends from Sapele in south central Nigeria to Ejagham FR. in west Cameroon and then southwards to Campo FR. on the border with Equatorial Guinea. *E. wendlandiana* is almost completely restricted to the coastal "Biafran" rainforest of Nigeria and Cameroon which is the largest of Africa's postulated Pleistocene forest "refuge" areas. This is the wettest part of Africa today.

Altitude

Below 600 m.

Soils

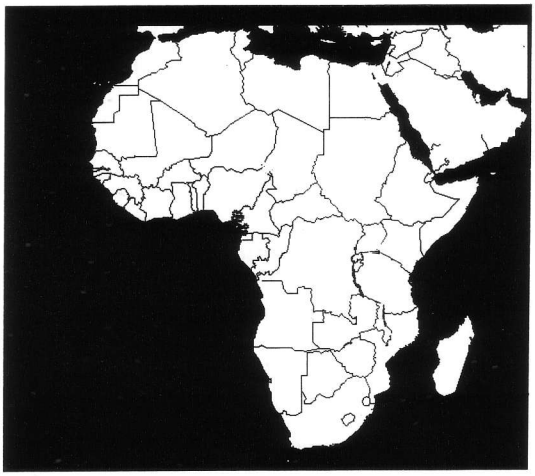
E. wendlandiana reaches its best development in swampy areas with heavy clayey soils even in very high rainfall areas.

Rainfall

Mean annual rainfall over the range is between 2,000 mm to 4,000 mm and above at the foot of Mount Cameroon. It tends to grow in localized areas in the forest favoring swampy boggy areas where the canopy is more open. However, it regenerates well under dense forest on freely drained areas.

Forest Disturbance

E. wendlandiana grows well where there are gaps in the forest canopy and so will tolerate a fair amount of forest disturbance. Thus it can be



Map 5. Distribution of *Eremospatha wendlandiana* Becc. *E. korthalsiifolia* (Becc.)[1] and *E. rhomboidea* (Burret)[2] are possibly synonymous with *E. wendlandiana* (P. Tuley, pers. comm. 1993).

found in secondary forest particularly where the soil is waterlogged.

Uses (Figs. 4,5)

The cane is split to make ropes. It is the only cane in which the pith of the stem is left on the ropes since it is also strong. The main use for the rope is to guide young yam tendrils to a stake placed at the center of a square formed by four yam mounds. The rope is also used to tie the bamboo and stick frame of houses before the frame is plastered with mud.

6. Laccosperma laeve (G. Mann & H. Wendl.) H. Wendl. Syn. *Calamus laevis* G. Mann & H. Wendl.

Morphology

Very similar in many respects to *L. opacum* (see below). Leaf rachis produced into a cirrus, armed throughout with similar sharp, recurved, black-tipped thorns. The fine cirrus bears pairs of enlarged hooks in addition to the small sharp thorns. Leaflets are broadly elliptic becoming gradually acuminate with a long fine tip, commonly with two prominent veins. Leaflet margins are unarmed.

[1] (Angola—Gossweiler, 7564; and Gabon—L.T. 1652).
[2] (Angola—Gossweiler, 10086).

Reproduction and Phenology

The inflorescence is terminal, bearing hermaphrodite flowers. The fruits are globose, one-seeded berries up to 1.5 cm in length with 18 vertical rows of small scales. Phenology unknown.

Distribution

The northern and westernmost point of the range is Gbanga (Liberia) which then extends east to Côte d'Ivoire and Ghana. A large gap occurs in east Ghana, Togo, Benin, and western Nigeria. From the Oban Hills, Nigeria, the range continues to Dzanga NP. in C.A.R. and southwards to Gabon.

Elevation

Below 500 m.

Soils

Seems to prefer waterlogged soils except in high rainfall areas (above 2,500 mm) where it grows on freely drained sites.

Rainfall

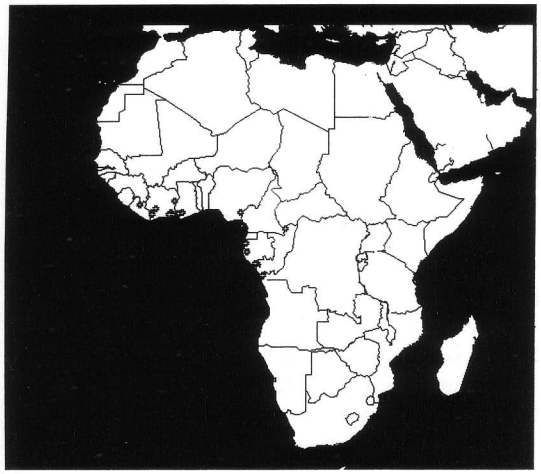
The mean annual rainfall over the range is between 1,400 mm and 3,000 mm and above. *L. laeve* is only found in the wetter areas of the Guineo-Congolian region. In Ghana and Nigeria for example, it is only found in the wettest regions of the country. On the basis of geological evidence, it has been suggested that several dry climatic phases have occurred in the past 20,000 years during which the African rainforest was reduced to a few isolated refuge areas. In the wetter conditions of today, *L. laeve* has not spread far beyond these "refuges" and remains within these areas except for one record from Dzanga NP. in C.A.R.

Forest Disturbance

L. laeve tends to be associated with gaps in mature areas and is rare in secondary forest.

Uses

The stem of this rattan is extremely hard and can only be split with great difficulty. Its main use is for walking sticks and occasionally for furniture frames.



Map 6. Distribution of *Laccosperma laeve* (G. Mann & H. Wendl.) Drude. Syn. *Calamus laevis* G. Mann & H. Wendl. Possibly also found in Equatorial Guinea, Congo Republic, Angola[3] and Zaire.

7. Laccosperma opacum (Mann & Wendl.) Drude. Syn. *Calamus opacus* (Mann & Wendl.).

Morphology

Stem, rarely more than 20 m in length. This rattan is smaller than *L. secundiflorum*. The plant grows in clusters of about three stems (there are usually few stems), circular in cross-section and 0.8–1.5 cm diam. Leaves, 2 m long or more. The leaflets and the diameter of the rachis are much smaller than that of *L. secundiflorum* (see below). Leaf sheath is armed with crowded black-tipped spines extending into an ochrea 15–30 cm long bearing similar spines. The rachis is armed with many, recurved, very sharp black-tipped thorns throughout, which is produced into a fine cirrus bearing six pairs of hooks in addition to the small sharp spines. Leaflets, broadly elliptic with one to four main nerves, the margin is armed with fine spinules.

Reproduction and Phenology

The inflorescence is terminal, up to 60 cm long with five or six primary branches bearing many flowered branchlets with hermaphrodite yellowish flowers. Fruiting and flowering not distinctly seasonal. Fruit, globose, red, one-seeded berry, 1.5 cm in diameter with scales in twelve vertical rows.

[3] (Maiombe—Gossweiler, 7995).

Distribution

L. opacum has been found in Guinea, Ghana, Nigeria, Equatorial Guinea, and Zaire. The easternmost and southernmost location it has been recorded at is Beni in the Kivu province (Zaire), close to the Uganda border.

Elevation

Below 500 m.

Soils

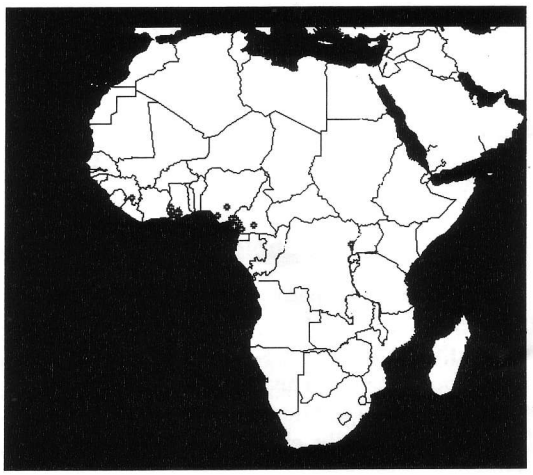
Associated with swampy areas and riverine forest where the soil is waterlogged. Significantly associated with base-poor soils (Hall and Swaine 1981).

Rainfall

Mean annual rainfall over the range is 1,250–4,000 mm with a dry season of two to three months or less. It is most abundant in the wettest forest areas receiving 2,000 mm or more (Hawthorne 1990).

Uses

Used to make cane rope for tying (Walker and Sillans 1961).



Map 7. Distribution of *Laccosperma opacum* (G. Mann & H. Wendl.) Drude. Syn. *Calamus opacus* G. Mann & H. Wendl. and *Ancistrophyllum opacum* Drude. There is a disjunction between Guinea and Côte d'Ivoire and another wide disjunction in the distribution between Cameroon and Zaire. It may yet be found in the gaps in between.

8. Laccosperma secundiflorum (P. de Beavois) Kuntze (Figs. 1,3) Syn. *Ancistrophyllum secundiflorum* (P. de Beavois) H. Wendl. (see Dransfield 1982). *Calamus secundiflorus* P. de Beavois.

This is easily the largest and most robust rattan palm in Nigeria, its large overall size, its very large leaves with a terminal cirrus, together with its extremely spiny leaf sheaths make it instantly recognizable (Figs. 1,3,8).

Morphology

Stem, up to 30 m in length or more, circular in cross-section, between 2 to 6 cm diam. (including the leaf sheaths). Grows in clumps of two to three stems and sometimes as many as ten. Leaf, pinnate, up to 2 m long with the stout cirrus extending another 0.5–2 m, bearing several pairs of large, yellowish, blunt, anchor-shaped hooks. Leaf sheaths covered with straight, sharp, brownish to light green spines. Rachis very large and thick, up to 2 cm in diameter. Leaflets, long and narrow with small spines on the leaf margin and on the principal nerves on the leaflet underside. Overall leaf up to 2 m long with cirrus extending another 0.5–2 m.

Reproduction and Phenology

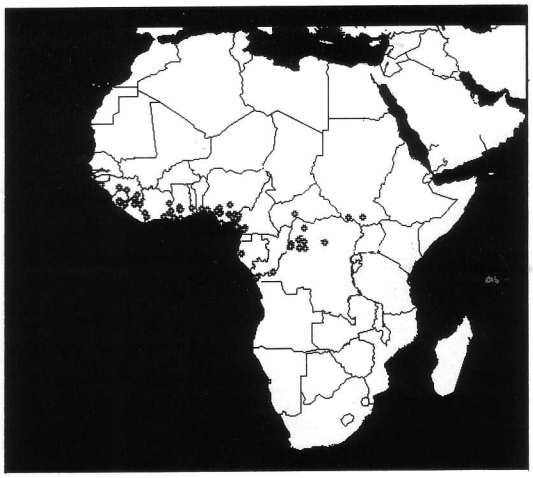
Terminal flowering, bearing large inflorescences, with greenish-white hermaphrodite flowers. Seems to flower predominantly during the rainy season and to fruit in the dry season. Fruits bright red, ellipsoid, 1.5 cm long with rows of scales.

Distribution

L. secundiflorum is the second most widely distributed rattan in Africa after *Calamus deerratus*. Its range extends from Basse Casamance (Senegal), eastwards to southern Sudan and then southwards to the Angolan province of Cabinda (Maiombe).

Altitude

Up to 1050 m in sub-montane forest in Guinea (West Africa).



Map 8. Distribution of *Laccosperma secundiflorum* (P. de Beavois) Kuntze Syn. *Calamus secundiflorus* P. de Beauv. and *Ancistrophyllum secundiflorum* (P. de Beavois) H. Wendl. It has also been found in the northern forests of the Congo Republic.

Soils

L. secundiflorum is associated with poorly drained waterlogged soils; however, in areas which receive more than 1,750 mm of rainfall per annum it is found on the drier well drained areas of the high forest.

Rainfall

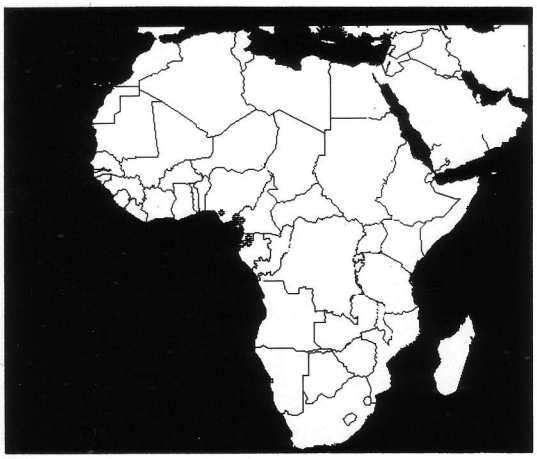
Mean annual rainfall over its range is from 1,100 mm to 4,000 mm and above.

Forest Disturbance

L. secundiflorum grows in gaps in dense high forest, hence it benefits from a certain amount of forest disturbance and flourishes in the more open canopy. Thus it can be quite common in secondary forest. The rootstock is easily killed by fire and it will not regenerate in areas that have been burnt several times in the past (eliminating the soil seed bank) unless a mature seed producing plant is close-by.

Uses (Figs. 7,10,11)

This is the main rattan used for furniture frames. The cane can also split though this is said to be difficult, it is then used to make basket frames when especially strong baskets are required. The



Map 9. Distribution of *Oncocalamus mannii* (G. Mann & H. Wendl.) H. Wendl. syn. *Calamus mannii* (G. Mann & H. Wendl.). *O. acanthocnemis* Drude*, *O. djodu* Wilde[4], *O. phaeobalanus* Burret[5], *O. macrospathus* Burret[6], *O. wrightianus* Hutch* are all considered to be synonyms of *O. mannii* (P. Tuley pers. comm., 1993).

frames are then woven with the softer and more easily split *Oncocalamus* or *Raphia.*

9. Oncocalamus mannii (G. Mann & H. Wendl.) H. Wendl. Syn. *Calamus mannii* G. Mann & H. Wendl.

Morphology

Grows in clumps of five to eight stems, up to 20 m in length, circular in cross-section and up to 3 cm diam. Leaves pinnate, leaflets about 16 on each side of the rachis, linear-lanceolate with a prominent midrib; rachis leafy to the base without stout, hooked prickles and produced into a slender cirrus 30–40 cm long bearing pairs of reflexed hooks (not neatly opposite). Leaf sheaths (and hence stem) covered in numerous flattened little triangular spines that come off easily (usually in your skin!). The rattan is inhabited by red biting ants.

Reproduction and Phenology

Inflorescences, terminal, produced simultaneously in the axils of the uppermost, often reduced leaves, bearing male and female unisexual flowers on the same inflorescence. Fruit spherical, one-seeded berry covered in vertical rows of light yellow scales. Phenology unknown.

Distribution

From Sapele in the Niger delta (Nigeria) eastwards to southwest Cameroon and then south to Libreville (Gabon). *O. mannii* is restricted to the coastal "Biafran" rainforest of Nigeria and Cameroon which is the largest of Africa's postulated Pleistocene forest "refuge" areas. *O. mannii* is a relict species possibly indicating a richer African rattan flora in the past.

Elevation

Below 500 m.

Soils

Grows in swampy, waterlogged soils but also found in freely draining areas.

Rainfall

Mean annual rainfall over the range is from 2,500 mm to 4,000 mm and above.

Forest Disturbance

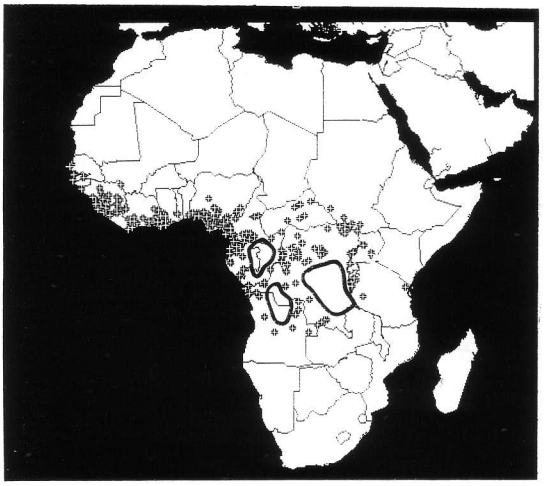
This species is associated with gaps in mature high forest. It is not common in secondary forest.

Uses

Oncocalamus is sought after because it is said to be relatively easy to drag down. The leaf sheaths come off very easily leaving a clean stem. The cane is split. Only the outer part of the stem is used for rope because the pith is too soft. The rope is used for tying yams to a "yam-barn" as it is less likely to bruise the yams than the tougher *Eremospatha macrocarpa* (the main cane rope species) and is also used for making protective coverings for machete handles, which will not be abrasive to one's hands. The rope is also used sometimes for basket weaving and the weaving on furniture backs and seats (as a substitute for *E. macrocarpa*).

Other species said to be in Nigeria are *Laccosperma acutiflorum* and *Eremospatha cuspidata,* which may just intrude into Nigeria near the border with Cameroon, but if so, it is very rare.

* Assumed to be juvenile forms.
[4] Zaire—R. P. Mathieu Renier S. J., 1948.
[5] Cameroun—Letouzey, 1978.
[6] Angola—Gossweiler, 9092.



Map 10. All the locations in Africa where rattans have been recorded to date. The area within the circles indicate important areas where rattans still remain to be collected.

Recommendations and Conclusions

The taxonomy and ecology of rattans in tropical Africa remains poorly understood and requires further study.

1. A Pan-African taxonomic study is needed to clarify the status of the 30 or so species so far named. It is suspected that at least half of these are synonyms of other species. Specimens from as many herbaria as possible worldwide need to be studied.
2. Further collecting of African rattans is required. Some areas of Africa are particularly poorly collected especially Angola, Central Zaire, Gabon, and Congo (see Map 10). Further collecting will aid taxonomic studies and will provide a better idea about the distributions and ecology of the different species.
3. A rattan arboretum should be established at the Limbe Botanic Garden, Cameroon. The phenology and changes in plant morphology with age can then be studied with ease providing information that could have potential applications for their silviculture.

These measures will help with devising a conservation strategy for these rattans and will also contribute towards research into their ecology and silviculture.

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Principes, 39(4), 1995, pp. 210–214

Production of Ramets and Germination of Prestoea trichoclada (Arecaceae)—A Source of Palm Heart in Ecuador

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ABSTRACT

Prestoea trichoclada is a common clustering palm on the slopes of both sides of the Andes. It is important economically because it is harvested for its edible palm heart.

We examined the potential for palm heart production in forest versus pasture by studying ramet production and seed germination. In forests, 16 ramets per individual are produced annually as compared to 6.3 in pasture. The production of ramets is weakly correlated with the number of stems per individual. Plants in the forest had lower ramet mortality rates than those in pasture. The rate of germination of seedlings is about 60% in both situations. Seedling recruitment was low in palms growing in pastures.

In Latin America several palm species are commercially harvested for palm hearts. The most important species for this harvest are *Bactris gasipaes* Kunth, *Euterpe edulis* Mart. (Balick 1984), *Euterpe chaunostachys* Dugand (Borgtoft Pedersen and Balslev 1990), *Euterpe oleracea* Mart. (Strudwick 1990), and *Prestoea trichoclada* Burret (Balslev and Henderson 1987).

In Ecuador, palms for palm heart production are *P. trichoclada* and *E. chaunostachys*. They provide palm hearts that are canned and exported. Occasionally, palm heart is sold locally. The first of these palms is the subject of this paper.

Prestoea trichoclada (Fig. 1) is a clustering species with 10 to 45 stems per plant (Fig. 2). The individual stems reach a maximum height of 9 m and about 9 cm in diameter. The palm is called "palmito" in Ecuador, where it is common on both slopes of the Andes between 1,000 and 2,500 m. The clustered habit makes sustainable harvest possible because new shoots will grow up to replace those used (Balslev and Henderson 1987).

The aim of the present study was to obtain data on the production of ramets and seedling establishment in primary forest compared to pastures (Fig. 3). This information is crucial to assess the reproductive potential of the palm in different environments and thereby its possible economic importance outside forests.

Study Site and Methods

The present study was conducted at the ecological station "Río Guajalito," located in the Province of Pichincha, at an altitude between 1,700 to 2,000 m (78°48′W, 0°13′S). The station consists of 400 hectares of primary forest of the lower montane rain forest vegetation type according to the classification of Harling (1979). The nature reserve is surrounded by secondary forest and grasslands. The annual precipitation is about 2,000 mm, and local farmers were asked for the relative rainfall distribution between months. At the study site, *P. trichoclada* dominates the forests along the banks of the river Saloya.

Ninety adult palms were selected randomly at three sites in forest and at three sites in pasture (15 palms at each site). In two cases individuals were not clearly distinguishable, and consequently, omitted from the sample.

Records for the monthly production of ramets were obtained from August 1992 through May 1993. It is noticeable that many of the small ramets never developed into stems. The mortality of the ramets was recorded along with the production of new ones. Since May 1993, the forest has been cut by colonists, and no further results could be obtained.

Three-hundred seeds were collected randomly from different individuals in the forest. Three seedbeds were established on forest and three were

established in the pasture (all the grass was removed before planting). At each seed-bed, 50 seeds were sown 10 cm apart and at a depth of 2 cm. After 3½ months the number of germinated seeds was recorded. Furthermore the number of seedlings was counted at each site within a square of 10 × 20 m.

Results

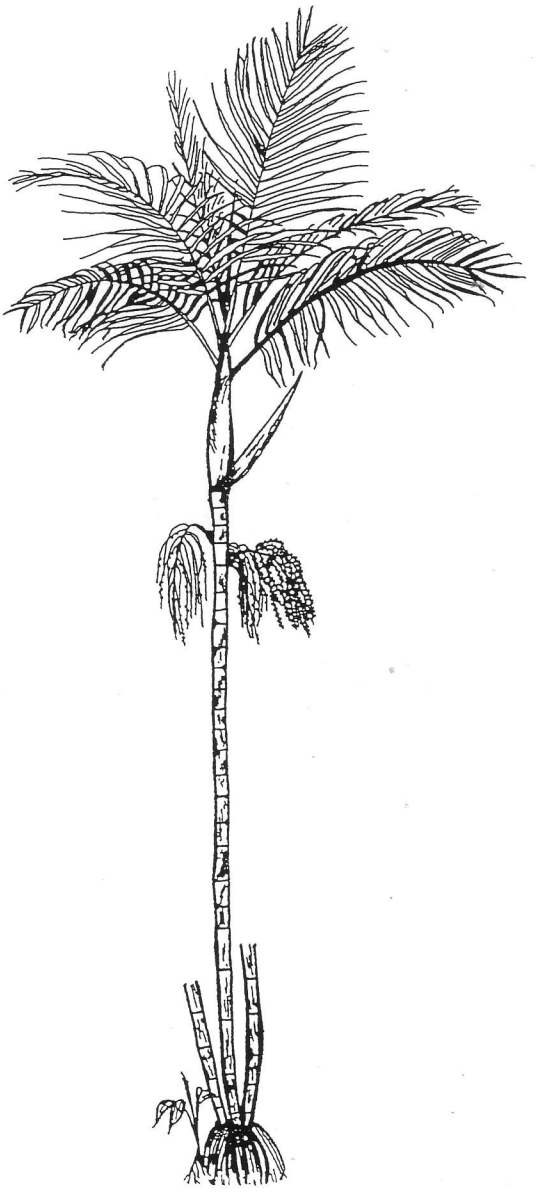
The average number of stems per individual was 18 in the forest (SD = 7.7; N = 43) as compared to 8.5 (SD = 5.8; N = 45) in pasture. On average each individual produced 13 (SD = 5.0) ramets per 10 months (16 per year) in the forest (N = 45) and 5.3 (SD = 2.2) ramets per 10 months) (6.3 per year) in the grassland (N = 45). The production varied greatly between months (Fig. 3).

During five months the mortality of ramets in forest and pasture was 45% and 63%, respectively. A statistical test (Mann-Whitney *U*-test) showed that both number of stems per individual, production of ramets, and mortality of ramets are significantly different between forest and pasture (at a 99.9% probability level).

It is noticeable that we found only a weak correlation or no significant correlation between number of stems per individual and production rate of ramets (in forest $r = 0.30$, $P < 0.05$; N = 43 and in pasture $r = 0.091^{NS}$; N = 45). In the seed-beds of the forest germination was 64% and outside the forest 58%. On the forest floor, 1.8 seedlings were present per m^2, whereas only 0.22 were found per m^2 in pastures.

Discussion

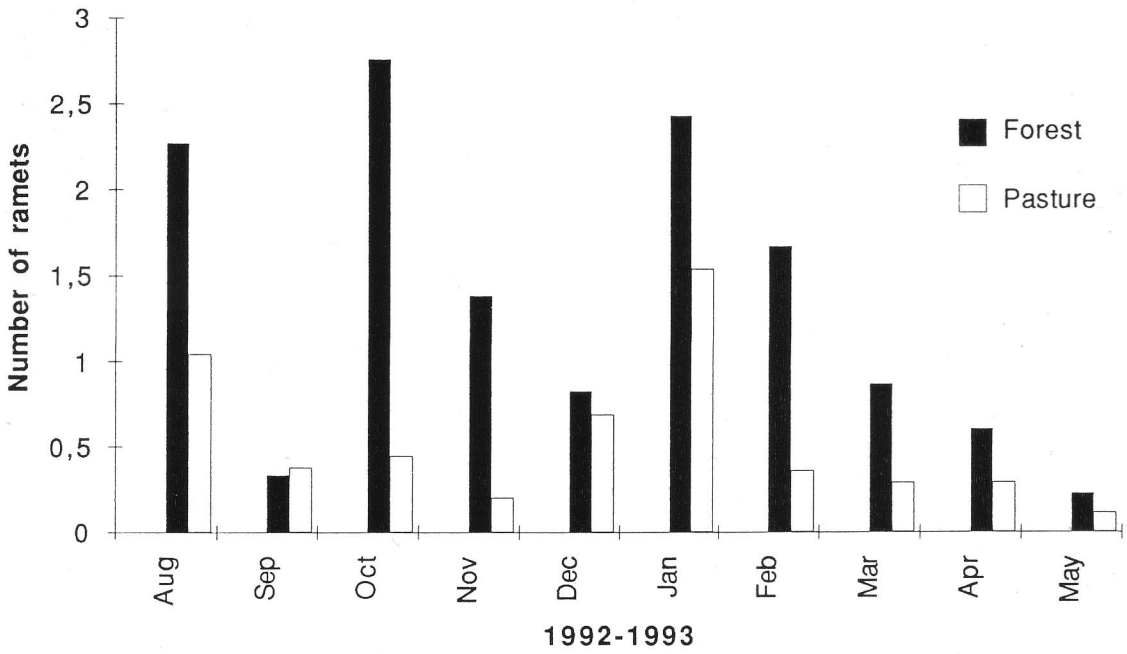
Lower light intensity and more constant temperatures and humidity on the forest floor may favor the production of ramets as compared with the pasture. Bannister (1970) reported that the constant humidity existing in forest favors the production and regeneration of *Euterpe globosa* Mart. in Puerto Rico. The same environmental conditions that cause high ramet production in forest also favor growth of the ramets already present. This was found for *E. chaunostachys* in Ecuador (Borgtoft Pedersen and Balslev 1990), *E. oleracea* in the Amazon estuary (Strudwick and Sobel 1988), *Podococcus barteri* Mann & Wendl in Cameroon (Bullock 1980), and *Rhapidophyllum hystrix* Pursh in Mississippi (Clancy and Sullivan 1990). Probably the same applies to *P. trichoclada*. This would explain the difference in number of stems per individual between forest and pasture. Also, it is likely that stems in pasture have previously been cut to obtain palm heart.



1. Habit of *Prestoea trichoclada*.

The poor correlation between the number of stems and the ramet production, indicates that clump size is not the main limiting factor for pro-

2. Tagging and counting of ramets in the forest.



3. Average production of ramets per individual in forest and pasture (N = 45).

4. *Prestoea trichoclada* in pasture.

duction of ramets. Thus, the fact that larger individuals are found in forest does not explain the higher production of ramets.

The production of ramets varied from month to month. Months with high ramet production seem to correspond with months with high precipitation.

Poorer growth conditions in pastures (Fig. 4) may explain the higher mortality rate of newly produced ramets. De Steven (1989) reported that the major part of the ramet mortality for *Oenocarpus mapora* Karsten in Barro Colorado Island is attributed to external factors such as herbivores, drought, and especially tree falls, and not to competitive resource limitation within the clone.

Apparently, the cattle on the pasture do not eat the palm ramets, but eat instead the leaves of young shoots. Protection against grazing in the early developmental stages would be necessary to lower mortality rates. In this way cattle and palm heart production could be combined.

Because germination is equally successful in and outside the forest, environmental conditions are not critical in the initial establishment stage. Probably the presence of grass would lower the germination rate considerably. The density of seedlings in forest is higher than in pasture. The reason may be that the density of palms is higher in the forest environment and that growth conditions in later life stages are better here than in the pasture.

In the forest each adult individual had an average of 18 stems. If one-fourth of the stems are assumed to be harvested, each individual could produce about four palm hearts. The price for one palm heart was in 1992 $0.23. The harvest of one specimen may thus produce about $1.00 income. Depending on the density of the palms the income per hectare may be around $100 when cut the first time. Harvesting may be possible every five to seven years (Knudsen in prep.).

Our study shows that even though the forest environment favors the reproduction of *P. trichoclada*, growth in pasture is possible. Especially, when destructive feeding by cattle is prevented and some trees are left on newly established pastures, palm heart could provide an additional income for the farmer.

Acknowledgments

We thank the staff of the biological station "Río Guajalito" for help during the field work; and Anders Barfod, Finn Borchsenius, Robbin Moran, Helle Knudsen, Finn Ervik, María Inés Bertero, and Vita Nielsen for valuable comments and help with the manuscript.

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Palms in Europe: The Palms of Elche

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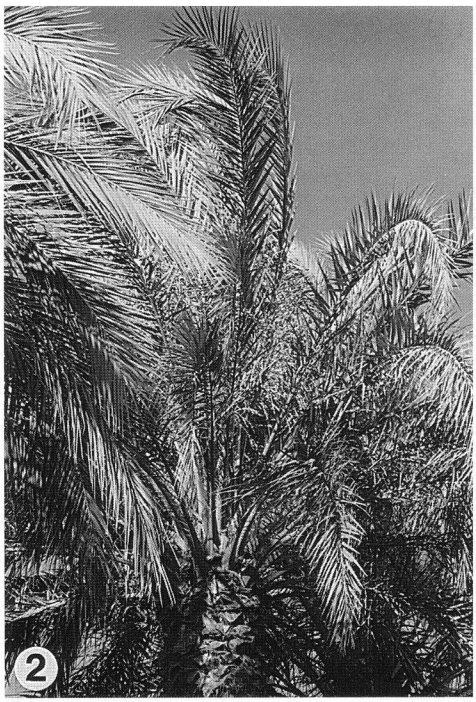
A Bit of History

Over 3,000 years ago the Phoenicians were the dominant seafaring nation of the Mediterranean. From their base in the east in which is roughly modern Lebanon, they explored westwards, establishing colonies and trading posts, the most important being the ancient city of Carthage on the coast of North Africa. The Phoenicians extended their influence farther west as far as the Pillars of Hercules (the Straits of Gibraltar) and beyond, using their trading posts as stations where boats could take on food and water and be repaired. One such trading post in the western part of the Mediterranean was south of modern Valencia in southern Spain at the site of the modern city of Elche (Elx in the Catalan language and Jllice in Latin). Elche today is an important, sizeable city, famous, among other things for its shoe-manufacturing industry.

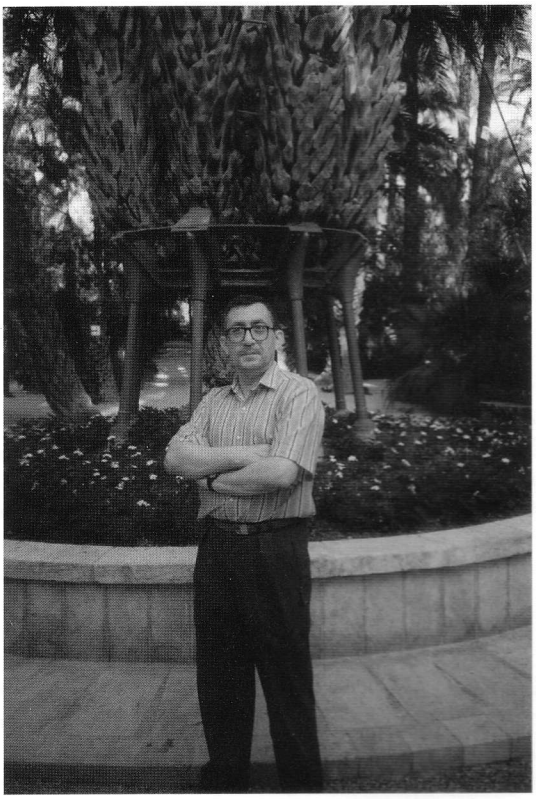
Since time immemorial, dates (*Phoenix dactylifera*) have been an important food crop, especially in the Middle East and North Africa. Not only are dates used locally, but they are also an ideal item of food for provisioning long journeys, and, indeed, wherever one travels in the drier tropics and subtropics, one can expect to find scattered groves of dates that, presumably, originate from discarded stones. However, in Elche the Phoenicians found a climate ideal for growing dates. Here they deliberately planted and cultivated the date for provisioning their trading ships.

The power of the Phoenicians waxed and waned, and other powers became dominant in the Mediterranean region. By AD 670, Elche was already under the influence of Islam and the Arabs. During

1. El Huerto del Cura, Elche, Spain.



2. Typical Elche date palm. 3. Another view of El Huerto del Cura. 4. The Imperial Palm. 5. Base of the Imperial Palm.



6. Francisco Orts Serrano, grandson of Curate Castaño, standing in front of the Imperial Palm.

the period of Arabic control that ended towards the end of the Middle Ages, dates in Elche were cultivated in proper plantation plots, in a way similar to that common in the Middle East and North Africa. These plots were square and separated by irrigation ditches, dates being planted along the edges. The center of the plots were used for the cultivation of other crops such as pomegranates, also introduced by the Phoenicians. The plots were irrigated with ground water, which, in the Elche area, is quite saline. By the early 16th Century it is thought that there were some 1,300,000 date palms in the plantations of Elche. The life expectancy of a date palm in cultivation is about two to three hundred years. By the end of the 19th Century, the huge number of palms had been reduced by approximately one half, largely due to lack of replacement of dead palms.

In the 20th Century, industrialization slowly started in Elche, and as the city grew, dates were cleared to make room for factories, houses and roads. More recently dates have been dug up and replanted as ornamentals.

The Palms of Elche Today

In Tenerife, Canary Islands, I came across a strange form of date palm in cultivation, that appeared sufficiently different from normal cultivated dates to stir my curiosity. I saw the same type of date in Mallorca in the Balearic Islands and elsewhere in southern Spain and, wherever I saw it, I would be told that the palm probably came originally from Elche. Recently while I was in the region of Alicante, I decided to visit Elche to see the distinctive form of the date in the place where it was supposed to originate.

The "Elche date" does not compare favorably with the best comestible dates. It is about 30 mm long and is not particularly sweet and flavorsome. However, there is still a lot of excitement in seeing what is probably a very ancient cultivated form of the date, a living historical relic that reaches back into ancient time and culture.

At the present day there are estimated to be between three and four hundred thousand date palms in Elche, surely the largest palm grove in Europe. The Elche date groves are now protected by laws that prohibit the uprooting of palms. These laws make it at times impossible for landowners to develop their land in the way they would wish, and the palms also need to be maintained, the costs of which landowners may be reluctant to bear.

El Huerto del Cura (The Curate's Orchard) (Fig. 1)

Around the turn of the present century Jose Maria Castaño, a curate, lived within the city of Elche; he had a passion for plants and it was probably he who alerted the residents of Elche to the unique nature and historical significance of the Elche date palms (Fig. 2). His house, constructed in 1894 in the style typical of the region, employs palm trunks in the rafters of the roof and for supporting pillars in the arcade. The curate eventually turned his orchard into a small botanical garden (Fig. 3). From the Empress Elizabeth of Austria to the King and Queen of Spain, many famous people have visited his garden over the past 100 years. The garden contains many plants typical of Mediterranean gardens, such as pomegranates, citrus fruits, carobs and jujubes. It also has a fine collection of succulents, cycads and

other subtropical plants. Palms are, of course, well represented, including *Trachycarpus fortunei*, *Chamaerops humilis*, *Jubaea chilensis*, *Butia capitata*, *Brahea armata*, *Washingtonia filifera*, *Howea forsterana*, and many species of *Phoenix* and *Chamaedorea*, all palms that are widespread in Mediterranean gardens. More unusually there are also *Ptychosperma elegans*, *Syagrus romanzoffiana*, *Livistona chinensis*, *Hyophorbe verschaffeltii*, *Neodypsis decaryi*, *Chrysalidocarpus lutescens*, *Sabal palmetto*, *Archontophoenix cunninghamiana*, *Bismarckia nobilis* and *Caryota mitis*.

However, the most astonishing and unusual palm is a splendid specimen of the Elche form of the date. This, the Imperial Palm (Fig. 4), forms the center piece of the whole garden and gained its name after the visit of Empress "Sissy" of Austria to the Curate's Orchard in 1894. The Imperial Palm has eight suckers that all emerged at the same time and at the same height, about one meter above ground level. The suckers cluster evenly around the main trunk, the base of which thus supports nine stems (Fig. 5). The total height of the palm is about 12 m, which probably represents 150 years of growth. The total estimated weight of the palm is about 10 to 15 tons, and for this reason, a metal corset was designed and erected some time ago to support the palm. The Imperial Palm makes an altogether impressive sight.

Acknowledgments

I would like to thank all those people in Spain who helped to arouse my curiosity in the Elche date. In particular I am grateful to Francisco Orts Serrano (Fig. 6), grandson of Curate Castaño, who spent his childhood in the orchard with his grandfather; it was he, who with great enthusiasm, told me the history of the Curate's Orchard and the origins of the Elche date palms.

Principes, 39(4), 1995, p. 218

Funding Available

At the October 1995 meeting in Sarasota, Florida, the IPS Endowment Fund Committee will meet to review requests for funds.

The purpose of the Endowment Fund meeting will be to consider any requests for "funds which would be used solely and exclusively for scientific and/or educational purposes related to the study of palms, their propagation, culture, conservation, care, or development." The members of this committee consist of all the directors of the IPS. The interest earned from Life Membership payments may be used for donations, funding, or grants for palm-related activities or research consistent with the purposes of the society.

Do you know of any institutions or groups in your area which have needs for funds consistent with the above goals? If so, please submit (or ask them to submit) a formal request for IPS Endowment Funding. Make sure the request provides information on the amount needed and what the funds will be used for, if awarded. All funding requests consistent with the above guidelines will be considered.

Funding decisions will be made by the Endowment Fund Committee and announced prior to the end of October 1995. The next opportunity after that date for such funding will be August of 1996.

JIM CAIN
PRESIDENT IPS

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Pseudophoenix sargentii: an Endangered Palm Species

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One of the principal problems in tropical countries today is the accelerated destruction of their ecosystems, particularly their tropical forests which are among the most diverse ecosystems of the planet (Raven 1988). The substitution of native vegetation with cultivated fields, pastures for cattle-raising, as well as the development of tourist infrastructures are processes that have increased rapidly during the last 20 years (Toledo 1988). On account of this continuous modification of natural ecosystems, a great number of native species have decreasing populations, to such a degree that many of these are now endangered.

Various authors have tried to estimate the rate of species extinction at the present time (see, Wilson 1988). Without doubt, it is difficult to know how many species disappear from the planet every year. However, it is clear that if the destruction of large areas of forest continues, in a few years, we will lose more than half of the genetic resources on which we rely. Toledo (1988) estimates that Mexico would see its native vegetation reduced to a mere 25% of its original extent in a lapse of only two decades. In addition, we will have lost a great part of our flora with an enormous potential value.

Another important cause of the decrease of populations is the massive and selective exploitation of certain desired species. Numerous species of birds, reptiles and mammals have been pursued for their plumage, skin, meat, or simply for sport. As for plants, many species of cacti, orchids and palms have been overcollected, endangering their survival in their ecosystems.

Undoubtedly, the only way to solve this problem is to stop the process of transformation of these ecosystems and implement different programs of conservation. However, it is of prime importance to have knowledge of some aspects of the biology of the species and of the ecosystems to be able to suggest alternatives of management and conservation. For example, it is necessary to know which are the ecosystems richest in number of species, which are the species in danger of extinction, which are the most sensitive stages of their life cycle, and which are the principal causes that are provoking the decrease of the size of their populations.

In this paper, I describe a demographic study of the palm, *Pseudophoenix sargentii* H. Wendl ex Sarg., with the objective to determine the state of conservation of its populations so as to know what factors affect the different life cycle stages and determine the size of these populations.

The species. Pseudophoenix sargentii is a medium-sized palm with a limited Caribbean distribution. Read (1968) reports that it occurs in the Dominican Republic and Haiti, Cuba, Bahamas, S. Florida, Belize and Mexico. It is precisely in Mexico where its populations reach their major development.

In Mexico, this species grows naturally only in the states of Yucatan and Quintana Roo (Quero 1981). It has a very limited distribution that includes only a few localities, some of which have been totally transformed by tourist and urban development. Besides, for their beauty, adult individuals are extracted from their habitat for commercial purposes as ornamental plants for the main cities of the Yucatan Peninsula.

In spite of its limited distribution, *P. sargentii* may be very abundant in some areas, being the dominant element of the communities at times (Fig. 1). This is an important aspect for the study, because it permits us to count on a large number of individuals for carrying out demographic estimations of all the stages of its life cycle.

P. sargentii is considered to be in danger of extinction on the Yucatan Peninsula by the International Union for Conservation of Nature (IUCN 1988) and by the Secretaria de Desarrollo Urbano y Ecologia of Mexico (SEDUE 1991; SEDESOL

1. *Pseudophoenix sargentii* in the coastal sand dunes of Rio Lagartos, Yucatan, Mexico.

1994), due to the decrease of the plant communities it occupies, the recent tourist development of the region, and its use for ornamental purposes.

Materials and Methods

Study Sites. Three localities were selected on the coastal strip of the Yucatan Peninsula (Fig. 2), all less than 2 km from the coast, but under very different climatic and edaphic conditions (Durán and Franco 1992).

a) The North Coast of the State of Yucatan, in the Special Biosphere Reserve of Rio Lagartos. This is a thicket on coastal dunes on sandy substrate and is exposed to the winds and salt spray from the sea.

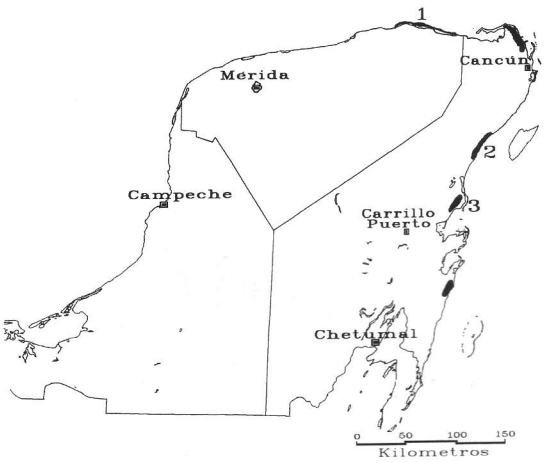
b) A low subdeciduous forest situated near Xel-Ha, in the State of Quintana Roo. The site is protected from the winds, since it is behind the vegetation of the coastal dunes. The palm grows on rocky ground with large solution holes and with little organic material.

c) The Biosphere Reserve of Sian Ka'an in Quintana Roo. This is a community of medium- to low-statured semi-evergreen forest with deeper soils and with more accumulation of organic matter. It occurs in an ecotonal zone between marsh vegetation and a semi-evergreen forest.

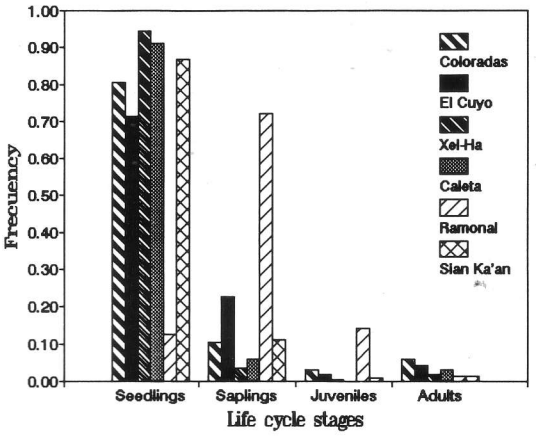
These localities have suffered different levels of human impact; therefore, the status of conservation of each one is very different. In Xel-Ha, there exist various zones where numerous juvenile and adult individuals of *Pseudophoenix* have been extracted for commercial purposes. The same occurs in Rio Lagartos, where a large part of the vegetation of coastal dunes has been disturbed by activities of the salt industry and by the substitution of the native vegetation with coconut plantations. On the other hand, Sian Ka'an has remained practically intact.

Methods. At each locality I chose two populations (El Cuyo and Coloradas in the Reserve Rio Lagartos; Xel-Ha and Caleta in the Park Xel-Ha; Sian Ka'an and Ramonal in the Reserve Sian Ka'an). For each population different plots were selected for sampling, where all of the individuals were marked in order to monitor them for several years.

Beginning in October 1988, and every 3 months thereafter, I censused the populations to determine



2. Distribution of the principal populations of *P. sargentii* in the Yucatan Peninsula. The numbers indicate the study sites: Rio Lagartos (1), Xel-Ha (2) and Sian Ka'an (3).



3. Structure of the populations of *P. sargentii*. The bars correspond at the different studied populations (modified from Durán and Franco 1992).

the growth rate of individuals, their leaf production, their survival, and their fecundity. The number of leaves produced during each interval were counted and marked, the height of each individual was measured to establish growth rates per season and finally the presence of flowers, fruit, and number of inflorescences was registered.

The populations were divided into five phenological classes: seeds, seedlings, saplings (individuals without a defined stem), juveniles (pre-reproductives with a trunk present), and adults (individuals in reproductive age).

With the information generated during two years of observations the growth of the populations was simulated by means of a transition matrix (Lefkovitch 1965). By means of an elasticity analysis (de Kroon et al. 1986), I determined which stages of the life cycle significantly affect the population's growth rate.

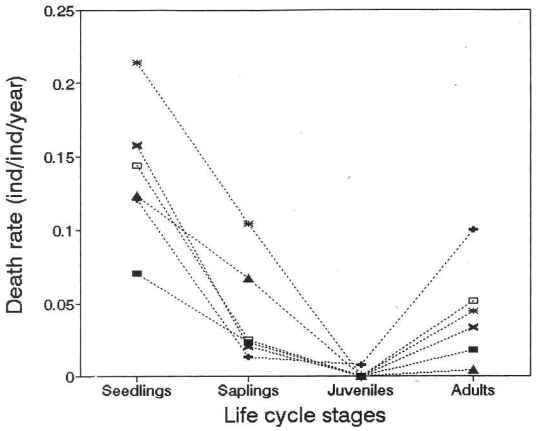
Results

Demographic Characteristics. Figure 3 shows that there is great variability in the structure of the different populations. Five of the six populations present a great number of seedlings, which suggests that good recruitment of new individuals exists in these populations.

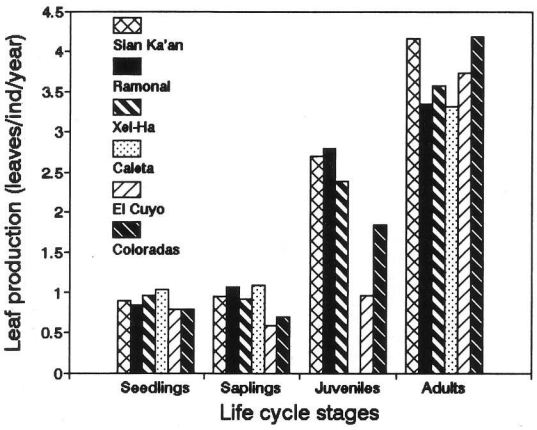
With regard to the mortality of individuals, in general, all the populations show a similar pattern (Fig. 4). However, the mortality of seedlings and saplings was greater in Xel-Ha, while the population of Sian Ka'an presented the lowest mortality for seedlings, and the population of Coloradas the lowest for the adults.

In all the populations, the mortality of juveniles was remarkably low, which suggests survival of the critical period of the first stages. Finally, the adult phase shows an increase in the rate of mortality. This is possibly due to the fact that the oldest and tallest individuals are more exposed to the winds of tropical storms and hurricanes.

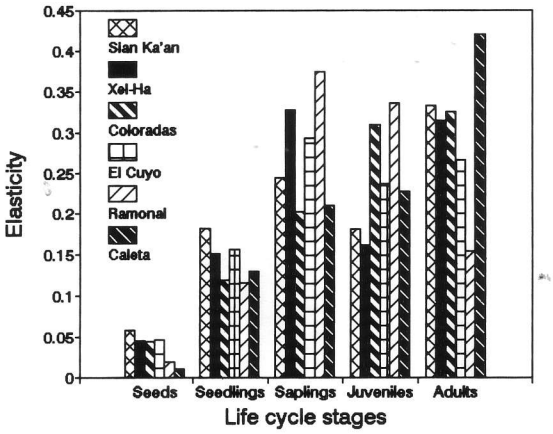
As far as the growth of the individuals is con-



4. Mortality rate of life cycle stages in the six populations. Coloradas (—▲—), El Cuyo (— × —), Xel-Ha (—∗—), Caleta (—□—), Ramonal (— + —) and Sian Ka'an (—■—) (modified from Durán 1992).



5. Leaf rate production of life cycle stages in the six studied populations (modified from Durán 1992).



6. Elasticity of the different life cycle stages in the studied populations (modified from Durán and Franco 1992).

cerned, the adult and juvenile stages are phases of fast growth compared with seedling and sapling stages. The leaf production rate increases according to the increase in the height of individuals. In all of the populations, the adult stage presents a higher rate of leaf production than the juvenile stage, and the latter is higher than the rate for sapling and seedling stages (Fig. 5).

It seems that the fecundity of the individuals does not vary between populations. In spite of the existence of a slight tendency towards the individuals of Sian Ka'an having a higher number of seeds per infrutescence than those of Xel-Ha and the latter a higher number than those of Rio Lagartos, statistically there is no significant difference.

It is interesting to note that the structure of the different populations seems to be in agreement with the patterns of mortality and growth that were detected in each one of them during the period of study (Durán 1992). Since the population structure is the result of the phenomena which occurred in previous years, the patterns detected suggest that these phenomena probably have been operating in the same manner during several years.

Table 1. Population growth rate (λ) of the six populations and age of individuals at first reproduction (modified from Durán 1992).

Population	Population Growth Rate (λ)	Age at First Reproduction (years)
Coloradas	1.199	39.83
El Cuyo	1.120	34.65
Xel-Ha	1.083	61.41
Caleta	1.147	55.63
Ramonal	1.000	77.90
Sian Ka'an	1.007	76.89

Populational Behavior. Upon incorporating the information of demographic parameters such as mortality, growth, and fecundity in the transition matrix and simulating the behavior of populations in time, we observe some interesting aspects: all the populations present a growth rate greater than or equal to 1 (Table 1). This signifies that all populations are growing or at least they maintain the size of their populations in equilibrium. It is necessary to point out that this is true only if the calculated population parameters are representative of the average behavior throughout many years.

The elasticity analysis of the life cycle stages shows that, in general terms, the populations of *P. sargentii* are more sensitive to the changes that the older categories experience (Fig. 6). This means that the population growth rate is more affected by the loss of adult and juvenile individuals than the extraction of seeds, seedlings, or sapling individuals.

Discussion

As already mentioned *Pseudophoenix sargentii* is included in the list of Rare and Threatened

Palms of the New World (IUCN 1988), as an endangered species for the Yucatan Peninsula and Florida.

It is necessary to discuss the reliability of these assertions. At first, the level of risk of the species considered in danger of extinction depends in great measure on the distribution and local abundance of these species, and on the factors that affect their habitats as well as the populations themselves. Harper (1981) suggests that the abundance or the rarity of a species has to be considered under a dynamic scheme in space and time.

The fact that a species is included in the Red Data Book of the IUCN or on different lists of specific groups depends on various factors: a) whether there are some researchers who study this species and, therefore, information exists about that species; b) it is influenced by the frame of reference of the researcher, by the level of geographical scale, and by the type of study, which is a product of his own experience (Harper 1981); and c) there is a lack of knowledge about the distribution of the species, and even more, of their local abundance in the localities where it occurs.

In order to resolve this problem, Rabinowitz (1981) proposes to measure the rareness of the species using three parameters: the geographic distribution, the specificity of habitat, and the local abundance of the species. This information, in addition to explaining the causes of its rareness, would permit one to determine a species' susceptibility to extinction.

As has been mentioned, *P. sargentii* is a species whose geographic distribution is limited to the Caribbean Basin (Read 1968). In Mexico, it is located only in the states of Quintana Roo and Yucatan (Quero 1981). Moreover, its distribution in the Yucatan Peninsula is limited to the coastal zone, since it always occurs in places near the sea.

On the other hand, undoubtedly, there exists an accelerated process of transformation of the ecosystems on the Yucatan Peninsula. In particular, in the coastal region, where the populations of *P. sargentii* are found, there has been a continuous growth of the tourist industry, and large areas of native vegetation have been modified. In this context, without doubt, the populations of *P. sargentii* are heavily exposed to human activities, even to the point of being extinguished.

Fortunately, some of these populations are included in the protected natural areas like National Parks and Biosphere Reserves. These can be the refuges that guarantee the permanence of this species, if and only if the activities of rational management and protection of these areas are fulfilled.

Besides, the results of this study indicate that all the populations of *P. sargentii* have a growth rate superior or equal to 1. This supports the idea that the factor that puts the survival of this species at risk is mankind, because in natural conditions the populations would maintain themselves and even increase.

Conclusions

The demographic study shows that without disturbance the populations of *P. sargentii* maintain their size or can even grow. Besides, some of these populations are located in Natural Protected Areas.

P. sargentii grows in few areas, has a restricted geographical distribution, the populations occur in a discontinuous pattern and most of them are small. In an absence of numerical data, it is felt that there is a set of human activities, modifying severely not only the habitat, but through overcollecting, the populations in a direct way.

Life cycle analysis has shown that the harvesting of juvenile and adult individuals has a very strong impact on the growth capacity and recuperation of the populations.

In agreement with this information, it is possible to sustain that due to its restricted distribution and due to the forces that are affecting its populations, *P. sargentii*, in effect, is an endangered species. Because of this, it is necessary to develop some measure of protection that stops or at least diminishes the impact of the forces that affect it. Therefore, it is necessary to modify the ways of utilization of this species, since the actual use consists of the harvest of individuals with a well developed stem.

Acknowledgments

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CHAPTER NEWS AND EVENTS (*Continued from p. 176*)

News from South Florida

The South Florida Chapter of the IPS met on June 21 at Fairchild Tropical Gardens. The meeting featured "Palms for Beginners and Palm Nutrition—A Panel Discussion", with accompanying lecture by Tim Brochat.

On August 16, the meeting focused on "Palms for Experts—A Discussion of Advanced Principles" to help experienced palm enthusiasts improve their palm growing techniques.

A field trip was held on September 16 to Nassau. This was a bus tour featuring many gardens, including the Langlois Estate, % the Bahamas National Trust. Dinner was at a seaside restaurant in the Bahamas.

News from Sydney Branch of PACSOA

The Sydney Branch of PACSOA met on July 18. Featured was a slide show by John Reid on his and his wife Judy's recent trip to China. The usual palm and cycad auction was held after John's presentation.

On Sunday, September 17, the Sydney Branch visited the "Australia in Springtime" Flora Festival at Mt. Penang, Kariong, near Gosford. The group met at the Impact Plants stand conducted by member Paul Anderson.

News from New Zealand

The Palm & Cycad Society of New Zealand met on July 4, 1995, for an informal Wine and Cheese meeting to "chat and be happy". On August 1, the meeting featured Peter Sinclair's presentation of slides from his recent trip to South Africa.

A meeting is planned for October 3 to hear Dick Endt's slide presentation on his recent trip to Bolivia, Argentina, Chile and possibly Peru.

News from the Louisiana Chapter

The Louisiana Chapter of the IPS met on August 20 at "The Palms"—the home of Danny Braud. The meeting featured another tour of the lush tropical garden that Danny has made on his one-acre grounds. He's added several new palm species and a new exotic flower bed since the last meeting there.

The next meeting is scheduled jointly with the Gulf Coast Chapter in October at the home of Maxwell Stewart in Mobile, Alabama. Details not available at press time.

1996 Biennial Meeting in California

Please mark your calendars now for the 1996 Biennial Meeting of the IPS to be held at the Hyatt Newporter Hotel in Newport Beach, CA in August 1996. Official events will be held on August 3–9, with other related events before and after. The meetings in Southern California will be followed by post-Biennial trips to be announced later.

It appears that the post-Biennial tour will be a nice trip to Ecuador starting on Friday, August 9 and probably running ten days/nine nights. The post-Biennial tour will be offered on an all inclusive

basis (including round trip airfares from Los Angeles). More later as details are finalized.

News from North Queensland

The North Queensland Palm Society (NQPS) met on May 8 at Tumbetin Lodge, The Palmetum. This meeting was an "in-house" night, featuring various slides of palms and cycads by members. The group also met on July 10.

The NQPS hosted visiting groups from the neighboring Rockhampton and Mackay Palm Societies on the Queen's Birthday Celebration, June 10–12. Various nurseries were visited, with plants for sale at various bush houses.

Additional 1995 meetings are scheduled for September 11 and November 13, at Tumbetin Lodge, beginning at 7:30 p.m.

In the April issue of *Mooreanan*, John Dowe reports that almost 150 new taxa were added to the Townsville Palmetum in January and February 1995. These included 50 species of palms, 60 species of trees and 30 species of assorted gingers, pandans, ferns, shrubs, cycads, and succulents.

News from Southern Queensland

The Southern Queensland Group of PACSOA meeting on May 29 was well attended. The meeting featured a discussion of Madagascar palms. A good selection of plants had been assembled and Stan Walkley commented on these, with other members contributing as well. Short discussions were also led by Will Kraa on *Chamaedorea stolonifera* and its interesting growth habits. He also showed a specimen of the cycad *Stangeria enopus* from South Africa.

At the July 17 meeting, President Will Kraa spoke on palm roots. They are very different from the roots of other families of plants and this has implications which are very important to their cultivation (e.g., transplanting, planting near buildings, planting out from containers, etc.). Also discussed at the meeting were the palm genera *Coccothrinax*, *Trithrinax*, *Zombia*, *Trachycarpus*, and *Chamaerops*. This idea of having a discussion of several genera of palms and cycads as well as slides and/or guest speakers is planned for future meetings.

The September meeting will discuss the cycad genera *Encephalartos* and *Dioon*. The November meeting will discuss *Chamaedorea*, *Geonoma*, *Synechanthus*, *Pholidostachys* species and additional Madagascar information.

Sunshine Coast (Australia) News

The Palm & Cycad Society, Sunshine Coast Group of Queensland, Australia met on June 5 at the Nambour Band Hall. This meeting featured discussion on the "Native Cycads of Australia." This portion of the meeting was capped off with a show of slides of native cycads from the collection of Stan and Jane Walkley. Members also brought unknown palms from their collection for attempts at identification. The raffle prize was a native cycad.

The group also met on August 7, featuring a group discussion on "Palms for Shade Containers". Max Pedley showed a selection of related slides. Members brought many different specimens of shade-loving palms, including *Chamaedorea*, *Dypsis* and many others. Problems, growing tips, and aids to identification were all discussed. The raffle palm for the evening was donated by Clayton York.

The August 1995 newsletter of the Sunshine Coast Group provided a very nice write-up on "How to Germinate Cycad Seeds", which may very well be of interest to many of our members.

The Palm & Cycad Society of Mackay (Queensland, Australia)

The annual Fete of the Palm and Cycad Society of Mackay was held at the Farleigh Mill Palm Gardens on May 7. The diversity and quality of goods for sale was obvious and many talents were evident. The seed giveaway and sale were very successful and the efforts of Russ King were much appreciated. The weather was unpleasant—a chilly, blustery, gloomy day and attendance was less than expected.

Several of the Mackay local society and six from the Rockhampton group made a field trip to Townsville on the Queen's Birthday Weekend, June 10–12.

The Palm and Cycad Society of Mackay met on June 25 at the home of Peter and Debbie Fairbrother in West Mackay; on July 23 at the home of Percy and Val Simonsen in Sarina; on August 27 at the home of Keith and Ailsa Boyden in Farleigh; and on September 24 at the Lew and Betty Dovey garden in Mackay.

The October 22 meeting will be hosted by Dwayne and Michelle Shea, Coral Coast Nursery, Cape Hillsborough Road, Seaforth. On November 26, the group will meet at the Farleigh Mill Palm Gardens.

News from Gold Coast—Tweed (Australia)

The Gold Coast—Tweed Palm & Cycad Society of PACSOA met on June 11 at the property of local President Phil Thomas. The group met at the Chinderah Palm Nursery, followed by a visit to the Thomas house, Upper Dungay, Murwillumbah. Phil has about 250 different palms, ranging in size from shot seed to mature fruiting specimens. There are also several mature stands of *Archontophoenix cunninghamiana* and *Lepidozamia peroffskyana*. Members of the South Queensland Group were invited to attend this meeting.

News from Western Australia

The Palm & Cycad Society of Western Australia met on June 19 at the Leederville Town Hall. The meeting featured a "quartet of experts" to talk about germination of palm and cycad seeds. A palm raffle was held following the meeting.

On June 25, the group held an informal bush walk to a hidden valley of *Macrozamia reidlei* at the Ellis Brook Valley Reserve. A field trip to the Northern Suburbs was held on July 16, visiting several private homes and a couple of nurseries. Lunch was taken at Hillary's Marina.

The PACSOA put on a display in Melville on September 9–10, in addition to the palm and cycad display at the Dianella Plaza Shopping Centre on September 28–30, 1995. Palms and cycads were sold as well as shown.

A special meeting of the society was held on September 22 at the Alexander Hotel to hear Dr. John Donaldson of the National Botanic Institute in South Africa. Dr. Donaldson has written a number of articles on South African cycads, particularly *Encephalartos*.

Pacific Northwest Chapter News

The Pacific Northwest Palm & Exotic Plant Society (PNWP&EPS) announces that Richard Woo has been assigned as InterNet correspondent for the chapter. He can be reached by email at either SNOW.PALM@GEnie.com or, for members on Compuserve, 72370.1466@compuserve.com. Members with email access who want additional information on the Pacific Northwest Chapter should contact Richard.

The group's summer BBQ was hosted by Phil Davies in Cloverdale on July 9. In addition, a Vancouver Garden Tour was organized for August 13. This tour began at Gerard Pury's at noon and covered several area gardens.

The August 1995 issue of Hardy Palm International presented several interesting articles, including an excellent spread with color photographs of Rudy and Donna Pinkowski's garden. The article pointed out that the Pinkowski garden was named as "the Best Residential Garden in North Vancouver" in 1988 and as Vancouver Magazine's "Most Innovative Private Garden" in 1990. Rudy serves as President of the Pacific Northwest Palm & Exotic Plant Society.

Other 1995 meetings are scheduled for September 18 and November 27, 1995. All are to be held at Van Dusen Gardens, Vancouver and all will start at 7:30 p.m.

News from India

IPS member Shri Dhar from India had a recent article published in the Horticultural Journal of India on his recent experiences in hybridizing *Latania loddigesii* and *L. lontaroides*. In addition, the November 1994 issue of *The Garden*, published by the Royal Horticultural Society, London, featured an excellent write-up on the private Culcutta garden of Shri Dhar and his wife Prabha. To quote the article on the garden on Dr. Norman Track: "It contains an impressive range of rare and unusual plants comprising one of the most comprehensive private collections in the country."

News from the Palm Beach (Florida) Chapter

On July 5, the Palm Beach Palm & Cycad Society chapter met at Mounts Botanical Garden to hear Bill Jones of Triple J Nursery, who shared his knowledge of growing palms. A plant auction followed. The August 2 meeting featured Richard Moyroud of Mesozoic Nursery, who spoke on native palms, their culture and uses in the landscape. He also spoke about the *Roystonea* project, which involves isolating and propagating a pure strain of the true Florida Royal Palm. July 19 was a workday at the Norton Sculpture Garden at the corner of Barcelona and Flagler in downtown West Palm Beach. The Palm Beach Chapter's annual palm sale is scheduled for the first weekend in October.

The Palm Beach Palm and Cycad Society, in conjunction with Fairchild Tropical Garden, is sponsoring a World Palm Symposium 1995 on October 20 and 21, the week preceding the IPS

Board Meeting. The World Palm Symposium will feature 13 of the top palm researchers in the world lecturing on their recent research on various palm genera, conservation, tissue culture and other palm studies. The speakers include Dr. Leng Guan Saw of the Forest Research Institute of Malaysia, Dr. Fin Borschsenius of Kew Gardens in England, Mr. John Dowe of the Townsville Palmetum in Australia, and Dr. Andrew Henderson of the New York Botanical Garden. For additional information, please write to World Palm Symposium, % Paul Craft, 16652 Velazquez Blvd., Loxahatchee, FL 33470.

News from Broward County, Florida

On July 27, the Broward County Palm & Cycad Society (BCP&CS) held their Giant Auction in lieu of a speaker. There were many one of a kind specimens to be had. Refreshments were provided.

Included for sale were *Pelagodoxa henryana*, *Johannestejsmannia altifrons*, *Pinanga crassipaes*, *Marojeyja darianii*, *Arenga undulatifolia*, *Calyptrocalyx hollrungii*, *Chrysalidocarpus decipiens*, *Dypsis gracilis*, *Pinanga dicksonii*, *Ceratozamia hildae*, *Cycas angulata* and other one of a kind specimens.

Several native species such as *Pseudophoenix sargentii* and *Coccothrinax argentata* were also available. Refreshments were provided.

News from the Hawaii Island Chapter

A Catered Barbecue and Members' Palm Auction by the Hawaii Island Palm Society was held on July 21 at Wailoa State Park. Special palms were brought by members for sale, with return auctioneer Gaila Vidunas doing the duties.

A local field trip was hosted by Tim Pickering at his nursery, Hawaii Palms and Cycads, in Puna on August 13. The chapter provided light refreshments.

A field trip was held on September 30 to Oahu. The trip began with an early morning flight out of Hilo and Saturday featured an in-depth tour of Lyon Arboretum. Ray Baker, Horticultural specialist in palm and other plantings at Lyon, led the tour. On Sunday, the group visited Ho'omaluhia Garden. This is a giant 400 acre garden laid out in eight geographic sections.

News from the Texas Chapter

The Texas Chapter of the IPS met on June 3 at Grant Stephenson's Grower's Mart Nursery in west Houston. The meeting featured Paul Craft of the Palm Beach Chapter, who gave a very interesting presentation. The meeting was well attended with over 50 members and guests in attendance.

The August 26 meeting was held at the home of Jim and Elizabeth Cain in Houston. The meeting featured a presentation by Gordon Hintz on the native *Washingtonia* palms in southern California, which he visited earlier this year. Texas barbecued brisket was served following a tour of the Cains' palm garden. Several palms in the garden were in fruit, including *Livistona chinensis*, *Syagrus* (*Arecastrum*) *romanzoffiana*, *Chamaedorea radicalis* (with 8 feet of trunk), *C. cataractum*, *Serenoa repens*, *Rhapidophyllum hystrix*, *Rhapis* sp., several *Sabal* species, and a *Phoenix reclinata* which looks as if it must be a hybrid with *P. canariensis*. Both large *Allagoptera* specimens bloom regularly, but have failed to set seed. The pool was open and enjoyed by some to escape the very hot Texas summer.

JIM CAIN

Do You Have Questions About Palms?

Send your queries to: DR. KYLE BROWN, Rt. 2, Box 2700, Glenn St. Mary, FL 32040. Telephone: (904) 259-2754.

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BOOKSTORE UPDATE

OCTOBER 1995

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Ceroxylon quindiuense at sunset. Photo by Andrew Henderson.