PRINCIPES

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PRINCIPES

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Contents for January

Cover Picture

Dictyocaryum lamarkianum (Martius) Wendl. growing on slopes of the western Cordillera in Colombia. Photo by Andrew Henderson.

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Principes, 36(1), 1992, p. 3

Editorial

The island of Krakatau, west of Java (not east as in the film), is of very great biological interest. An active volcano, Krakatau erupted catastrophically in 1833, with huge loss of life on nearby Java, and completely sterilizing any remaining fragments of the island group. Since then the recolonization of the island group has been closely monitored and now, after over a century, closed forest has developed on several of the islands. Dr. Rob Whittaker of Oxford and his colleagues from Bogor in Indonesia have been carrying out ecological work on the islands and in this issue of *Principes* they report on one of their studies, an account of the behaviour of *Oncosperma tigillarium*.

Dispersal of seeds, mostly by animals, is the most important method by which palms colonize new habitats such as Krakatau; yet we still know rather little about different dispersal methods, so an article on the interaction between animals and palm fruits is always welcome. In this issue we publish an article by P. W. Lucas and R. T. Corlett on how macaque monkeys feed on palm fruits in the last remaining fragment of primary forest in Singapore.

D. A. Griffiths of Hong Kong University has written an essay that introduces us to the old literature on palms in China.

The article by C. A. Hollier and S. C. Doughty on the mycoflora of the roots of *Sabal* will be of interest to growers who have had to face the problem of root rot and die back and two palm workers from Nigeria, E. A. Oruade-Dimaro and C. A. Ekundayo, report on seedling blight of *Raphia*.

Traditional uses of palms are being modified and in some areas lost altogether as the culture of peoples changes and adapts to modern life. It is of great importance to document such uses before they are lost. Neela de Zoysa, from Sri Lanka, has been closely involved in studies of the last significant area of lowland humid forest in Sri Lanka at Sinharaja. Here she describes how local people have used, sustainably, the kitul palm, *Caryota urens* as a source of sugar.

In this issue we also include several short articles featuring individual palms. Fred Essig describes a new species of *Heterospathe* from New Britain, Bill Gunther provides an interesting anecdote about *Chamaedorea minima*, Phillip Cribb describes well known *Licuala grandis* in its not so well known native habitat, and Scott Zona records the presence of *Sabal domingensis* in Cuba.

Please note well the Corrigendum on page 6; Dr. Timothy Broschat draws attention to the new fact sheet on palm nutrition that supercedes the earlier one of 1981 that was referred to in D. H. Romney's article in *Principes* 35: 161–164.

The editors wish all readers of *Principes* a happy new year. The year promises to be an exciting one for members of the International Palm Society. In June we expect the publication of Don Hodel's book on *Chamaedorea* and then in November the Biennial Meeting of the Society will be held in Florida. We hope to see many members there.

JOHN DRANSFIELD
NATALIE W. UHL

Principes, 36(1), 1992, pp. 4–6

A new species of Heterospathe (Palmae) from New Britain

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During an expedition in 1989 to the mountains of central New Britain (Papua New Guinea), several specimens were collected of a species of *Heterospathe* that has proven to be new. The occurrence of an endemic species of this genus in New Britain follows a pattern found in several other palm genera, in which the species found in the Bismarck Archipelago (New Britain, New Ireland, etc.) are distinct from those in both New Guinea and the Solomon Islands. A name is provided for the species in order to facilitate completion of an inventory of the palms of New Britain. A revision of *Heterospathe* is underway at the University of South Florida.

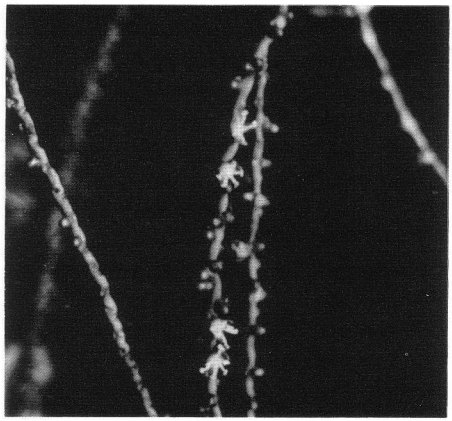
Heterospathe parviflora Essig. sp. nov.

Palma mediocris, solitaria, floribus minutis, staminatis 2.5 mm longis, staminibus 6, pistillodio columnari, fructu globoso, reliquiis styli apicalibus. Typus: Papua New Guinea, West New Britain Province, *Essig & Katik LAE 64060* (Holotypus USF; Isotypi LAE, BH).

Solitary palm to 7 m; stem d.b.h. 10–15 cm. Leaf to 3 m long, with ca. 33 regularly arranged pinnae per side; leaf sheath ca. 25 cm long, brown-lepidote submarginally, with the margin briefly fibrous; petiole short, ca. 20 cm; middle pinnae to ca. 70 cm × 5.5 cm, with apices acute and minutely notched, and with small ramenta on main ribs near the base abaxially. Inflorescences interfoliar, with 2–3 orders of branching; peduncle ca. 80–90 cm long, thickly brown-lepidote in the lower part, the scales gradually becoming thinner distally; entire prophyll not seen, peduncular bract 140 cm long, lightly brown lepidote externally; lowest branch with peduncle 21 cm long, and with 5 branches, the lower two again branched into 2–3 rachillae; rachillae 20–39 cm long, 1.8 mm wide at base when dry, to ca. 1 mm wide near tip, reddish gray-green when fresh, axes minutely and sparsely red-brown lepidote; triads/diads to ca. 110 per rachilla. Flowers reddish-brown when fresh; staminate flowers ca. 2.5 mm long before opening, sepals ca. 1.1 mm high, broadly imbricate, petals ca. 2.2 mm long, valvate, stamens 6, filaments white, about the same length as the petals, anthers yellow, ca. 1.3 mm long, versatile; pistillode thick, columnar, as long as stamens; pistillate buds ca. 1.5 mm high at staminate anthesis. Fruit globose to subglobose, red, 9–10 mm in diam. when dry, stigmatic residue apical to subapical. Seed readily separating from the dried pericarp, shiny, globose, 8.5–9.5 mm in diam., with endosperm deeply ruminate.

Distribution: PAPUA NEW GUINEA. Island of New Britain, scattered in forest throughout the central mountains at low to middle elevations.

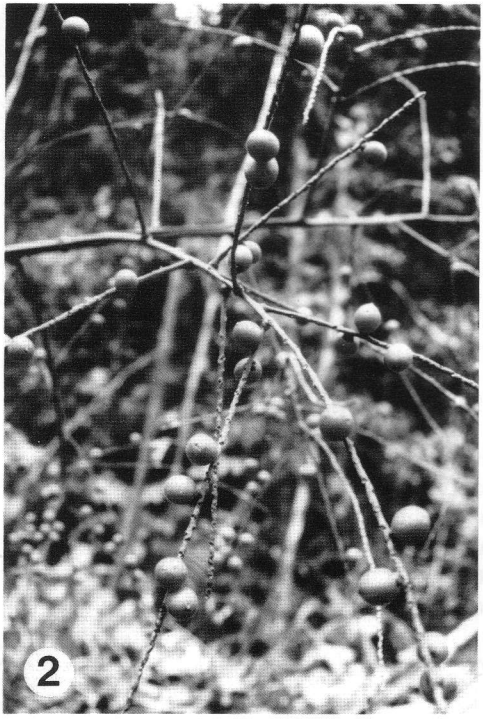
Specimens Examined: PAPUA NEW GUINEA. West New Britain Province: Mountains south of Hoskins, Kapiura Timber Area, near village of Sampantabil, alt. ca. 700 m, *Essig & Katik LAE 64060* (Holotype, USF, Isotypes K, LAE, BH), *LAE 64018, 64064* (USF, LAE, BH); Kandrian Subprovince, upland logging



1. The tiny flowers of *Heterospathe parviflora* are only 5 mm across when fully expanded. The six white stamens contrast with the dull red petals.

area, Fulleborn Harbor, alt. 450 m, *Clunie & Whitmore LAE 63066* (BH, LAE). East New Britain Province: Pomio Subprovince, lower slopes of Mt. Lululua, alt. 1,495 m, *Stevens & Lelean LAE 58272* (BH, BRI, L, LAE).

The combination of very small flowers, with the staminate having six stamens and columnar pistillode (Fig. 1), sparsely scaly inflorescence axes, globose fruits (Fig. 2), and relatively broad pinnae (Fig. 3) distinguishes *Heterospathe parviflora* from other species in both Papua New Guinea and the Solomon Islands. The New Guinea species that have six stamens and an elongate, columnar pistillode (*Heterospathe* sensu strictu—cf. Moore 1969), are all



2. The globose red fruits of *Heterospathe parviflora* are usually borne rather sparsely, despite the numerous flower scars on the rachillae. 3. One of my guides from Sampantabil holds the large leaf and an infructescence of *Heterospathe parviflora*. The pinnae are broader than they are in related (those with six stamens) arborescent species.

either acaulescent, have elongate fruit, or have densely lepidote inflorescence axes. *H. pulchra* H. E. Moore, from Fergusson Island, has glabrous inflorescence axes and globose fruits, but the stigmatic residue of the fruit is markedly excentric and the staminate flowers have short, trifid pistillodes (Moore 1969).

All seven species known from the Solomon Islands appear also to belong in the 6-stamen group, although several are known only from fragmentary material. Most have markedly elongate rather than spherical fruit, and the pinnae are narrower, the broadest not measuring more than 2.2 cm wide, as far as is known. *H. salomonensis* Burret has globose fruit, but the species appears to be a more diminutive palm, and the fruit is only 6 mm in diameter.

Heterospathe woodfordiana Beccari, from Santa Isabel and San Jorge Islands has only slightly elongate fruit, and minutely scaly inflorescence axes, with flowers (mature?) 2.5 mm long, but the number of stamens was not reported and vegetative parts were lacking when Beccari described this species. It is thus potentially as closely related to *H. parviflora* as any known species, but much more needs to be known about it.

A systematic study of *Heterospathe* has been undertaken by a graduate student at the University of South Florida. It can be expected that a better understanding of the relationships among the various species will emerge from that study.

Acknowledgments

This study was made possible by a grant from the National Geographic Society (#3903-88). Thanks are also due to Karl Kerenga, Paul Katik, and Thomas Umba for their assistance on the 1989 expedition to New Britain.

LITERATURE CITED

MOORE, H. E., JR. 1969. New palms from the Pacific, III. Principes 13(3): 99–108.

Corrigendum

Readers of D. H. Romney's article on coconut palm fertilization (*Principes* 35: 161–164) should be aware of some errors in the 1981 fact sheet by Donselman that he cites. The scorched new leaf symptoms that often occur after cold weather or on alkaline soils are not caused by boron deficiency. Research has shown that it is actually caused by manganese deficiency and that boron deficiency, which has similar symptoms, is rarely a problem in south Florida landscapes. Recent studies of potassium deficiency in south Florida (*Principes* 34: 151–155) also update information contained in this fact sheet. Because of rapid changes in the field of palm nutrition, the University of Florida published a completely new "Palm Nutrition Guide," by T. K. Broschat and A. W. Meerow in 1990 (Fla. Coop. Ext. Serv. Circ. SS-ORH-02) which supersedes Donselman's 1981 fact sheet.

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Principes, 36(1), 1992, pp. 7–17

Ecology and Distribution of Nibung (Oncosperma tigillarium within the Krakatau Islands, Indonesia

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ABSTRACT

A study of the distribution and ecology of *Oncosperma tigillarium* (Jack) Ridl. (nibung) within the Krakatau Islands, Indonesia, was conducted to gain an understanding of factors controlling location and dynamics of populations. The history of its colonization and that of other palm species is also briefly examined. Four plots were established at different sites on the three main islands.

Reconnaissance throughout the islands between 1979 and 1989 revealed that nibung grows in the lowlands below 150 m altitude, but away from the immediate vicinity of the sea. Populations were studied within a number of different forest types (as described by Whittaker, Bush and Richards 1989), and it was concluded that the palm appears to be relatively insensitive to community characteristics and to between-island differences in disturbance histories.

Examination of seed, seedling and sapling densities in relation to parent trees revealed a large number of propagules failing to disperse, and in consequence tendencies toward clumped distributions. The seedlings tend to grow best in hollow and/or moister sites. The Krakatau islands remain poor in palm species (eight) and numbers of individuals, however, the evidence from this study, exemplified by nibung, is of a slow but steady increase in their presence.

Nibung (*Oncosperma tigillarium* (Jack) Ridl.), is one of eight palm species known from the Krakatau Islands (below). The tree is tall, clustering and spiny with distinct crown shafts and pinnately divided leaves. Nibung may reach in excess of 25 m in height and clusters may have up to 10 major stems. Based on the collections at Herbarium Bogoriense and other available information (e.g., Seeman 1856, Ethelbert Blatter 1926), nibung is widely distributed throughout Sumatra, Kalimantan, Peninsular Malaysia, and Java. The species is generally confined to forest below 50 m above sea level, in near-costal localities (Steenis 1935, Backer and van den Brink 1968, House 1984).

Recently this palm tree has become threatened in many places, especially near the coast, due to utilization for "bagang" poles. Stems of nibung are also used as a major building component, the leaf sheaths in basket making and the heart or cabbage is eaten raw or cooked in a coconut sauce (Dransfield 1976, House 1983). Seeman (1856) quotes Low as stating it to be "the most esteemed of all the excellent vegetables of Borneo," with a very sweet nutty flavor. According to local fishermen, it currently sells in Lampung for about 20,000 rupiahs per stem. Despite the economic value of the plant, little is known about the ecology and distribution of this palm. By studying it in a habitat protected from marked human disturbance, we hope to be able to make a small contribution to an understanding of the autoecology of the species.

The Krakatau islands provide a classic site for the study of primary colonization and ecosystem regeneration in the humid tropics, a context in which palms are a relatively neglected component. In focusing on the history and dynamics of nibung

within these islands it is intended to provide a simple case study, hopefully provoking further interest in the subject.

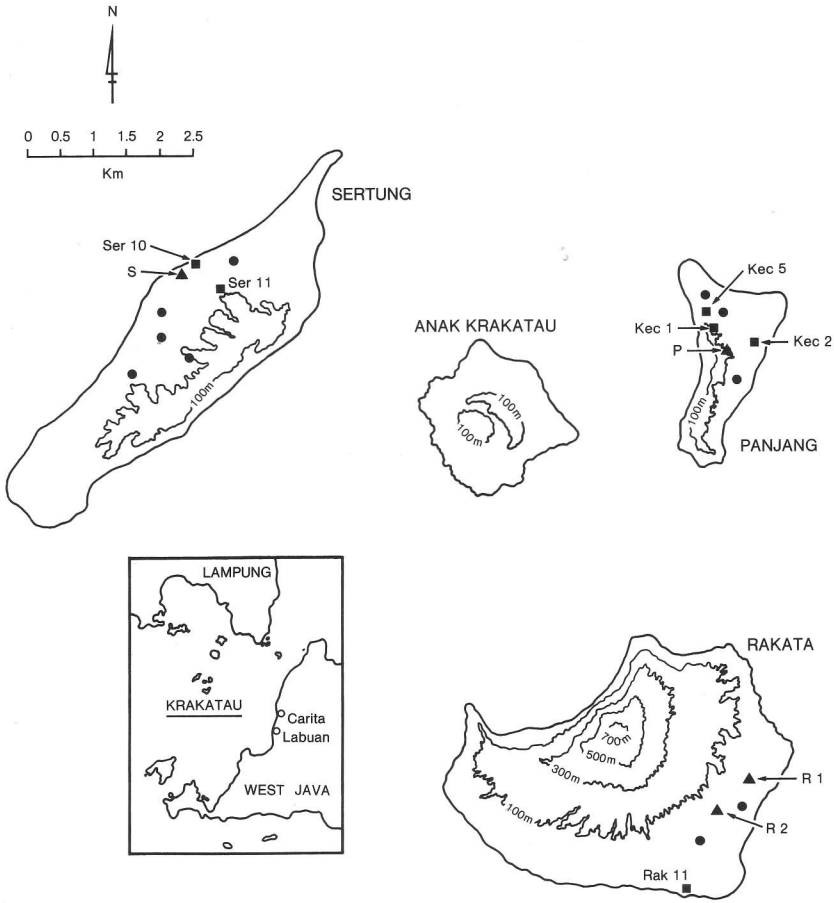
Study Area and Methods

The Krakatau Islands are situated approximately in the middle of the Sunda Straits, between West Java and South Sumatra (Fig. 1). The group consists of four small islands: Rakata or Krakatau Besar, Sertung or Verlaten, Panjang or Lang (Rakata Kecil), and Anak Krakatau (the smallest island with an active crater). The Islands are mostly forest-covered with the exception of Anak Krakatau, the majority of which still consists of open bare areas of black ash. The group was completely sterilized in the eruptions of 1883, but now supports a variety of secondary forest communities. The history of recovery and current forest types are described by Whittaker, Bush, and Richards (1989).

The soils of Rakata have developed on top of a thick layer of white volcanic ash produced by the 1883 eruptions, but those of Sertung and Panjang are developed from complex series of mainly post-1930 ejecta (RJW, work in progress). These were produced by Anak Krakatau, which emerged in the center of the group over the period 1927 to 1930, and which has been intermittently active since. Particularly severe eruptions occurred in 1930, 1932, 1934/5, 1952/3, 1961 and around 1970; in each of these cases (and doubtless others) Sertung and/or Panjang has been affected (reviewed in Whittaker et al. 1989). It appears that little, if any, of either island has escaped from serious damage at one time or another. The forests of both islands are consequently ecologically immature and species-poor in comparison to Rakata. In addition, their soils are less developed and the surface horizons are coarser textured, being typically 80–90% sand fraction (Newsome 1986, M. Saunter, unpubl. data). Erosion by fluvial action has produced pronounced ridge and gully systems, particularly on Rakata, with most major gully-forming activity probably taking place in the initial unvegetated period. The shorelines of the three older islands have also been eroded by wave action, such that the majority of the coastline consists of steep ash walls with many hanging valleys (Bird and Rosengren 1984). The coastline is quite dynamic and although the major process has always been erosion, areas of accretion (and hence colonization of thalassochorous species) exist on each island. On Sertung there is a quite pronounced spit, fed by longshore drift from the eroding cliffs (see Fig. 1). In short, inland parts of Rakata have been relatively stable since very shortly after the eruptions of 1883, but the vegetation of Panjang and Sertung has experienced significant disturbance by volcanic events in the past sixty years. Coastal and near-coastal populations have also been variously affected by geomorphic change.

Reconnaissance was undertaken to determine the nibung distribution within each island. The data presented in Table 1 were then collected using a plot based method. Three plots of 10 × 100 m and one of 10 × 120 m were set up under selected parent nibung trees. Two plots were established on Rakata and one plot each on Sertung and Panjang. All trees with trunks of >10 cm dbh and saplings of 2 cm diameter at 1 m above ground level were measured. Data recorded were diameter, total height and bole height in all sub-plots of 10 × 10 m. Ground cover was sampled from further subplots of 2 × 2 m, which were set up systematically within each 10 × 10 m sub-plot. Voucher specimens were collected for identification of all taxa present. The fallen seeds of nibung under the selected parent nibung trees were counted systematically, within concentric contours.

Prior to the analyses of these data, we first review the historical data for the colonization of the islands by Nibung and other palms. Surveys of the islands have not been



1. Known distribution of *Oncosperma tigillarium* in the Krakatau Islands, Indonesia. NB. Site locations are approximate. ■ 1983/4 plots in which *O. tigillarium* was recorded (after Whittaker et al. 1989); ▲ 1989 study sites; ● other locations in which *O. tigillarium* was recorded in 1989.

particularly systematic and have been of varying frequency and intensity through time. Whittaker et al. (1989) group the survey data into the following "collection periods," which broadly indicates the pattern: 1886, 1897, 1908, 1920, 1922, 1924, 1929, 1932, 1934, 1951, 1979, 1982, 1983. In addition, we report previously unpublished finds of 1989.

Results and Discussion

History of palm colonization of the Krakatau Islands. Nibung is one of seven palm species recorded for the Krakatau Islands post-1883 by Whittaker et al. (1989). One of these, *Nypa fruticans* Wurmb has been observed only as a seedling on Anak Krakatau in the early 1930s, and did not survive the eruptions of that period. The remaining species are *Calamus unifarius* Bl., *Calamus viminalis* Willd., *Cocos nucifera* L., *Corypha utan* Lam., and *Licuala spinosa* Thunb., all of which have been recorded during the surveys of 1979–1989. However, specimens collected in 1989 and provisionally identified as *Licuala spinosa*, were later found

Table 1. Sample plot data recorded in 1989.

	R1		R2		S		P	
	No.	I.V.	No.	I.V.	No.	I.V.	No.	I.V.
Tree Layer								
Neonauclea calycina	10	58.29	21	108.03	2	12.15	9	80.49
Terminalia catappa	6	55.82	3	21.64	7	50.72	—	—
Ficus fistulosa	8	49.65	3	22.06	—	—	—	—
Timonius compressicaulis	5	29.65	—	—	31	118.83	18	122.83
Villebrunea rubescens	3	15.75	—	—	—	—	—	—
Macaranga tanarius	2	13.19	—	—	—	—	1	8.09
Ficus fulva	2	12.69	—	—	—	—	1	8.09
Ficus ampelas	2	11.78	—	—	—	—	—	—
Ficus septica	2	11.36	2	15.82	—	—	—	—
Dysoxylum guadichaudianum	1	6.41	—	—	—	—	4	36.32
Ficus tinctoria	1	6.33	2	15.04	—	—	—	—
Oncosperma tigillarium	7	6.31	21	83.48	8	26.55	5	28.02
Arthrophyllum javanicum	1	5.82	—	—	—	—	—	—
Bridelia monoica	1	5.70	1	7.85	—	—	—	—
Glochidion borneense	1	5.63	—	—	—	—	—	—
Antidesma montanum	1	5.62	—	—	—	—	—	—
Pipturus argenteus	—	—	5	18.99	—	—	1	8.00
Tarenna fragrans	—	—	1	7.09	—	—	—	—
Gnetum gnemon	—	—	—	—	7	40.37	—	—
Hernandia peltata	—	—	—	—	6	26.98	—	—
Morinda citrifolia	—	—	—	—	3	18.33	—	—
Artocarpus elasticus	—	—	—	—	1	6.07	1	8.16
Shrub/Sapling								
Leea sambucina	64	54.83	82	87.85	1	2.65	18	29.65
Ficus fistulosa	30	34.34	12	20.68	4	7.05	7	23.20
Antidesma montanum	38	33.29	22	31.48	—	—	20	37.47
Timonius compressicaulis	26	27.73	1	2.25	11	28.86	1	3.41
Dysoxylum gaudichaudianum	12	25.32	—	—	4	6.70	37	51.06
Neonauclea calycina	18	24.50	19	32.55	2	7.77	6	16.26
Leucosyke capitellata	18	22.63	12	17.70	—	—	—	—
Arthrophyllum javanicum	15	15.78	4	8.52	—	—	3	7.56
Tarenna fragrans	8	11.01	6	14.09	—	—	—	—
Villebrunea rubescens	5	7.32	5	7.53	—	—	1	2.98
Ficus ampelas	6	7.14	10	14.38	1	2.64	6	12.38
Buchanania arborescens	4	6.26	4	8.68	—	—	18	27.33
Ficus septica	3	5.08	6	8.91	—	—	—	—
Ficus tinctoria	3	4.45	4	8.07	—	—	7	26.09
Bridelia monoica	3	4.36	2	4.26	—	—	—	—
Ficus fulva	3	3.95	5	7.04	6	13.63	4	8.24
Morinda citrifolia	2	3.72	—	—	1	2.81	1	2.28
Calophyllum inophyllum	2	3.03	—	—	3	8.56	—	—
Mussaenda frondosa	1	1.82	—	—	—	—	—	—
Ardisia humilis	1	1.57	—	—	1	2.79	—	—
Ficus pubinervis	1	1.47	—	—	—	—	1	2.73
Macaranga tanarius	—	—	3	3.81	1	2.90	2	3.69
Pipturus argenteus	—	—	2	2.79	—	—	3	8.44
Syzygium polyanthum	—	—	1	2.23	—	—	3	7.09
Litsea sp.	—	—	1	2.04	—	—	—	—
Glochidion borneense	—	—	1	2.04	—	—	—	—
Melastoma malabathricum	—	—	1	2.01	—	—	—	—
Gnetum gnemon	—	—	—	—	202	167.73	4	8.20

Table 1. Continued.

	R1		R2		S		P	
	No.	I.V.	No.	I.V.	No.	I.V.	No.	I.V.
Hernandia peltata	—	—	—	—	6	24.87	—	—
Oncosperma tigillarium	—	—	—	—	8	14.40	6	13.54
Artocarpus elasticus	—	—	—	—	1	2.64	—	—
Terminalia catappa	—	—	—	—	—	—	2	5.00
Mangifera indica	—	—	—	—	—	—	2	3.40
Seedling and Herb								
Neonauclea calycina	129	91.41	3	3.78	—	—	—	—
Mussaenda frondosa	25	28.96	—	—	—	—	—	—
Antidesma montanum	29	26.61	10	20.17	—	—	3	9.09
Syzyzium polyanthum	14	23.25	—	—	—	—	—	—
Macaranga tanarius	13	19.26	—	—	—	—	1	3.24
Nephrolepis hirsutula	11	11.30	—	—	—	—	—	—
Bridelia monoica	6	11.00	1	2.77	—	—	—	—
Angiopteris evecta	6	9.35	—	—	—	—	3	41.09
Tetrastigma lanceolarium	5	8.10	51	68.72	1	5.84	1	3.24
Terminalia catappa	5	7.77	3	3.98	1	5.84	—	—
Flagellaria indica	4	7.21	1	2.77	—	—	—	—
Hoya diversifolia	11	7.05	—	—	—	—	—	—
Ficus tinctoria	7	6.56	1	12.63	—	—	—	—
Ficus fistulosa	2	6.51	2	3.17	1	7.23	—	—
Tylophora asthmatica	3	3.83	1	2.77	8	21.90	9	20.89
Leea indica	3	3.83	4	10.76	—	—	17	19.61
Oncosperma tigillarium	1	3.82	12	13.24	4	7.86	3	13.29
Smilax zeylanica	2	3.48	2	3.17	—	—	—	—
Drynaria quercifolia	2	3.36	—	—	—	—	—	—
Tectaria melanocaula	3	2.72	—	—	—	—	—	—
Dysoxylum gaudichaudianum	2	2.14	1	2.57	1	5.84	46	53.05
Lygodium flexuosum	1	2.02	27	54.51	—	—	2	6.62
Ficus septica	1	2.02	—	—	1	5.84	—	—
Buchanania arborescens	1	1.79	2	3.78	—	—	3	8.78
Nephrolepis biserrata	—	—	20	28.88	1	5.84	—	—
Tectaria dissecta	—	—	7	10.21	—	—	1	3.39
Glochidion borneense	—	—	1	6.47	—	—	—	—
Microsorium punctatum	—	—	2	5.95	—	—	27	56.15
Ficus fulva	—	—	2	5.95	—	—	—	—
Arhtrophyllum javanicum	—	—	2	5.54	—	—	1	4.64
Tacca palmata	—	—	2	5.01	—	—	—	—
Tarenna fragrans	—	—	1	4.41	—	—	—	—
Mycetia javanica	—	—	1	4.41	—	—	—	—
Pteris vittata	—	—	2	3.37	—	—	—	—
Cayratia trifolia	—	—	1	2.77	—	—	—	—
Leucosyke capitellata	—	—	1	2.57	—	—	—	—
Ficus ampelas	—	—	1	2.57	—	—	—	—
Calophyllum inophyllum	—	—	1	2.57	1	5.84	1	3.39
Hernandia peltata	—	—	—	—	80	149.52	—	—
Gnetum gnemon	—	—	—	—	8	26.86	—	—
Stenochlaena palustris	—	—	—	—	3	23.66	—	—
Ardisia humilis	—	—	—	—	3	20.09	3	8.78
Dicranopteris linearis	—	—	—	—	1	5.84	—	—
Elaeagnus latifolia	—	—	—	—	10	32.21	—	—
Microsorium nigrescens	—	—	—	—	1	9.30	—	—
Artocarpus elasticus	—	—	—	—	1	3.24	—	—

Table 1. Continued.

Total number of *Oncosperma tigillarium* seedlings recorded within study plots: Plot R1 = 130, R2 = 215, S = 11, P = 47.

Site details			
Site	R1	Locality	S.E. Rakata
Plot size (m^2)	1200	Slope (°)	20
Altitude (m)	10	Vegetation	*Terminalia-Neonauclea*
Site	R2	Locality	S.E. Rakata
Plot size (m^2)	1000	Slope (°)	30
Altitude (m)	50	Vegetation	*Neonauclea*
Site	S	Locality	N.W. Sertung
Plot size (m^2)	1000	Slope (°)	15
Altitude (m)	20	Vegetation	*Timonius-Terminalia*
Site	P	Locality	Central Panjang
Plot size (m^2)	1000	Slope (°)	10
Altitude (m)	120	Vegetation	*Timonius-Neonauclea*

No. = number of individuals.
I.V. = importance value (Relative dominance + relative density + relative frequency. For seedlings, dominance was calculated from cover values.)

to belong to *Corypha utan* (J. Dransfield, pers. comm.). It is thought most parsimonious that the only previous record of *L. spinosa*, in 1982, was also a misidentification of *C. utan*. In the 1989 survey a further species, *Salacca zalacca* (Gaertn.) Voss, has been provisionally identified from Rakata and a confirmed identification of another *Calamus* has also been made, *C. polystachys* Becc. (J. Dransfield, pers. comm.). Thus, excluding the *Licuala*, there are eight palm species known from the Krakatau Islands, of which seven may be regarded as successful colonists.

The first palm species recorded on the group was *Cocos nucifera* L., found in 1897 on Rakata and Panjang. The next record is for nibung in 1920, by Docters van Leeuwen. He found a very young specimen growing in a "wilderness" of *Hibiscus tiliaceus* L. on the sandy spit at the northern end of Sertung. It was mentioned that the soil there was moist but not salty (Docters van Leeuwen 1936). Given his frequent visits to Rakata and occasional visits to Sertung during the 1920s, it is unlikely that it colonized the former, or spread markedly in the latter during this period, as he would typically have recorded such events. The next record of this species is not until 1932, when he found it at two places on Panjang. He did not observe it in his first brief visits to Panjang in 1928/29, but in 1932 he found three young specimens in a mixed wood in the northeast of the island, behind the strandbank and about 10 m from the coast. He also observed some specimens in one of the highest ravines on the south-east side of the island, about 90 m above sea level. The specimens were well-developed and rose with their leaves above the surrounding vegetation, but were not yet flowering (Docters van Leeuwen 1936). The other palms present at this time in the group, *Cocos nucifera* and *Corypha utan*, were respectively slightly more common and slightly less common than nibung. The history of the first fifty years of ecosystem

recovery on Krakatau is thus one of an extreme poverty of palms, both in numbers of species (three) and in numbers of individuals (e.g., contrast with House 1984).

Borssum Waalkes (1960) failed to record *Oncosperma tigillarium* during his botanical observations on the Krakatau Islands in 1951 and 1952, but it should be noted that he spent only a few hours on Panjang and Sertung, in comparison to about 9 days on Rakata. In the more intensive sampling efforts of 1979–1989, the palm has been recorded on each of the three main islands but it has not yet been found on Anak Krakatau (Whittaker et al. 1989: appendix 1 and 2*).

Present Distribution of Nibung

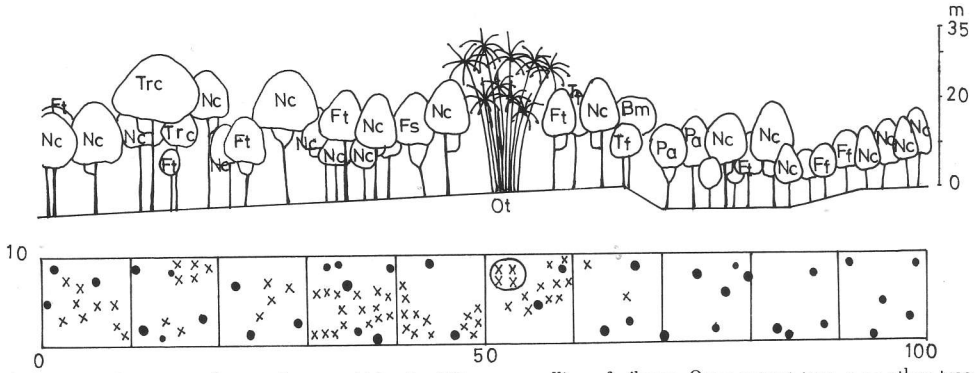
Of 35 vegetation sites (average size approximately 900 m^2) enumerated by the Krakatoa Centenary Expedition in 1979 and 1983/84, nibung was recorded in six (Bush and Whittaker 1986), as follows. Their Rakata site 11 was located at 15 m altitude, in near-coastal *Neonauclea calycina–Terminalia catappa* ecotone forest on the south side of the island. The palm was large enough to be recorded as part of the tree layer, with 2.7% csa (cross-sectional area). On Sertung, it was found in sites Ser 10 (2.63% csa) and Ser 11 (present but <30 cm girth), respectively at 35 m and 80 m altitude. The former site was in the *Terminalia catappa–Timonius compressicaulis* forest, the latter in *Timonius compressicaulis* forest. Both sites were at the northern end of the main part of Sertung. In Panjang, nibung was present in sites Kec 1 (Kecil = Panjang), Kec 2, Kec 5, each as individuals of less than 30 cm girth, and respectively at altitudes of 90 m, 115 m, and 90 m, in the northern half of the island (Fig. 1).

During the 1982 and 1983 Kagoshima/Bogor expeditions, the first author (TP), also observed several clusters of flowering and fruiting nibung on Panjang, Sertung and Rakata. In 1989 particular attention was paid to this species, and patches of seedlings and trees were observed scattered within the three islands (Fig. 1). Four additional sites were selected for detailed study (above). In these plots (R1, R2, S, and P), 34 arboreal species were recorded, belonging to 28 genera and 17 families (Table 1).

The two Rakata plots, R1 and R2, were located on the gentle slope of south-east Rakata at altitudes of 10 m and 50 m above sea level. The vegetation of both sites was dominated by *Terminalia catappa* and *Neonauclea calycina* (Fig. 2 and Table 1), with the former providing the tallest trees, of about 35 m height. The second layer consisted of a mixture, principally of *Timonius compressicaulis*, *N. calycina*, *Dysoxylum gaudichaudianum* and nibung itself. The data in Table 1 are entirely compatible with the coastal and near-coastal vegetation types described for Rakata by Whittaker et al. (1989). The nibung clusters consisted of about 7 stems in the first plot and 21 stems in the second plot. Most of the nibung trees were flowering and fruiting. In the third layer, there were several shrub species, such as *Antidesma montanum*, *Leea indica*, *Leucosyke capitellata* and *Villebrunea rubescens*. The ground vegetation layer was characterized by *Tetrastigma lanceolarium*, *Nephrolepis biserrata*, *Lygodium flexuosum* and nibung. The latter occurred as seedlings in both sites, most numerously in R2, in which the species was clearly better established (Table 1).

Plot S was placed within the *Timonius compressicaulis* forest on the west side of Sertung island (Fig. 1, Table 1). The emergent trees consisted of *Terminalia catappa* and *Hernandia peltata*, reaching heights up to about 30 m (Fig. 3). The main canopy was characterized by *T. compressi-*

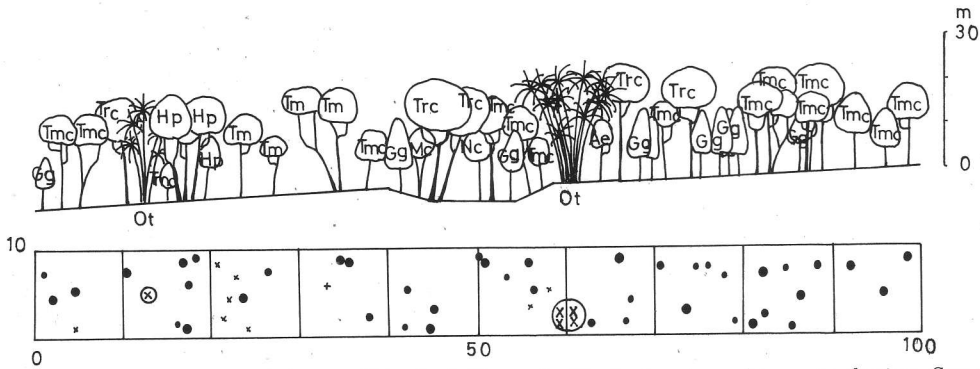
* See for taxonomic authorities of species mentioned in this paper, unless given here.



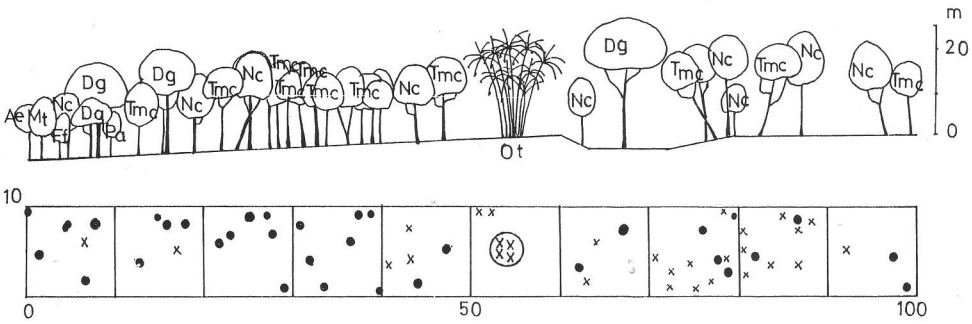
2. Profile diagram and map of trees within plot R2. x = seedling of nibung. Ot = parent tree. • = other tree species Bm = *Bridelia monoica*, Fs = *Ficus septica*, Ft = *Ficus tinctoria*, Nc = *Neonauclea calycina*, Pa = *Pipturus argenteus*, Ff = *Ficus fistulosa*, Trc = *Terminalia catappa*, Tf = *Tarenna fragrans*.

caulis and, to a lesser extent, *Neonauclea calycina*. In this less mature forest nibung grew as an emergent tree, in a cluster of 8 stems. There were some saplings of nibung in the second layer, but it was dominated by *Gnetum gnemon* (common at this end of Sertung). In general the ground vegetation was sparse, due to the relatively dense arboreal cover. However, a small number of nibung seedlings were observed in hollow sites near to the parent trees (Table 1).

The last plot (site P) was established on the central ridge of Panjang, which supported a *Timonius compressicaulis* community unusually rich (for Panjang) in *Neonauclea calycina*, such that it might be termed a patch of *Timonius–Neonauclea* forest. The shrub/sapling data (Table 1) indicate this site to be transitional to *Dysoxylum gaudichaudianum* forest, a pathway described by Whittaker et al. (1989). As in plot S, the forest had a relatively thin, broken canopy (Fig. 4), typical of *T. compressicaulis*, allowing healthy growth of the nibung, the crowns of which were an important component of the main forest canopy layer. Although requiring shade in the early stages of growth, *Oncosperma tigillarium* is known as a facultative light demanding species when approaching reproductive maturity;



3. Profile diagram and map of trees within plot S. Key as for Fig. 2, plus: Ae = *Artocarpus elasticus*, Gg = *Gnetum gnemon*, Hp = *Hernandia peltata*, Mc = *Morinda citrifolia*, Tmc = *Timonius compressicaulis*.



4. Profile diagram and map of trees within plot P. Key as for Figure 3, plus: Dg = *Dysoxylum gaudichaudianum*, Ff = *Ficus fulva*, Mt = *Macaranga tanarius*.

however, exposure is needed gradually for its development into the mature tree (House 1984). This was reflected by the occurrence of several small clusters of nibung under quite dense forest canopies (e.g., see Fig. 2). The data presented here are interpreted as showing nibung to be insensitive to community type within these near-coastal forests and to have no obvious association with other plant species.

Distribution of Nibung in Relation to Environment

In mainland Java, Sumatra and Kalimantan, nibung is generally known from brackish swampy areas or behind the tidal forests (Steenis 1935). Backer and van den Brink (1968) mention that nibung can be found at altitudes between 1 and 50 m above sea level, extensively associated with near-coastal localities, salt water swamps and "denudated rocks." Interestingly, Hommel (1987) describes an *Oncosperma tigillarium–Salacca edulis* (=*S. zalacca*) vegetation community from a low-land fluvio-alluvial plain within Ujung Kulon (west Java). It is described as secondary in status and is near-coastal in location, but its distribution explicitly does *not* include the coastal plains, swamps and beaches. It is not stated, however, whether *O. tigillarium* itself is similarly restricted. In the relatively aseasonal climate of Siberut (140 km west of Sumatra) another member of the genus, *Oncosperma horridum* (Griff.) Scheff., occurs commonly in the interior, but is replaced by *O. tigillarium* near the coast on sandy beach-derived deposits and along the tidal stretches of large rivers (House 1984). House found on Siberut that both species show a preference for coarse-textured, well-drained soils, of low fertility, and that these conditions were more often met with on slopes rather than in hollows. On Krakatau, such conditions are more or less ubiquitous and indeed drought conditions in the dry season are more likely to be limiting than is water-logging.

Within Krakatau, nibung has been found in Rakata, Sertung and Panjang at altitudes between 2 and 150 m above sea level. Although the young plants of *Oncosperma tigillarium* are reported to tolerate saline conditions (Koebernik 1966), no seedlings were recorded close to the shore line during the present study. The closest individual of nibung to the shore was about 10 m from an eroding coast. We conclude therefore that at least in the Sunda Straits area, it behaves as a near-coastal but not strand-line species.

Dispersal and Regeneration

The fruits of nibung are globular and about 12 mm in diameter. At first they are dark green but they turn black-purple on ripening (Backer and van der Brink

1968). Docters van Leeuwen (1936) was of the view that they had been brought to the islands by birds, probably the pigeon *Myristicivora bicolor*, which occurred at that time in large numbers. In support of this he cites observations of Ridley (1930) that the fruits are taken by other pigeons and, the facts that the young plants stood together in groups within woodland some distance from the beach.

The maximum distance that seeds were found from the parent trees within the study plots was about 10 m. A detailed count of the number of seeds in the vicinity of selected parent trees is shown in Table 2. House (1984) states that the closely related *Oncosperma horridum* does not germinate in open, sunny conditions but that the shade requirement for establishment and early growth is gradually lost as the palm grows into the main tree canopy. Nibung may well have a similar autoecology, requiring shady, humid conditions in the early stages. This is supported by our field observations that seedlings of nibung tended to be found in largest numbers in the moister sites within the study plots examined. In addition to seed production, nibung clumps also increase by the production of new buds at the base of the trunks of mature plants.

The distribution and population dynamics of nibung on the Krakatau Islands may be influenced by many factors. Strong winds, unconsolidated substrates and heavy rain all contribute to tree-fall. This means that canopy structures are relatively unstable. As important, the forests of Panjang and Sertung have been significantly disturbed by volcanic action on several occasions (above). It is hard to judge the impact on the nibung populations of these processes. The populations have spread as well on the more disturbed islands Panjang and Sertung as on Rakata, on which, however, it arrived most recently. The known distribution of the species within the islands suggests that most seed falls close to the parent trees, but that populations on each island have gradually spread from the initial colonization point, presumably aided by occasional animal-dispersal of seeds into suitable sites. Although nibung is not known as a true gap exploiter, it needs canopy space for successful flowering and fruiting. The seed falling very close to the parent trees is effectively "wasted," as the effects of continuous shading from the dense array of palm crowns, the damage caused by falling palm fronds and competition with parent plants leads to poor prospects of survival. The apparent ineffectiveness of dispersal agencies (Table 2) may thus be a limiting factor on the spread of the species, although the proportion of seed production involved is unknown. On the other hand, the buds shooting from the base of the trunk will generally be protected from the fallen palm leaves since nibung stems (especially the outer side of the clusters) tend to be a bit bent. As the palm, when full grown, is often taller than the surrounding trees, particular clumps may thus persist well. It may be that the main factor limiting the spread of nibung is low levels of soil moisture, particularly in the dry season. Comparison of data in Tables 1 and 2 indicates better initial germination and establishment rates in the deeper shade and more mature forests of Rakata;

Table 2. Densities of nibung seeds per m^2 on the study plots.

Distance from parent tree (m)	Nibung seeds				
	Plot				
	R1	R2	S	P	Average
0–1	6	11	1	2	5 (±4.6)
1–2	8	14	1	1	6 (±6.8)
2–3	8	17	6	1	8 (±6.7)
3–4	2	6	4	1	3.3 (±2.3)
4–5	7	5	3	1	4 (±2.6)
5–6	1	0	1	0	0.5 (±0.6)
6–7	0	0	2	0	0.5 (±1.0)
7–8	0	0	1	0	0.3 (±0.5)
8–9	0	0	0	0	0 (±0.0)
9–10	0	0	0	0	0 (±0.0)

although this remains something of a matter for speculation. It was also noted, however, that the development of the nibung population appears to be threatened by illegal cutting on each island.

Conclusions

1. In the first fifty years of recovery following sterilization in 1883 only three palms species were recorded on Krakatau, *Oncosperma tigillarium* being one of them.

2. After 106 years, eight palm species are known, all but one of these having established a continued presence. Nibung has now established a scattered distribution in near-coastal vegetation, below 150 m altitude and away from the strand-line.

3. Nibung appears from our data to be relatively insensitive to the between-island differences in vegetation, soil development and disturbance histories within the Krakatau islands.

4. Its spread appears to be limited by the effectiveness of local dispersal agencies and quite possibly by soil moisture conditions. Nonetheless it forms an occasional canopy component in all three original islands of the group.

5. We hope that this paper, although leaving many unanswered questions, may serve to awaken further interest in the ecology of palm colonization within tropical forest successions.

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Palms of China

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While gathering information on the role of palms in the economies of Southeast Asia and the Neotropics (Griffiths 1989*a*, *b*), I was struck by the paucity of information on palms from mainland China; what little material was available had the added disadvantage to general readers that the information was written in Chinese script! Realizing that China might be a source of useful information I embarked on a project to investigate the role of palms in China, both from the standpoint of their cultural role in the history of that country and their economic usefulness. I am fortunate to be in the somewhat privileged position of being on the doorstep of China and having at my disposal a number of colleagues who could help in the work of translation; the result of this effort is summarized in this short communication.

Palms are a feature of the Chinese indigenous flora and have been exploited since early recorded history as a source of food, shelter, timber, and pharmaceutical products. In searching early Chinese literature for information, one encounters the basic problems of nomenclatural identity and the correctness of assigning data written in Chinese ideograms to the corresponding Latin equivalent. This problem has been encountered by numerous sinologists in the past and in particular has been commented upon by Bretschneider (1882), a physician to the Russian Legation in Peking and an expert sinologist interested in botanical aspects of Materia Medica of the ancient Chinese kingdoms. He reports as follows:

"The first difficulty that arises is to find out where to look for the plant about which information is required. Chinese botanical works note from 5000 to 6000 names of plants, the synonyms of each plant being for the most part numerous. The Chinese have nothing similar to the alphabetical indexes of our comprehensive works.

It cannot be said that the style of Chinese writers on botanical matters presents difficulties to European readers acquainted in some degree with the language. In describing plants the authors use for the most part always the same terms. The chief obstacles encountered by European inquiries studying these writings will be found to consist in the right interpretation of geographical names which occur, and in ascertaining the time when the quoted works were composed.

The only exact method of ascertaining the botanical names corresponding to Chinese denominations of plants is to obtain the plants *in natura* and to determine them. I may however observe that, although the common cultivated plants are known under the same Chinese names all over the Empire, many other plants, especially drugs, go under different local names in different provinces.

The first difficulty we encounter in identifying Chinese names of plants with the scientific appellations, is to secure trustworthy and competent natives to procure authentic specimens of the plants desired."

Although palms were used locally to provide the everyday necessities for living in primitive conditions, i.e., timber, shelter and food, etc., ancient Chinese communities were seemingly obsessed by the identification of plant extracts as a cure for ills, as stimulants and as balms for bodily abrasions. A great folklore developed in various regions of China where voluminous works were produced extolling the virtues of various drugs to alleviate pain and suffering and to help the patient to lead a full and fruitful life!

Again, in trying to ascertain the exact botanical identity of many of these drugs one runs into the ever-present problem of nomenclature. For example, Bretschneider (1882) states:

"The majority of drugs dealt with in Chinese treatises on Materia medica are yielded by wild growing

mountain plants. The mountains of Chihli, Shantung, Shansi, Honan and Sz' ch'uan are especially famed for the medicinal herbs they produce. These drugs (roots, leaves, flowers, fruits, etc.) for the most part reach the apothecary's shop cut in little pieces or pulverized. The apothecary knows nothing about the plants from which they are derived, nor concerning the place whence they have been gathered. Our specialists in Europe are also seldom able to determine these fragments."

The first attempt by Europeans to describe Chinese drugs was made by Gauger (1848) in his "Repertorium für Pharmacie und practische Chemie in Russland" who described 54 drugs with their Chinese names but gives no accurate botanical descriptions.

In describing the pharmaceutical uses of palms *per se* ancient writers are somewhat scant in their descriptions and one is left with a tantalizing statement that extracts of the plants are "efficacious in childbirth" or "good for colds" etc.

In this paper I will attempt firstly, to give a historical background to Chinese writings on botanical subjects with special reference to the palms.

Palms in the Ancient Texts

Among the earliest Chinese treatises giving a systematic account of plants is the Nan-Fang Ts'ao-Mu Chuang written in the 4th century by Chi Han and now available in an English translation by Li (1979). The book deals with the tree flora of southern China and lists, among others, the Sugar palm (*Arenga pinnata*); the date palm (*Phoenix dactylifera* L.); the Betelnut palm (*Areca catechu*), and the coconut palm (*Cocos nucifera*).

For example, the author Chi Han names the sugar palm (*Arenga pinnata* (Wurmb.) Merr. syn. *A. saccharifera* Labill.) as Kuanglang but only refers to its usefulness in making ropes from the bark and for the extraction of a flour from a region just under the bark. He does not mention the formation of the inflorescence from which natives in Burma and Malaysia obtain sugar-yielding sap.

This palm was previously mentioned in the 3rd century treatises "Kwang Zhi" and "Buo Wu Zhi" and also mentioned as being of economic value in the 4th century text, "Ben Cao Shi Yi Hua Yang Guo Zhi" and also in the 16th century treatise, "Pen Ts'ao Kang Wu." This latter treatise on Materia Medica and Natural History was written by Li Shi Chen in 1552 and took twenty six years to complete. It is probably the treatise on Materia Medica most widely quoted by European sinologists.

The date palm (*Phoenix dactylifera* L.) is referred to as Hai-tsao-shu or the jujube tree. The author states that the taste is very sweet and agreeable. The date palm has probably existed since prehistoric times in Northern Africa and Asia Minor and some of the Chinese names refer to its foreign (e.g., Persian) origin.

The Betel-nut Palm (*Areca catechu* L.), known in Chinese as Pin-lang-shu, gets a more extensive treatment from Chi Han presumably because of its obvious pharmacological attributes. The description given below is that derived from the translation of the original description by Li (1979):

"The Pin-lang-shu are over one hundred feet in height. The bark resembles the Ch'ing'tung and the joints, the Kuei-chu. The trunk is not enlarged at the bottom nor narrowed at the top. It is straight and ascending, and tens of thousands of this tree look exactly the same, green and stately and without branching. From the top grow the leaves which resemble the leaves of the banana, broken into strips along the veins. Gazed up at from a distance, they appear like numerous banana leaves stuck on top of bamboo sticks, swaying in the wind like numerous feathered fans sweeping the sky. Below the leaves are attached several spathes . . . , each with clusters of several tens of fruits. The fruits are as big as peaches and plums with naturally formed spines densely covering the base; these protect the fruits. Cut open the skin and peel off the flesh; the taste is acrid and astringent. When hung and dried, the fruit becomes hard like dried jujube. By taking it together with betel-leaf and oyster-shell lime . . . , it is slippery and tasty, and it dissolves gases and promotes digestion. It grows in Lin-i, where the people consider it valuable. . . . Another name is Pin-men-yao-chien (guest door medicinal sweet-meat).

Chi Han was obviously aware of the prevalence of this nut as a masticatory and presumably was aware of the intoxication produced in subjects following prolonged chewing. He is also aware of the use of the nut as a socializing factor and "distinctly emphasizes that inadvertant omission of presenting betel-nut to a guest would be a mark of enmity" (Li 1979). We know from many betel-eating societies that its effects are anthelmintic in animals and a decoction of the nut is recommended in cardiac conditions and as an astringent lotion for eyes. The decoction is also applied to ulcers, bleeding gums and for urinary discharges. Essential oils from the leaves are said to be effective in bronchitis, laryngitis and throat inflammations; it is also used to induce labor. The active ingredients are the alkaloids, arecoline, arecaine, guvacine and guvacoline. It is listed in America as a narcotic stimulant and the deleterious effects of the alkaloids have been listed; large doses, e.g., 8–10 seeds can be fatal. Subcutaneous atropine is suggested as an antidote.

The value of *Areca* palm in the Chinese pharmacopoeia is evident when one considers that authors such as Lu Ho, in his Shih-wu pen-ts'ao (Materia medica of Nutrition), written in the 16th century describes the value of this palm in a virtually identical manner and describes the active principle, Ping-Lang as follows:

"Ping lang. Taste: acrid; [thermo-influence:] warm; no distinct medicinal strength. [The drug promotes] the digestion of grains and eliminates water. It removes mucous congestions. It relieves sensations of repletion, breaks through [obstructions in the flow of] the body's influences and drains obstructions in the body's depots and palaces. It is added to all medications meant to descend [in the body]. It kills the Three Worms and the tapeworm. If [this drug] is consumed in large amounts, it damages one's original influences. The people in Fukien and Kanton wrap the ping-lang in the leaves of the chu-chiang [plant]. The resulting taste is acrid-aromatic, and a pleasant feeling in the area of the diaphragm is produced. If lime prepared from shells is added, the effect should be even better. However, [after the use of this preparation], a red substance must be spit out, which is not particularly aesthetic." [Quotation after Unschuld 1986]

The coconut palm (*Cocos nucifera* L.) receives scant treatment and mention is made only of the taste of the flesh (endosperm) though drinking the juice is said to induce intoxication presumably after it has fermented. Mention is also made of the legend referring to the shape of the fruit:

"It is colloquially called Yueh-wang-t'ou (head of the king of Yueh). It is said that once upon a time there was a feud between the king of Lin-i and the king of Yueh. The former sent a knight-errant to assassinate the latter and cut off his head and hung it on a tree. It suddenly changed into a coconut. The king of Lin-i was angered and had it cut open and made into a drinking vessel. This custom is still followed by the people of the South. It is said that when the king of Yueh was being killed, he was very intoxicated and thus the juice of the coconut was just like wine." (Li 1979).

Later writers have referred to the beneficial effects of eating the flesh in that it promotes a healthy plumpness of figure and face! The flesh is variously described as being "heating" or "cooling" to the body and useful in the treatment of haematemesis and dropsy. The bark of the coconut palm can be used as an astringent and styptic remedy in haemorrhages and fluxes and the incinerated shell when mixed with wine may be used as a treatment for secondary and tertiary syphilis (Smith 1871). The only other palms mentioned in the Nan-Fang Ts'ao-Mu Chuang are *Livistona chinensis* R. Br. and *Trachycarpus*.

In his important work, Botanicon Sinicum, Bretschneider (1895) refers to an obscure Chinese text, the Shan hai king, which I have been unable to trace, and in it is described a palm *Trachycarpus fortunei* called either "Tsung" or "ping lu." Confirmation for the identity is provided by the 11th century author Su Sung who refers to the same palm under the epithet "Tsung lu." Both descriptions refer to terminal leaves atop a stalk forming a circle resembling a wheel with spokes. Some con-

fusion remains as Bretschneider considers the palm *Chamaerops fortunei* to be identical to *C. excelsa* described by Kaempfer in 1712 in his Amoenitates Exoticae along with other palms (and this is the quite different *Rhapis excelsa*).

In searching the Chinese botanical literature readers frequently note major omissions, due presumably either to a genuine lack of knowledge or else a total lack of interest in a particular group of plants. One such omission is the complete absence of a mention of palm or palm trees in the 12th century text, Kiu Huang Pen Ts'ao—"a treatise on plant fit for supporting life in time of scarcity" (Bretschneider 1882). The author (probably Chou ting Wang—an Imperial Prince but possibly his son Chou hien Wang) made a detailed study of plants suitable for use as food and derived a greater part of his information from peasants and farmers.

The next major work to identify palms was the 16th century treatise. Ben Ts'ao Kang Wu—written by Li Shi Chen (who also wrote under a number of pseudonyms). As was stated previously this is probably the most widely quoted ancient Chinese work on Materia Medica by European scholars and is an impressive compilation of facts and illustrations in some 52 chapters (referred to as 52 books in Chinese). The first few chapters were devoted to the bibliographic details of previous writers; the natures and properties of medicines, and a list of diseases and the prescriptions available as remedies. The remaining 46 chapters represent the main body of the text being an account of the various drugs and the classification of natural objects. Palms are discussed under the general heading "Fruits" and more specifically under "Foreign Fruits." The following palms are mentioned:

Areca catechu
Cocos nucifera
Borassus flabellifer
Persian dates (*Phoenix*)
Caryota

Under the heading "Aromatic Trees" is mentioned "Dragons blood" which might possibly refer to the palm *Daemonorops draco* Bl. while the section on "Stately Trees" contains a reference to *Trachycarpus fortunei.*

While the Ben Ts'ao Kang Wu is recognised as an important work of reference some authorities have questioned the accuracy of the botanical identifications within the text. For example Sampson (1869) makes the following pertinent point:

> "Other names are however given, with less certainty of correct identification, some of them probably referring to other Palms of which the writers have heard, and in their ignorance have "lumped" with the Cocoa nut, a process to which the Pen Ts'ao in particular is very prone."

This writer also gives an excellent account of the etymology concerned with the various Chinese names used to describe the Persian date (*Phoenix*).

The next important treatise to mention Palms is the 17th century work, Nung Cheng Ts'uan Shu written by Su Kuang R'i but incomplete on his death in 1633. The manuscript was completed by Tsz'lung in 1640. The title may be translated as "Complete Treatise on Agriculture" and the two palms *Trachycarpus fortunei* and Cocoa-nut (*sic*) tree are mentioned in Books 37–38 "On Planting Trees."

Trachycarpus fortunei is also mentioned in the 17th century text Shou Shi T'ung K-ao—a compilation of various economically important plants but the work provides little attendant discussion or critical examination of the plants.

The Modern Texts

Many of the earliest Chinese texts on matters relating to science and agriculture were known and available only to a comparatively small European audience and restricted to those scholars who had a

knowledge of the written Chinese script and a background of ancient Chinese literature. However, with the advent of widespread exploration of distant lands, particularly countries of Asia, by European voyagers in the eighteenth and nineteenth centuries there resulted in Europe a dramatic increase in the awareness of exotic plants and for example, an expansion of Botanic gardens in many European cities where unusual plants were seen for the first time by an incredulous audience. Along with a general interest in plants came a reevaluation of Chinese botanical and agricultural literature and the availability, often for the first time, of translations relating to these fields of study.

Mention has already been made of the 17th century treatise Nung Cheng Ts'uan Shu (a treatise on agriculture completed in 1640) and the Amoenitates Exoticae of Kaempfer in 1712 which, although describing the flora of Japan gave the names of many plants in Chinese characters and gave European scholars botanical descriptions coupled with the correct Chinese ideograms. The nineteenth century saw a proliferation of works devoted to Chinese Botany and agriculture among which was the "English and Chinese Dictionary" of Morrison, published in 1822 and containing the Latin names and Chinese equivalents of 148 plants native to Southern China. Brigeman's "Chinese Chrestomathy" contains the Chinese and English names of 445 plants and in 1863 Williams published his "Chinese Commercial Guide" which contained a list of commercially important plants. In China too 19th century works such as the Zhi Wu Min Shi Tu Kao Chong Pien described economic plants including palms.

A somewhat curious publication to yield information specifically on the palms of China is the "Notes and Queries on China and Japan" published in the last century by Charles A. Saint. In Vol. 3 of this work are found two most useful papers describing both the botanical description, economic importance, and correct Chinese etymology of a number of palms by Sampson (1869) and Bretschneider (1869). Sampson's notes in particular, are most valuable to anyone wishing to study the origin of orthography in relation to the names given to palms.

One of the most important contributions to bring details of the studies of Chinese Botany to the attention of Europeans was by Bretschneider (mentioned above) who summarized all of the previous European studies on Chinese studies in his "Early European Researches into the Flora of China" published in 1880. In this work the author gives accurate botanical descriptions in Latin of the following palms found in and described from China with their correct Chinese ideograms; *Areca catechu*; *Caryota*; *Phoenix pusilla* and *Cocos nucifera*.

Bretschneider, in Vol. I of his Botanicum sinicum, refers somewhat scathingly to work published some 10 years before his own (i.e., in 1871) by Dr. Fr. Porter Smith under the title "Contributions towards the Materia Medica and Natural History of China" in the following terms:

> "[The book] which has often been quoted as a standard work in his department by people who cannot discern its real value, and who rely upon the assurance with which the author's information is presented. Dr. P. Smith's book indeed contains notices of a great number of Chinese drugs: Chinese and scientific names are always given and identified without any hesitation. One might believe that Chinese Pharmacology is as well known to Europeans as our own drugs are to us, and that Dr. P. Smith has left nothing to be done in this department. But if anyone attempts to examine the matter thoroughly, he will soon be aware of the arbitrary character of his identifications and of the insufficiency of the knowledge we really possess with regard to Chinese drugs and economic plants. Thus, P. Smith's scientific denominations of Chinese plants, being drawn without any critical discernment from trustworthy and untrustworthy sources, have little value and render his book unreliable for any scientific purpose. It cannot however, be denied that there are in it many interesting accounts, translated from Chinese works, relating to the medical virtues ascribed by the Chinese to their drugs."

Smith refers to the palms *Areca* and

Cocos and provides notes on their use in medicine.

The only work known to me which has a section devoted specifically to palms is the book, "Forest Botany of China" by Lee (1935). In it the author gives both a key to the family Palmae as well as descriptions of the following genera and their representative species: *Phoenix*, *Trachycarpus*, *Rhapis*, *Licuala*, *Livistona*, *Calamus*, *Caryota*, *Arenga* and *Areca*. The author also gives notes on the distribution of each palm within China.

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Principes, 36(1), 1992, pp. 25–27

Mycoflora of Roots of Texas Palm (Sabal mexicana) in Louisiana

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Root rot has been reported as a problem of palms worldwide (Carpenter and Elmer 1978, Djerbi 1983, Joseph 1978, Joseph and Jayasankar 1982). Various fungi have been associated with serious damage to the root system expressed aboveground as decline, dieback or death of the entire plant (Carpenter and Elmer 1978, Joseph 1978, Joseph and Jayasankar 1982).

Several dozen Texas palms in New Orleans, Louisiana display symptoms of decline or dieback and root rots have been associated with these symptoms since the early 1980's. Attention was drawn to these palms because they either were leaning at angles other than vertical which is normal for the species or had completely fallen over. Damage caused by root rots is difficult to assess in the field.

Our objectives were to determine 1) the frequency of fungal invasion of roots of Texas palm and 2) the extent to which invaded tissues show disease symptoms.

Materials and Methods

Belowground parts of four asymptomatic and five symptomatic Texas palms were assayed for internally borne fungi. Roots were exposed, cut with a shovel and washed to remove loose soil. The cut plant roots were kept on ice en route to the laboratory, where they were cleaned by agitation in a mild detergent solution and rinsed under running tap water. Root sections were cut into about 1-cm pieces, and pieces were randomly selected for assay. Tissues assayed from each plant included 20 pieces of root replicated five times for a total of 100 pieces per root system.

After tissue pieces were examined for discoloration or necrosis, they were surface-sterilized in an aqueous solution of 0.5% NaOCl (Clorox) and 5% ethanol for 2 min, rinsed with distilled water, blotted dry on sterile tissue paper and placed on potato dextrose agar (PDA) amended with 30 mg/L each of chlortetracycline-HCl and streptomycin sulfate. Plates were incubated at 26° C for four days. Fungi were then counted directly or subcultured on PDA for identification.

Data pertaining to fungi isolated from symptomatic and asymptomatic plants were used to calculate relative frequency (RF) of invasion. RF was defined as the number of root pieces invaded per 20-piece sample.

Results

Roots of both symptomatic and asymptomatic plants rarely showed disease symptoms. From symptomatic plants 11% of the total number of root pieces assayed were discolored while those from asymptomatic plants numbered less than 3% although one or more fungi were isolated from over 75% of the root pieces regardless of source.

Rhizoctonia solani and *Fusarium* spp. were isolated most often from symptomatic plants with means of 19.4 and 4.6, respectively (Table 1). *Curvularia* spp., *Trichoderma* spp. and *Phoma* spp. were isolated less often with RF values of 2.1, 1.5 and 0.4, respectively.

Table 1. Relative frequency (RF) of isolation of fungi from roots of symptomatic and asymptomatic plants of S. mexicana *in New Orleans.*

Fungus	Symptomatic (RF means)#	Asymptomatic (RF means)#	Significance
Curvularia sp.	2.1 c	1.2 b	ns
Fusarium sp.	4.6 b	2.2 b	*
Phoma sp.	0.4 d	0.7 c	ns
Rhizoctonia solani	19.4 a	8.5 a	*
Trichoderma sp.	1.5 cd	9.5 a	*

RF = the number of root pieces invaded per 20-piece sample. Means in columns followed by the same letter do not differ according to LSD (P = 0.05).

* Indicates significant differences between means in a row ($P = 0.05$, ns = not significant).

From asymptomatic plants *Trichoderma* spp. and *R. solani* were isolated most often with RF values of 9.5 and 8.5, respectively. *Fusarium* spp., *Curvularia* spp. and *Phoma* spp. were found less frequently (Table 1).

When RF values of symptomatic versus asymptomatic plants were compared, symptomatic *R. solani*-infected root values were significantly greater than when compared to its presence on asymptomatic plants. The same was true for *Fusarium* spp., but the opposite was true for *Trichoderma* spp. (Table 1). The other fungi isolated did not differ in frequency regardless of source.

Discussion

The fungi isolated from the root systems of symptomatic and asymptomatic Texas palms were the same regardless of source. Root discoloration percentage varied slightly but the percent of root pieces from which one or more fungi were isolated was very high.

In symptomatic plants the RF of *Rhizoctonia solani* was significantly greater than for any other isolated fungus. It was found more than four times that of any other fungus. *R. solani* is a known root rotting organism of several species of plants (Agrios 1988). Its presence in such quantity may explain the slight increase in the observed root discoloration of the symptomatic plants and the presence of aboveground symptoms. Currently pathogenicity studies are underway to determine the role of *R. solani* in this process.

Trichoderma spp. was more prevalent from the roots of asymptomatic plants. It was evident that as *Trichoderma* spp. increased, the RF of *R. solani* decreased. *Trichoderma* spp. is a known antagonist to several fungi (Agrios 1988, Chet and Baker 1980) and probably explains the decrease in the presence of *R. solani*. The reduction in the presence of *R. solani* from the roots of asymptomatic plants further supports the theory that *R. solani* plays an important role in the deterioration of Texas palm root systems and subsequently leads to symptom expression.

Some fungi commonly isolated from palm roots, species of *Monacrosporium*, *Cylindrocarpon*, *Pythium* and *Penicillium* were noticeably missing in our study. These fungi might have been present but not detected because of competition from other microorganisms, incompatibility with Texas palm or unsuitability of the culture medium used for isolation.

Even though we observed relatively little root discoloration or necrosis indicative of disease, fungi, including reported root pathogens, were frequently found. Perhaps the presence of fungi in symptomless Texas palm root tissue is a more common phenomenon than previously believed. For symptomless but invaded roots to become diseased may require one or more stress factors or the natural weakening of senescence to trigger pathogenic activity by these fungi.

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Tapping Patterns of the Kitul Palm (Caryota urens) in the Sinharaja Area, Sri Lanka

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Palms are perhaps the most beneficial of plants to people in the Tropics. A typical example is the familiar kitul palm (*Caryota urens* L.) native to humid Tropical Asia. In Sri Lanka it is best known for the production of jaggery (a crude brown sugar) and treacle. Both are traditional sweeteners, and their usage and popularity are island-wide. At the village level it is of economic importance, especially for communities living along forest fringes, providing a significant source of income to the people.

The sugar sap from the inflorescence which yields jaggery, is converted to toddy, a weak alcoholic beverage, and then to vinegar on fermentation. The palm also has several other well known uses. The wood is strong and beautiful. The inner tissue of the stem yields a starchy substance which can be used as sago. The leaves yield "salopa" or "kitul" fiber as it is popularly known in Orissa and is obviously the origin of the currently used Sinhala term. Also the word "jaggery" may have originated from "chakkaray" as it is called in Travancore (Sawyer 1895). The uses of the palm are most comprehensively documented by Watt (1889) in the Dictionary of Economic Products of India, while the palm is discussed in a more Sri Lankan context by Molagoda (1945).

The Kitul Palm

The handsome kitul palm attains 40 to 60 feet (15 to 20 m) in height under favorable conditions. Its large bipinnate leaves reach as much as 6–7 m in length. The ultimate leaflets are very characteristic, shaped somewhat like the tail of a fish, thereby earning the popular English name, the "Fish-Tail palm" (Trimen, 1898).

The kitul palm grows wild in the low country wet-zone of Sri Lanka and is a component of the rain forest understorey. It is found more often in cool shady valleys. Because of its utility value, it is commonly found growing in home gardens, but rarely is it cultivated.

Kitul Tapping in Sinharaja

In the Sinharaja area, where the only sizeable extent of lowland rain forest still remains in Sri Lanka, the villagers who live in and around the forest depend greatly on the production and sale of jaggery for their livelihood. As in most palms, in kitul too, the sugar sap is extracted from the young inflorescence. The method and process of extraction vary in detail from place to place. The tapping patterns, evolved through many centuries of practice, are often associated with a great deal of custom and ritual. In relatively undisturbed forest areas such as Sinharaja, one could expect the practice of tapping the kitul palm to have changed little with time, the original methods being still preserved to a great extent.

Rapid destruction of natural forests usually brings about the disintegration of traditional communities. It is therefore impor-

tant that where these traditions still continue, an attempt be made to document the numerous uses made of forest products by the villagers. These uses are steeped in tradition and culture; often based on sound ecological principles realized through knowledge and experience accrued through time.

The Process of Tapping

Flowering. It is believed that a kitul palm growing in a relatively open area will bloom within a period of 10 to 15 years. However, when growing within the forest, it takes much longer, perhaps up to 15 to 20 years, to bloom, depending on the opportunity the palm has of reaching out to the sun. An experienced tapper is able to recognize a palm which is about to bloom from the gradually changing crown form. On reaching maturity, the palm has a characteristic crown of 10–20 loosely arranged leaves, the mature fronds being horizontal. The younger ones are directed obliquely upwards until the last leaves stand erect.

Once in bloom, it produces several inflorescences for a period of three to five years. The flowering is in reverse order, the first inflorescence appearing at the terminal region of the palm and subsequent ones appearing in successively lower leaf axils. Inflorescences also develop on the bare stem beneath the crown from buds in the axils of leaves shed previously. After the lowest inflorescence has matured into fruits, the tree dies. The mature inflorescence is 3 to 4 m long, much branched with a stout peduncle and numerous pendulous branches. The peduncle curves downwards, and the inflorescence hangs clear of the leaf bases. Usually the first inflorescence is the largest and those developing later progressively smaller in size.

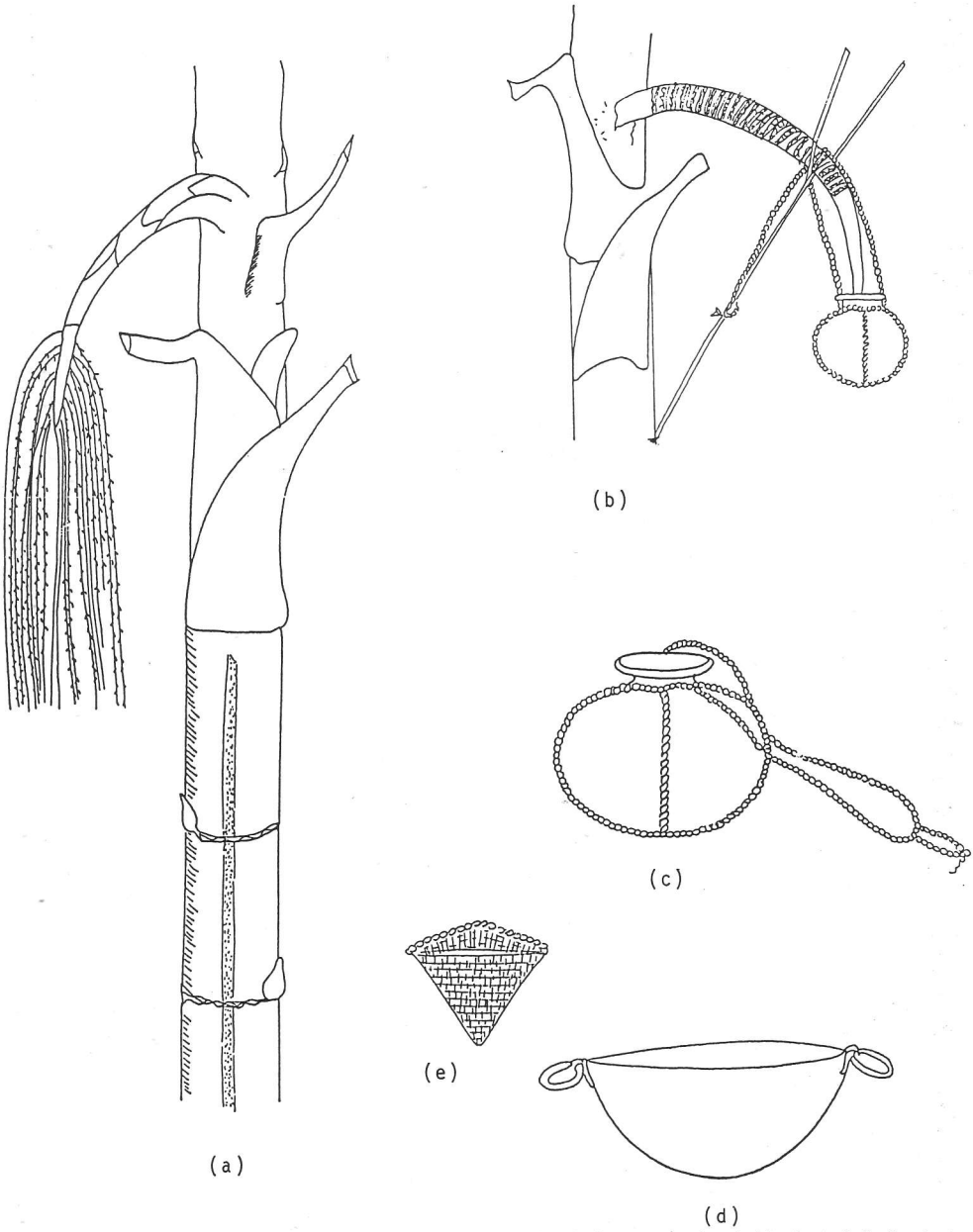
Preparation of the Palm. Once it has been decided to tap the emerging inflorescence, a ladder is improvised to enable climbing up the trunk of the palm. This process is known in Sinhalese as "hera gesima" (Fig. 1a). The ladder consists of a tall staff placed against the palm and bound with woody climbers at regular intervals of about 1.5 ft (0.5 m) to serve as footholds (Fig. 2). In some cases a crude platform is constructed just below the inflorescence.

The wood used for the staff is one that is resistant to decay, that can be rapid in a constantly, humid environment with high microbial activity. The species favored are *Chaetocarpus castanocarpus*, *C. coriaceus* ("Hedawaka"), *Timonius jambosella* ("Angana"), *Nargedia macrocarpa* ("Wal kopi"). The most commonly used species of woody climber for the footholds is *Nepenthes distillatoria* ("Bandura"), however, others such as *Artabotrys zeylanicus* ("Pattikka"), *Cissus acuminatus* ("Mala labu") and the forest bamboo *Ochlandra stridula* ("Bata") are also used as substitutes.

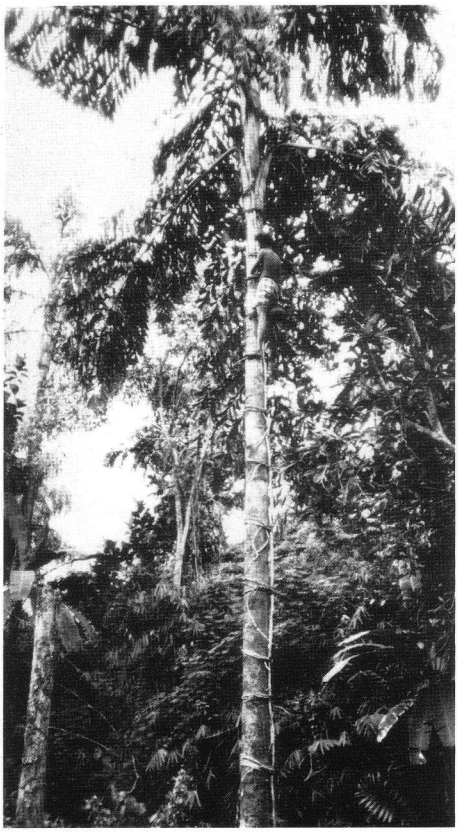
Preparation of Inflorescence. When the inflorescence has emerged sufficiently (about 3 ft) just prior to unfolding, it is supported by means of a 4 to 5 ft long pole forked at the top (Fig. 1b) and maneuvered into a horizontal position for convenience of tapping. The shape of the inflorescence indicates its maturity; cone shaped when immature but acquiring an inverted crescent shape at maturity. The inflorescence by this time has reached its maximum length and is on the verge of unfolding.

The inflorescence is next subject to a process of stimulation—more precisely, a process by which growth is arrested, but not totally prevented. Firstly the enclosing bracts are removed. The peduncle is bruised gently by tapping with a small stone or the handle of the tapper's knife. Applied to the bruised area is a paste of a ground mixture of *Pogostemon heyneanus* ("kollan kola") leaves, slaked lime, lamp black and other additives such as salt, garlic, mustard, lime and young leaves of *Toddalia asiatica* ("Kudumirissa") and *Nepenthes distillatoria* ("Bandura").

The treated inflorescence is bound along



1. a, Palm prepared for climbing, bound at regular intervals which serve as foot holds. b, A forked pole is used to support the inflorescence prior to unfolding and to attach the pot for collecting sap. c, Pot used for collecting sap. d, Pan used for boiling down the sap. e, Rattan strainer for cleaning the sugar syrup of debris.



2. *Caryota urens* with ladder and tapper.

its length with cord made from woody climbers (Fig. 1b) and left exposed for a couple of days. If the weather is dry the inflorescence is shaded using a bract from the Areca nut palm (*Areca catechu*), leaves of *Agrostistachys hookeri* ("Maha beru") or *Coscinium fenestratum* ("Weni wel"). Of late polythene is increasingly used.

The main inflorescence axis yields the greatest amount of sap. All lateral branches and spikes are therefore trimmed before binding it along its length. The terminal end of the main axis is gradually sliced off with a very sharp knife. The exuding sap is collected in a vessel, this process being carried out twice a day for a period of about two months.

Preparation of the Vessel. The vessel used for collecting the exudate is often a clay pot previously used for cooking and therefore well seasoned. The inner surface of the pot is made waterproof by coating with melted resin. The resin is extracted from *Canarium zeylanicum* ("Kekuna") and *Shorea stipularis* ("Nawada").

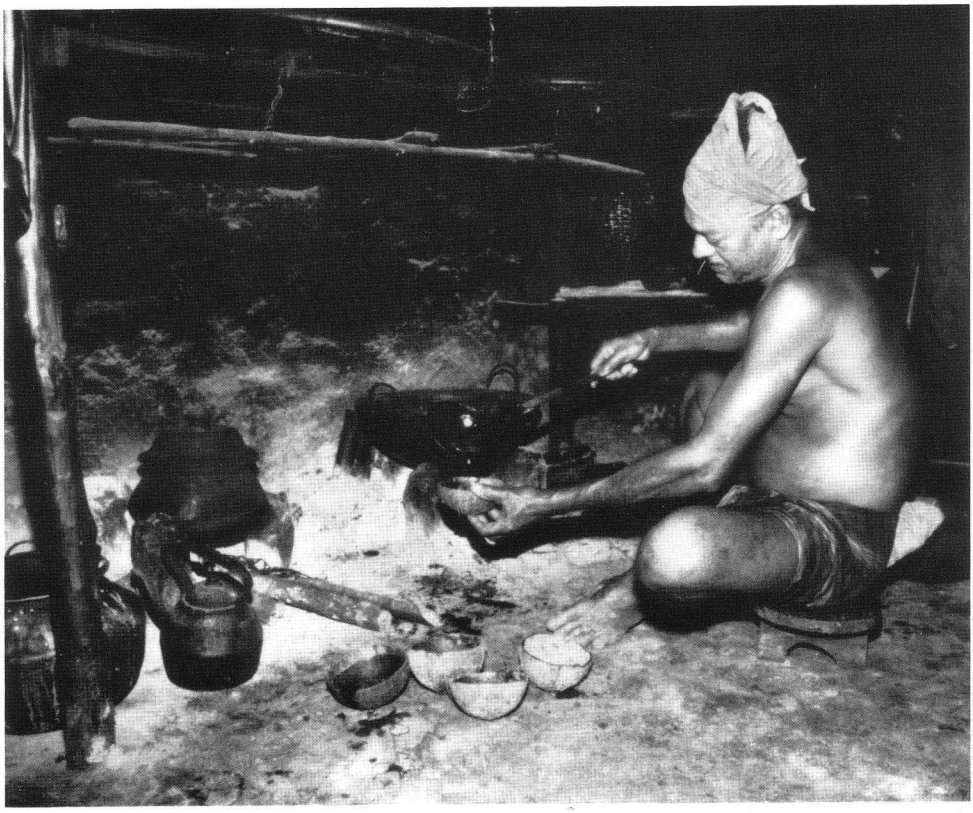
The pot is supported by a handle made with cord woven from woody climbers (Fig. 1c), such as *Nepenthes distillatoria* or *Calamus digitatus* ("Kukulu wel"). The positioning of the pot is shown in Fig. 1b. It is generally hung on the fork of the pole that supports the inflorescence.

To prevent fermentation of the sap, a strip of bark about 1″ in length and ½″ in width of *Shorea stipularis* is put in to the pot. Other bark substitutes used are *Vateria coppalifera* ("Hal"), *Vatica chinensis* ("Mendora").

Tapping Operation. The pot full of sap is removed twice a day, usually at 6 am and 4 pm. A thin slice is cut off the end of the inflorescence axis each time a collection is made and replaced with a fresh pot. A razor-sharp knife is used for slicing off the inflorescence and it is carried in a sheath attached to a waist band worn by the tapper. When climbing up or down the trunk of the palm the pot is hung on the knife handle at the waist of the tapper.

The Production of Jaggery. The sap is first strained into a large vessel (Fig. 1d) through a strainer made of woven rattan or bamboo strips (Fig. 1e). The sap is then immediately placed on the fire. After five to six hours of boiling when the liquid forms froth it can be removed from the fire and the sap can be kept for several hours without fermenting. On further boiling the sap thickens to a syrup and needs to be stirred constantly; at a suitable consistency it is taken off the fire.

The thick syrup is poured into precleaned coconut shells rinsed in cold water, and left to solidify (Fig. 3). A pinch of slaked lime is added to induce crystallization. The solid sugar or jaggery is gently prized out of the coconut shells and wrapped



3. Syrup is poured into cleaned coconut shells.

in dried banana leaf ready to be marketed. The residue left at the bottom of the pan is scraped out and made into balls for use as a domestic sweetener.

Future Prospects

It is evident from recent scientific studies on palms that they require precise environmental conditions for germination and establishment; often regeneration is limited or virtually absent (Moore 1979). Overutilization by man has severely affected the process of natural regeneration. Recent investigations on the floristics of the Sinharaja forest have revealed that mature individuals are very rare in their natural habitat (Gunatilleke and Gunatilleke 1987). It is also known that fruit bats, pole cats, and palm civets (Viverridae) aid in the dispersal and germination of the kitul seed. Whether any specialized relationships exist between the palm and its dispersal agents is not known.

The increasing demand for kitul products may perhaps one day result in the elimination of this species in the wild. The tradition of allowing the first inflorescence to mature and seed is now gradually disappearing, with severe consequences on regeneration. In the interests of preserving the species efforts must be made to study its biology and propagation. As an immediate conservation measure, adequate natural habitats should be protected to conserve wild populations of the palm. The

scientific basis of prevalent customs, rituals, and methods should be investigated for exploiting the resource more efficiently. The popularization of the kitul palm for home garden systems and mixed plantations should be vigorously pursued.

Acknowledgments

My thanks are due to Prof. M. D. Dassanayake and Profs. Nimal and Savitri Gunatilleke of the Department of Botany, University of Peradeniya, Sri Lanka for their comments on the script. This article was compiled in 1982 while working on a research project in Sinharaja. Since 1985 the Dept. of Botany has been engaged in detailed studies on the reproductive biology of the palm. My grateful thanks to the villagers of Sinharaja who spent their time explaining and demonstrating the tapping process, and helping me to see the palm through their eyes. Photographs were provided by Vimukthi Weeratunga.

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Distribution Update: Sabal domingensis in Cuba

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I recently had the privilege of visiting the province of Guantánamo, Cuba, while collecting *Roystonea* for a study of that genus. Along the southern coast, near the town of Imías, I met with an apparently indigenous species of *Sabal* that was in all respects more massive than *Sabal* seen elsewhere on the island. Having recently studied the genus *Sabal*, I was especially interested in these palms and curious about their identity. Regrettably, the palms had been heavily cropped for thatch, and I was unable to gather material for study and identification.

One week later, in the Herbarium of the Institute of Ecology and Systematics of the Cuban Academy of Sciences (HAC), I found three complete specimens with leaves, flowers, and fruits that permitted me to identify the Imías palms as *Sabal domingensis* Becc., a species heretofore known only from northern Hispaniola (Zona 1990). The specimens are: *León 14249* collected in November, 1929, at Río del Medio, at the foot of the Sierra de Imías; *León 14258* collected in January, 1930, from the banks of Río Imías; and *León 14603* collected in June, 1930, from the Imías region.

This extension in the range of *S. domingensis* is not unexpected. From the eastern end of Cuba, one can see the mountains of Haiti on the horizon. *Sabal domingensis* occurs abundantly in the northern part of Haiti and the Dominican Republic, and the fruits of all *Sabal* are readily transported by birds (Zona 1990). The eastern end of Cuba shares its greatest floristic affinity with Hispaniola, so *S. domingensis* echoes a well documented relationship between the two islands (Howard 1973).

Bisse (1981) reported a palm from the southern coast of Cuba which he called "*S.* cf. *umbraculifera*," an ambiguous name which has been applied to many species of *Sabal* from virtually every island in the Caribbean (Zona 1990). Bailey (1939) applied the name *S. umbraculifera* Mart. to the *Sabal* of Hispaniola, and Bisse may have been using the name in this sense. There are, however, two species that occur on Hispaniola: *S. domingensis* in the northern part of the island and *S. causiarum* (Cook) Becc. to the south. As Bisse cited no specimens, his report could not be verified, and the Imías palm could not be identified until now.

This addition to the palm flora of Cuba brings to four the number of species of indigenous *Sabal*. *Sabal domingensis* is restricted to the Imías region of Guantánamo, *S. maritima* (Kunth) Burret is found throughout central Cuba, *S. palmetto* (Walt.) Lodd. ex J. A. & J. H. Schultes (syn. *S. parviflora* Becc.) is widespread, and *S. yapa* Wright ex Becc. occurs in western Cuba and the Isle of Youth. No species is endemic to Cuba.

Support for field work in Cuba was provided by a Michaux Grant from the American Philosophical Society. I gratefully acknowledge the assistance of the staff of the Jardín Botánico Nacional and the Instituto de Ecología y Sistemáticas, Havana.

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PALM BRIEF

Ptychosperma elegans regenerating in Southern California

In the Spring of 1970, I planted a one gallon sized plant of *Ptychosperma elegans*. In those days, we had our usual ten year cycle of freezes. For the last four or five years, we have been having them every year. Apparently 1970 was a good year, because the palm got off to a good start, and had grown well from the very beginning. I also planted close by, a plant of *Chrysalidocarpus madagascariensis* var. *lucubensis*, which initially grew much more slowly. I was thrilled when my *Ptychosperma* got to the point when a trunk began to form. Hey, this was a rare palm in those days for California. As a matter of fact, the *Ptychosperma* had two and a half feet of trunk, while the *Chrysalidocarpus* had not yet formed even an inch. Three years ago, the *Ptychosperma* developed an inflorescence and when seed formed, I gathered them up in an effort to germinate them. Not a single one sprouted. The following year, seed formed again, and I had intended to sprout them, but neglected to do so, and they all fell to the ground. I intended to gather some to try to germinate them, but again neglected to do so. About a year and a half ago or so, in March, after a winter freeze, I happened to be working in the garden, when I noticed hundreds of small seedlings sprouting in the ground under the *Ptychosperma elegans*. I could hardly believe it, especially after a freeze. I gently dug many of them and potted them into liners. Last January, the seeds ripened again, and this time I collected and planted them into an appropriate mix. Two months later, they sprouted and now I have hundreds of small seedlings. There are still small seedlings growing in the ground and to my knowledge, this is the first time this particular palm has regenerated in a garden in Southern California. Of course, I don't claim that one could throw seed on a vacant lot or parcel of ground and they would germinate, as would be expected of *Washingtonia robusta* or *Phoenix canariensis*, but I think with a reasonable amount of garden moisture they might. I would like to think that my *Ptychosperma elegans* would be a little more hardy for California than those grown from seed that came from the tropics. Perhaps it can be tested some day. By the way, the *Chrysalidocarpus madagascariensis* var. *lucubensis*, now has a taller, wider trunk, and is taller overall than the *Ptychosperma elegans*, but it has not yet flowered. I am patiently waiting for that day to come.

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Licuala grandis in its Native Habitat in Espiritu Santo, Vanuatu

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The center of the island of Espiritu Santo in Vanuatu (formerly the New Hebrides) in the South-west Pacific is virtually unknown territory for the botanist. It contains several mountains over 1,700 m high and, being in the tropics, these are clothed in rain forest presenting from a distance a forbidding dark green cloak. I have for several years been preparing an account of the orchids of Vanuatu and I suspected that this island, the largest in the archipelago and close to the Solomon Islands, was much richer in orchids than had previously been suspected. In late 1988 I at last had the opportunity to see for myself. Our party comprised three college students, Jos Wheatley, a forester who was a volunteer from England, a keen local naturalist, three guides from local villages and myself. The aim was to traverse the island, some 60 miles across, and to sample the vegetation from the coast to the highest peak, Mt. Tabwemasana (1,879 m). The major difficulty was envisaged to be the people who lived on our route who traditionally have been antagonistic to the government and had turned back previous visitors. However, we had our research permit and had obtained permission to try our luck.

After weeks of heavy rain, we woke to a fine morning and were taken by the local schoolmaster, Barry Laing, in his Land Rover to Big Bay in the north of the island from where our trek was to start. Quiros, the Spanish adventurer who discovered the archipelago, had landed here nearly four hundred years ago and was convinced that he had discovered the great southern continent. The river that flows into the bay was christened by him the Jordan and we aimed to follow it inland to its source and then to join another river running south to the sea near Luganville, the only large town on the island.

We started our ten day trek at Brokstone, a large outcrop of limestone overlooking Big Bay and about 3 km inland. Although the Forest Department maps show the interior of the island to be covered

1. *Licuala grandis* at Chonitavara, Espiritu Santo.

2. The road to Big Bay.

in continuous rain forest, many people live in the interior in villages of from two to thirty huts and much of the land, especially on the flatter areas, is either cleared for agriculture or is secondary forest dominated by *Kleinhovia*. Introduced cattle and horses that have now escaped have also damaged the lower areas. However, there are patches of reasonable primary forest along the river and in a couple of these we came across two interesting palms. The first in high forest on limestone was a rattan in full fruit. These were white and borne in large branching bunches. John Dransfield has tentatively named this as *Calamus* near *C. vitiensis*.

Towards the end of the first afternoon colonies of a small but very pretty palm attracted my attention. Standing only up to 4 m tall, the top of the slender stems bore several dark green fan-shaped leaves. This was *Licuala grandis*, known from Espiritu Santo and a few neighboring islands (see J. Dowe 1989, Palms of the Southwest Pacific), and collected originally in late Victorian times when Peter Gould Veitch of the famous nursery of Messrs. Veitch and Sons of Chelsea sent seed back to England. Veitch grew it successfully and it has become one of the most widespread of all palms in cultivation. Until recently, its origin remained a mystery because Veitch said that it came from New Britain, no doubt to mislead competitors.

The colonies were invariably growing in deep shade in forest by the river and by subsidiary streams. Many of the plants had their feet in water when we saw them but it had been very wet for the previous few weeks and by the time we returned ten days later the forest floor had dried up in most places. The distribution of the palm in the Valley of the Jordan River was very restricted, possibly covering only a few square km. However, the forest floor where it was found was, in places, covered by

3. The view north to Big Bay from above Chonitavara, Espiritu Santo.

young seedlings. Some larger specimens growing in a cleared plantation near the river were in full fruit and seed that was just turning orangey red was collected. These have been successfully germinated at Kew and we hope they will eventually be added to the specimen of unknown origin already on exhibit in the Palm House.

The expedition, which was mainly looking at the orchids, was a success although we were turned back in our attempt to cross the island after we had climbed Tabwemasana. These islands are still very poorly botanized and the fact that this one expedition of ten days increased the number of orchids recorded from the island from twenty seven to one hundred gives some idea of the need for further exploratory work there.

Acknowledgments

I would like to thank my companions, Jos Wheatley, Vira Glen-Alo, Agasten Tabi, Reuben Mawa, Graeme Malau on this trip; Barry & Chris Laing for logistical help; and G. Hermon Slade for making the visit possible.

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Chamaedorea minima

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The April 1991 issue of *Principes* has arrived, and it was a real pleasure to receive it. It was a pleasure because in that issue, finally, Bob Wilson's "dwarf pumila" *Chamaedorea* palm has been recognized as a new species and named *Chamaedorea minima*, by Don Hodel. Bob Wilson was the founder of the Las Cruces Botanical Garden, in south Costa Rica (that garden now is called the Jardin Botanico Roberto y Catherine Wilson). Don Hodel is a southern California botanist who is the author of the new book *Chamaedorea Palms; the Species and their Cultivation*, soon to be published by the International Palm Society. This article is to tell the interesting story of how Bob Wilson obtained *Chamaedorea minima*. This information has never before been published; it should be on record now before it goes to its grave with me, the last living person who got the story directly from Bob Wilson.

The story follows:

In the 1960s, Bob Wilson was busy developing Las Cruces Botanical Garden; he had a staff of "Ticos" (slang for Costa Ricans) working for him, at minimum wages. One of his Ticos brought in a friend and introduced him to Bob Wilson; we will call the friend José. José was very bright and intelligent, so Bob offered him a job as an additional member of his staff. José declined the offer—but alternatively he showed Bob a specimen of a *Chamaedorea* which Bob had never before seen, and offered to provide duplicates of it in exchange for Costa Rican currency amounting to about 75 cents in U.S. money, per plant. Also he said that "later" he would reveal to Bob Wilson exactly where the plant grew in the wild.

Bob and José shook hands on that arrangement and during the next few months José prospered well from that arrangement. Too well—because inventories showed that the Las Cruces collection of this new palm was growing at about one quarter of the rate José was being paid. Obviously, José was busy at night, digging up palms from Las Cruces for which he already had been paid, then reselling them again the next day to Bob Wilson. (Yes, some Ticos are just as clever, and just as crooked, as are some Gringos.)

At this stage, Bob Wilson was furious. So what he did was to mark the tools in his toolhouse at closing time, to determine whether or not they were used during the night. The next morning, when he checked, he found that many of the marked tools not only apparently had been used—they were also missing. Not only were the palms being stolen, the tools to steal them were also being stolen.

Bob was doubly furious. And when José came in that day with more palms to sell, Bob confronted him with the evidence. To that confrontation, José simply smiled, and said to Bob Wilson that neither Bob nor any other botanist would ever locate the native habitat of what now has been described as *Chamaedorea minima*. And he then walked out.

Around 1987, Paul Mahalik (then Chairman of the San Diego and Imperial Counties Section of the International Palm Society) and I visited Las Cruces botanical Garden, where Bob Wilson, still somewhat bitter over his continued failure to locate

the native home of the palm, loaned us his jeep and driver and one of his Tico workers, and asked us to search for the palm in a designated area. For two days we searched, but our search was unsuccessful. By then, Bob Wilson was already too unsteady to accompany us.

Soon thereafter, partly for imagining that José still was stealing specimens of the palm, and partly because of a disagreement with the Organization for Tropical Studies (which by then owned the garden) Bob Wilson secretly dug up all the little *Chamaedoreas* which he could find in Las Cruces, and transplanted them into a nearby canyon, which he still owned. (For *Chamaedorea minima*, this was not a big problem; I have not seen it over six inches tall, but Don Hodel in his description generously indicates that it sometimes grows to twice that height. But even if it does, it is still not much of a "tree.")

Both Bob Wilson and Paul Mahalik have since died. Luis Gomez, now Director of the Wilson Garden, assures us that all the small chamaedoreas which Bob transplanted have been returned to the garden. José has not been seen since his confrontation with Bob Wilson. And the native habitat of *Chamaedorea minima* remains unknown.

None of the above is "essential horticultural information"; it is just irrelevant gossip—but it is all true. And for knowing it, very surely *Chamaedorea minima* will become far more desireable a palm for your garden than otherwise.

So try your best to get it.

But don't steal it!

CLASSIFIED

Scott Zona Wins Award for *Sabal* Study

The 1991 Jesse M. Greenman Award has been won by Scott Zona for his publication "A monograph of *Sabal* (Arecaceae: Coryphoideae)," published in Aliso 12: 583–666. 1990. This monographic study is part of a doctoral dissertation from the Claremont Graduate School, Claremont, California, under the direction of Sherwin Carlquist.

The Greenman Award, a certificate and a cash prize of $500, is presented each year by the Missouri Botanical Garden. It recognizes the paper judged best in vascular plant or bryophyte systematics based on a doctoral dissertation published during the previous year.

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Seedling Blight Disease of Raphia hookeri Caused by Glomerella cingulata in Nigeria

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ABSTRACT

A seedling disease of *Raphia hookeri* known as seedling blight is described for the first time. Among the associated organisms are *Curvularia eragrostidis* Henn. (*C. maculans*), *Drechsclera halodes* Subr. & Jain, *Glomerella cingulata* (Stonem) Spauld & Shrenk, and *Pestolotiopsis sp. Glomerella cingulata* has been implicated as the causal organism of the disease. Survey of the disease showed occurrence in *Raphia* groves of six states of Nigeria.

Raphia hookeri Mann. and Wendl. is among the eight species in the genus *Raphia* which are indigenous to Nigeria (Otedoh 1982). Economic uses of *Raphia* include making of Piassava ropes, palm wine and alcohol and the fiber from the trunk and leaves have been recommended for paper production (Tuley 1965; Otedoh 1975; Odeyemi 1984, 1985). *Raphia* palm wine, now bottled for commercial purpose at Nigerian Institute for Oil Palm Research (NIFOR), has become a very popular drink in the country.

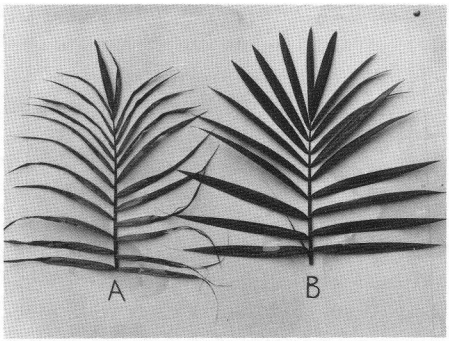
In spite of these many uses of *Raphia*, there is no report of any disease of the crop in literature. Available information on fungi associated with *Raphia* palm is that of Bailey (1966) who reported that species of *Sphaerulina* and *Hysterostomella* have been isolated from leaves of *R. sudanica* and *R. vinifera* respectively.

Following observation of seedlings infected in the nursery having a blighted appearance in the Nigerian Institute for Oil Palm Research, near Benin City (Anon. 1981) this investigation was undertaken to determine the cause of the leaf disease and its spread among sprouted seedlings in the groves of six states of Nigeria. In the groves ripe fruits that drop from ripe infructescences germinate to form numerous seedlings from which cyclical replacement of old stands takes place.

Materials and Methods

Leaves of seedlings of *Raphia* in the nursery were examined visually for symptoms of spots resulting in death of tissues or blighted appearance.

Isolation of Fungi Associated with Blight: Infected leaves were removed with sterile scissors from seedlings, and taken to the laboratory in sterile polyethylene bags. Leaflets were washed in running tap water and cut into pieces 5 mm in length. The pieces were surface sterilized with 0.1% mercuric chloride solution for 1 minute and rinsed with three changes of sterile distilled water, dried with sterile tissue paper, and plated on potato dextrose agar (PDA). Plates were incubated for seven days. Pure culture of fungi growing from the pieces were sub-cultured on fresh PDA. All pure cultures of fungi were maintained on PDA slopes in MacCartney bottles at 5° C in the dark.



1. (A) *Raphia* seedling, frond infected by blight. (B) *Raphia* seedling, frond healthy.

Identification of Fungi: Pure culture of fungi isolated from infected leaves was identified using Barnett and Hunter (1972) and C.M.I. description of pathogenic fungi and bacteria. Identifications were confirmed by the Commonwealth Mycological Institute, Kew, London.

Pathogenicity Test: Spore suspension of each isolate was prepared according to the method of Susuri et al. (1982) from three week old culture on PDA plates. Tween 80 was added to each lot of spore suspension at the rate of 1 ml/liter for easy spread of spores on leaves. Spore suspension of each isolate with spore load 5.0×10^5 was sprayed to wetness on the upper and lower surfaces of leaflets of 2 month old seedling of *R. hookeri* with a hand sprayer (Gallenkamp W-BS-520-J) which produces a powerful intermittent or continuous jet of fine spray. The surfaces of leaflets were cleaned with cotton wool soaked in methylated spirit and rinsed with sterile distilled water and allowed to dry before spraying. Plants sprayed with sterile distilled water served as control. Fifteen seedlings of *R. hookeri* were sprayed for each isolate. The sprayed plants were enclosed in moistened polyethylene bags with water soaked paper towels placed at their bases for 48 hours to maintain high humidity. These plants were observed for three weeks for disease development in the greenhouse. The experiment was repeated twice. Where there was disease development, isolation was carried out, and isolates were compared with original isolates used in inoculation in terms of symptoms, conidia type and growth habit in PDA.

2. (A) Seedling of *Raphia* infected by blight. (B) Seedling of *Raphia* healthy.

Survey for Incidence of Seedling Blight: Survey for incidence of seedling blight was carried out in 1984 in NIFOR Mainstation and *Raphia* groves in two locations in six states of Nigeria within the growing belt. Seedlings were randomly examined in all locations. Percentage infection was determined using the formula:

$$\% \text{ Infection} = \frac{\text{No. of infected seedlings}}{\text{Total no. of seedlings examined}} \times \frac{100}{1}$$

Results

Symptomatology: The symptoms begin with the youngest fully expanded leaves as a water soaked or oily transparent yellow

Table I. Incidence of seedling blight of Raphia *in survey.*

Location	Sample Size	No. of Seedlings Infected	% Infection	% Death
Bendel State				
NIFOR	600	106	63.60	2.67
Warri	300	76	25.33	7.00
Mosogar	200	85	42.50	12.00
Imo State				
Owerri	300	119	39.67	16.3
Umuahia	500	108	21.60	6.20
River State				
Elele	256	89	34.77	5.86
PortHarcourt	368	90	24.46	8.15
Cross River State				
Akamkpa	461	102	22.13	4.79
Oban	259	97	37.45	7.34
Akwa-Ibom State				
Abak	260	89	34.23	5.77
Ikotekpene	300	95	31.67	12.00
Anambra State				
Onitsha	362	99	27.35	8.00
Awka	260	76	29.23	5.38

circular spot about 1.0 mm in diameter, appearing on both surfaces of leaflets. They are found more on the tips, edges and middle region of leaflets. These circular spots become necrotic, surrounded by yellow haloes, giving an entire spot size of about 2–5 mm in diameter. Such numerous spots coalesce within two weeks from the onset of infection. The coalesced spots form a shade of chlorotic lamina with occasional occurrence of acervuli of *Pestolotropsis*. The infection spreads from tip to the base of leaflet (Fig. 1). At an advanced stage of the disease the lamina of the leaflets become fragile and gradually fall off, leaving a tattered leaflet and the entire seedling blighted (Fig. 2). In heavy attack complete death of seedling may occur, or surviving seedling may exhibit thrifty growth.

Associated Organisms: Isolation made from infected leaves revealed the fungus *Collectotrichum* state of *Glomerella cingulata* with C.M.I. number 283846. Other fungi isolated are *Curvularia eragrotidis* with C.M.I. number 282583 and *Drechsclera halodes* with C.M.I. number 261639. *Pestolotiopsis* sp. was also occasionally isolated. *Glomerella cingulata* is pinkish white in PDA medium, producing unicellular conidia enclosed in pinkish orange acervuli. The conidia measured 12.5–15.0 μ long and 3.75–5.25 μ wide.

Pathogenicity Tests: There was development of typical oily water soaked spots on leaflets of plants inoculated with *Glomerella cingulata*. These developed into typical blight symptoms within three weeks of inoculation. The organism was re-isolated from inoculated plants and produced symptoms on reinoculated plants. Inoculation with *Curvularia eragrostidis*, *Drechsclera halodes* and *Pestolotiopsis* sp. did not produce blight symptoms nor did control plants show any symptom.

Survey for Incidence of Blight: The result of incidence of blight in six states of Nigeria and NIFOR is presented in Table 1.

Discussion

The symptoms of *Raphia* seedling blight described in this study are similar to those of the oil palm described by Johnston (1959) in W. Malaysia and Watanavanich (1981) in Thailand, and partially similar to leaf anthracnose type 'C' of oil palm described by Bull (1954) and Robertson (1956). In all cases, the disease starts with the youngest fully expanded leaves. *Curvularia eragrostidis* was found to be the causal organism of oil palm seedling blight in Malaysia, Sabah and Thailand. But in this study this organism only occurred as associated organism in seedling blight of *Raphia*. *Glomerella cingulata* has been reported as the causal organism of anthracnose type 'C' in oil palm in Nigeria (Bull 1954) and leaf blight of onion in northern Nigeria (Ebenebe 1981). In this study apart from being frequent in isolation *G. cingulata* was shown to be the causal organism of seedling blight of *Raphia*. The occasional presence of acervuli of *Pestolotiopsis* in infected chlorotic leaf area in the nursery makes seedling blight of *Raphia* differ from that of oil palm. The result of the survey for incidence of seedling blight indicates that the disease is found among seedlings in *Raphia* groves of all states visited. The highest percentage of infection was recorded in NIFOR with low death. The application of fertilizer and proper agronomic care of seedlings in the nursery may also precipitate seedlings vulnerable to attack by the disease when compared to those in the groves. This however requires investigation.

Acknowledgments

We are grateful to the Director of NIFOR for permission to publish this paper and to Dr. M. O. Otedoh for supplying seeds of *R. hookeri*. Assistance rendered by the staff of Pathology Division, especially Mr. R. D. Etuknwa for technical assistance and Mr. P. E. Osarenkhoe for typing the manuscript is highly appreciated. We are gratefully indebted to C.M.I. Kew London for identification of fungi.

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Notes on the Treatment of Palm Fruits by Long-tailed Macaques (Macaca fascicularis)

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The dispersal agents for many Sundaland palms are unknown (Uhl and Dransfield 1987, Kiew and Davison 1989) though a large number of vertebrate frugivores seem to be attracted to the fruit. Anthropoid primates, including members of the genus *Macaca*, eat the fruits of rattan palms (Dransfield 1979, Whitten and Whitten 1982, Caldecott 1986) and the Mentawai gibbon (*Hylobates klossii*) eats ripe *Arenga obtusifolia* fruit (Whitten 1980). In the course of a study on the diet of the long-tailed macaque (*Macaca fascicularis*) in Bukit Timah Nature Reserve in Singapore between July 1986 and November 1987, it became clear that the fruits of some palms were important in its diet. The ability of *Macaca fascicularis* to disperse palm seeds could be critical to the survival of these plants in Bukit Timah since most of the larger birds reported in the literature as possible dispersers (e.g., hornbills and pheasants, Kiew and Davison 1989) are absent or extinct. The musang (*Paradoxurus hermaphroditus*), which is a possible disperser of rattans (Uhl and Dransfield 1987), is now very rare there and seldom seen.

Approximately sixty percent of the 71 ha of Bukit Timah is primary forest (Corlett 1988). The reserve has a more or less intact flora with over 800 species of seed plants having been collected there this century (Corlett 1989). Twenty-eight species of palms have been recorded including 19 rattan spp. (Corlett, pers. comm.), some of which, such as *Calamus oxleyanus*, are plentiful. In addition, *Oncosperma horridum* is common in some valleys. On the fringes of the primary forest, *Caryota mitis* is the only native palm though there are several planted *Elaeis guineensis* on one of the summits. Curiosity as to the factors influencing the maintenance of what appears to be a typical coastal hill forest flora, given that much of the large fauna has disappeared (Corlett 1988), alerted our attention to the possibility that the 80 individuals of *Macaca fascicularis*, the largest common frugivore left, could be important in dispersing large seeds.

One group of more than 30 animals was studied for 510 hr by a standardized scan-sampling method (Corlett and Lucas 1990). Group members were observed eating ripe fruit on 1,964 occasions and unripe fruit, 205 times. 223 records of feeding on ripe palm fruits were obtained and 33 on unripe fruit. Rattan palm species were identified after the study utilizing Dransfield (1979, 1984).

Rattans

143 records involved the consumption of apparently ripe rattan fruit. At least 65 of these were of *Calamus oxleyanus* which appeared to fruit over much of the observation period. Other *Calamus* spp. could not be determined with any certainty but

probably included *C. luridus* and a member of the *C. insignis* group. Three records were of *Daemonorops* spp. and included *D. didymophylla*. One record was of an undetermined *Korthalsia* sp. However feeding on *K. echinometra* and *K. rostrata* was also seen in ad-lib observations.

Feeding while perched on a rattan plant was extremely rare, quite obviously due to the spiny nature of the leaf sheath. Monkeys most often took a sprig of fruit and removed the scaly epicarp by bringing the fruit to the incisor teeth and making a single bite. This was then dropped. They then placed the seed (i.e., stone plus sarcotesta in *Calamus* and *Daemonorops* or seed plus mesocarp in *Korthalsia*) in one of their two cheek pouches positioned behind the molar teeth. It was difficult to count the number of seeds that could be placed in one cheek pouch but calculation from the slightly smaller fruits of *Eugenia longifolia* suggests that up to 10 seeds could easily be accommodated. Seeds were then brought back to the mouth, apparently one-by-one, and the flesh removed with the cheek teeth. On many occasions, this involved a loud noise resembling fracture. However, we could not confirm that any stones were destroyed by the teeth in this way and, following the noise, seeds that were still in one piece were often removed by the monkey from its mouth so that it could inspect the remaining flesh visually. We assumed that the noise involved the scraping off of flesh using the cheek teeth. As far as could be ascertained, all rattan stones were eventually dropped from the mouth. No stones were found in 76 fecal samples that were examined by sieving.

The macaques often moved away from the plant while processing the flesh. In 32 recorded instances, adult males, females and juveniles, took rattan stones between 10–100 m away from the plant. On only two occasions, however, was an entire sequence seen of plucking the fruit, moving 20 m and then dropping the stone. However, this indicates a clear potential for dispersal.

Oil Palms

Elaeis guineensis palms have been planted around the lower of two summits. Entrance to the telecommunications area there is restricted but there are less than ten of these trees. 65 observations of feeding on the fruit flesh were made. Monkeys also cheek-pouched the "seed" (seed plus endocarp with some flesh attached to it) and were seen removing them from the mouth with hands at a distance of up to 100 m from the nearest oil-palm tree. One instance of an *Elaeis* stone being dropped 20 m from the nearest tree was recorded. No *Elaeis* stones were found in the feces.

The monkeys tried on several occasions to break open the endocarp with the molar teeth in order to eat the kernel, but without success. They have been introduced to the taste of the kernel by personnel stationed in the reserve who break open the endocarp and hand the pieces to the monkeys.

Oncosperma horridum

Sixteen observations of feeding on *Oncosperma horridum* fruits, which were available in March–August 1987, were made. Few of the stones had the dark purplish flesh completely cleaned off. However, monkeys were observed with fruit in the cheek pouches nearly 100 m from the nearest tree. No stones appeared in the feces and therefore they must have been dropped at some point. Potential for dispersal would depend on whether removal of the flesh is important for viability of the seed—which it appears to be for some *Calamus* spp. (Ng 1983).

Caryota mitis

Green unripe fruits (33 records) of the common fish-tailed palm were eaten in all but two months of the period of observation. Though many observations of cheek-

pouching following by dropping (or spitting) of the stones were made (maximum distance from a plant for an entire plucking-to-dropping sequence was 10 m), these were the only palm stones found in the feces. However, they were rare being only 8 "seeds" out of more than 5,000. Since over 98% of individual seeds in the feces were <4 mm in maximum width and *C. mitis* seeds are 8–10 mm irregular spheres, this is somewhat perplexing. *Caryota* stones were the largest "seeds" found in the feces. It is unclear why the macaques were not apparently deterred by calcium oxalate crystals in the fruit (Dransfield 1974), particularly since a *berok* monkey (*Macaca nemestrina*), famous for having been used for making botanical collections, appears to have died after eating *Caryota* (Kiew and Davison 1989).

Discussion

We have no information on the viability of palm "seeds" that were dropped or spat out. However, a cleaned "seed" dropped singly 20 m or more from a parent plant is probably more successfully dispersed than if deposited in a fecal clump with many other seeds (Corlett and Lucas 1990). What we cannot judge is if this dispersal happened frequently enough for long-tailed macaques to be considered good dispersal agents. *Macaca fascicularis* is typically an animal of riverine, mangrove and secondary forest. However, no rattans other than *Plectocomia elongata* are found in secondary forest at Bukit Timah. We did observe long-tailed macaques consuming *P. elongata* fruits in the central Catchment area of Singapore in mid-1985. Most fruits were processed very rapidly in a "suck and spit" manner (Dransfield 1979). We presented some *P. elongata* fruits to captive *Macaca fascicularis*. Over a lengthy period, two animals succeeded in breaking the stone but with so much effort that we doubt whether the stones are destroyed commonly in the wild.

We tentatively conclude that macaques may influence the dispersal and, therefore, the distribution of rattans. *Calamus* is listed by Caldecott (1986) as one of the key genera for macaques in the Sundaland region because it is commonly mentioned in dietary lists. Nevertheless, there has probably been little if any coevolution between macaque and rattan. Macaques have only been in South east Asia for the last one million years (Delson 1980) whereas the different genera of palms must surely have been established before then. Though the importance of macaques as dispersers in a forest with an intact fauna should be studied, they should be considered as potential dispersal agents of forest palms.

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South Florida Chapter, International Palm Society Fall 1991 Show and Sale at Fairchild Tropical Garden

The thirteenth "modern" Fall Show and Sale of the South Florida Chapter was anything but unlucky. Plants in a record number—over 3,900—were grabbed up by palm enthusiasts on the weekend of November 2 and 3. Over 400 species of palms were offered by 56 growers. All of the available space was occupied by plants ranging from seed pots to field-grown specimens. Long-time observers of the Chapter's Fall event agreed that more well-grown species of palms were available than ever before. And for at least the third consecutive year, the average price per plant, $15.84, was actually lower than that of the year before.

The theme for this year's Show and Sale was Palms of Australia and Lord Howe Island. Numerous exceptional palms were entered into the education/show display in the Montgomery Auditorium. Containerized specimens of *Wodyetia bifurcata* scraped the high ceiling of the expansive room to create a palmetum atmosphere. Awards were given for first, second, third and honorable mention in the categories of: Australian/Lord Howe Island Palm, Rare and Difficult-to-Grow Palm, Indoor/Patio Palm, Field-Grown Palm, Open Category and *Chamaedorea*. The ribbon for Best of Show was awarded this year to Bill Shannon for his hybrid *Chamaedorea stolonifera* × *ernesti-augusti*. The same specimen won a first-place ribbon in its class in 1990.

In the sale area there was the traditional repotting demonstration by Louise Futch. For the fourth consecutive year, an information table staffed by Chapter volunteers provided buyers with guidance in the grower area and advice on cultivation techniques, as well as the chance to obtain the Biennial T-shirts and color palm posters offered by the Chapter. Special thanks are due De Hull, Sale Chairman, Bill Theobald, Education Chairman, and those nongrower Chapter members who have repeatedly volunteered their time and resources to help make this event a success year after year. We are particularly grateful to those growers who devoted the extra effort to bring in palms. Not only were these plants desirable, but also they went out into the community at a reasonable cost. At the same time, these growers provided income to Fairchild Tropical Garden and the Chapter. As before, we feel that we have succeeded in reaching our goal of acquainting the public with the palm family and making a wide variety of plants available to them.

The theme for 1992 is Palms of Mexico and Central America. The Spring Sale in Broward County will be held May 2 and 3 at Flamingo Gardens. The Fall Show and Sale will be held November 7 and 8, the weekend before the 1992 International Palm Society Biennial Meeting. The Chapter invites IPS members to offer their services for any of the numerous volunteer assignments needed to ensure smooth functioning of these two significant events which promise to be both hectic and exciting. Please call LEONARD GOLDSTEIN at 539-7142 (W) or 667-4609 (H) and/or BILL THEOBALD at 252-4416 (W) or 251-0246 (H), in Area Code 305.

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CHAMAEDOREA BOOK PRESALE COMMENCES

The prepublication sale of "*CHAMAEDOREA PALMS: The species and their cultivation*," by Don Hodel is now underway. A brochure is included with this issue of *Principes*. The prepublication price of U.S. $49.95, including book post worldwide, will continue until June 1, 1992. After that date, the regular price of the book will be U.S. $59.95, including book post worldwide. The beautifully finished books will not be mailed until June 1992.

Just to let you know what a bargain you are receiving from the International Palm Society and Don Hodel when you buy "*CHAMAEDOREA PALMS*" I'm going to summarize some of the things that made this book possible.

Since time began, everyone interested in palms wanted to collect and know more about the little *Chamaedorea* palms. They are now *The Most Cultivated Palms in the World*. Many botanists wrote articles about these little jewels, and some even thought of writing a book! But then on second thought, they decided it was too involved and too complicated. Five years ago the seed was sown in Don Hodel's head that he should be the one! He started gathering information that other botanists had written over the years, getting their papers translated into English where necessary, taking trips to see chamaedoreas in their natural habitats, and verifying all the information he had gathered. He made nine trips to Central and South America to see these palms in their natural habitats and collected 500 specimens to bring back to his greenhouse in L.A. to study. He visited private collections in six states, and examined 5,000 herbarium specimens of *Chamaedorea* palms in herbaria in Europe, Latin America, and the United States. Three years ago he began devoting most of his time to writing the book. Both the wild and cultivated chamaedoreas are covered in the 350 pages, 127 pages of which contain 550 beautiful color photographs.

Don has not received any money for his time involved in writing this book. His trips were funded by private individuals and grants. All this has been accomplished because of the love of *Palms*.

The International Palm Society has a Revolving Publication Fund, which was established in 1978 through donations, fund-raising activities, plant sales, raffles, etc., to raise money to publish palm oriented books that otherwise would not be printed and available to the public at an affordable price. Our first book published was "*Genera Palmarum: A classification of palms*," by Natalie Uhl and John Dransfield. We have sold over 4,000 copies. Profits from the sale of this book are back in our fund waiting to be used for "*Chamaedorea Palms*," but are not enough! That is why it is so important that you purchase one or two copies of "*Chamaedorea Palms*" *Now!*

The Revolving Publication Fund needs your commitment and money! Please send U.S. $49.95 to: *Chamaedorea Palms*, P.O. Box 1897, Lawrence, KS 66044, U.S.A. This will assure you of a copy in June. Thanks.

PAULEEN SULLIVAN, Chairwoman
The Revolving Publication Committee

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NEWS OF THE SOCIETY

Brief Report of Burotrop Meeting

The First African Seminar on Coconut took place at Arusha, Tanzania from the 4–8th February 1991.

The seminar was entitled "Working towards a better future for the African coconut farmer." Its main objectives were to identify constraints facing the coconut industry in Africa and to work out strategies to overcome these through collaborative research and development networks.

The seminar was organized by the Bureau for the Development of Research on Tropical Perennial Oil Crops (BUROTROP) and hosted by the National Coconut Development Programme (NCDP).

All coconut growing countries in Africa received invitations to participate, together with a number of external organizations concerned with coconut research and development. The following people from organizations in various countries participated:

Mr. R. Smith, UK Overseas Development Administration and Chairman of Burotrop; Mr. F. Dufour, Director, Burotrop; Mr. G. de Taffin, IRHO-CIRAD, France; Mr. G. Breag and Mr. A. Swetman, Natural Resources Institute, UK; Dr. F. Opio, University of the South Pacific, Western Samoa; Mr. T. Hall, European Economic Community; Mr. J. Ter Vrugt and Mr. J. Ohler, IBRD; Dr. S. Eden-Green and Dr. P. Jones, Rothamsted Experimental Station, UK; Mr. F. Attere, IBPGR Regional Office for East and Southern Africa, Kenya; Mr. P. Kakanakou, DRA, Benin; Mr. L. Ortet, MDRP, Cabo Verde; Mr. B. Kouame, MRS, Côte d'Ivoire; Mr. Y. P. N'Cho and Mr. A. Sangare, Marc Delorme Research Station, IRHO, Côte d'Ivoire; Mr. N. N'Goran, Palmindustrie, Côte d'Ivoire; Mr. S. Msaidie, CEFADER, Comores; Mr. E. D. Arkhurst, Ministry of Agriculture, Ghana; Mr. A. T. Bah, IRAG, Guinea; Mr. G. Ferrao, APC, Moçambique; Mr. A. E. Asuquo, FDA and Mr. S. N. Utulu, NIFOR, Nigeria, Mr. R. Oliveira, Ministry of Agriculture, Sao Tôme, Mr. Tsala Messi, SOCAPALM/AFOPDA, Cameroon; Dr. C. Breure, Harrisons Fleming, U.K.; Mr. I. M. Barnwell, SOCFINCO, Belgium; Mr. P. Kinyawa, Dr. L. Diehl, Dr. B. Löhr, Dr. A. Kullaya, Mr. Z. Seguni, Mr. M. Schuiling, Mr. R. Behrens, Mr. S. Mogaeka, Mr. N. Temu, Mrs. G. Chipungahelo, Mr. H. C. Harries, Mrs. A. Mpunami, Mr. C. Hoeck, Mrs. M. Soragha, Mr. E. Krain, NCDP, and Dr. F. Shao, Assistant Commissioner, Crop Research, Ministry of Agriculture, Livestock, Development and Cooperatives, Tanzania.

The first day began with registration, a welcome by the NCDP Coordinator, remarks by the Chairman of Burotrop and an official opening speech by the Principal Secretary of the Ministry of Agriculture, Livestock Development and Cooperatives. Country reports were presented by delegates from Benin, Cameroon, Cape Verde, Comoro Islands, Côte d'Ivoire, Ghana, Guinea, Kenya, Moçambique, Nigeria and Tanzania. The chairman of the African Association for Oil Palm Development described that organization and how its principles might be applied to the coconut palm.

On the second day, general introductions continued with presentations from the representative of the International Board for Plant Genetic Resources (IBPGR) for East and Southern Africa and from the EEC tropical agriculture representative for scientific and technical cooperation with developing countries.

Then the meeting moved into the main area of activity which was to establish group sessions on the following topics:

Processing and Marketing
Agronomy and Farming Systems

Breeding
Pests and Diseases
Extension and Training

The chairman appointed to each of these sessions then outlined what were to be the subjects for consideration, the delegates divided between the various groups and the sessions continued until the third day.

On the third day, after beginning with a continuation of the separate sessions, the main meeting reconvened to hear what projects had been proposed, to discuss them and to agree which should go forward to BUROTROP for consideration.

The recommendations which went forward to Burotrop covered the following topics:

Marketing and Processing

Local coconut products processing technologies.

Medium-scale production of oil from fresh nuts with integrated production of charcoal, fibre and peat substitute.

Agronomy and Farming Systems

A network to research sustainable coconut farming systems for Africa.

Multi-location trials for drought tolerance.

Breeding

Establish an African coconut genetic resources network.

Multi-location variety trials.

Breeding for resistance to MLO diseases (combined with recommendation from Pest and Disease session).

Breeding for drought tolerance (combined with recommendation from Agronomy and Farming Systems session).

Establish an African coconut breeding working group.

Pests and Diseases

Detection and diagnosis of lethal yellowing related diseases.

Extension and Training

Inter-regional, annual or biannual coconut training seminar/workshops

Create an African Coconut Association

The meeting closed with a summary of the recommendations by the Burotrop Chairman and a closing speech from the Assistant Commissioner for Crop Research at the Ministry of Agriculture, Livestock Development and Cooperatives. After the meeting, most delegates returned to Dar es Salaam and spent one day looking at NCDP trials.

For more details of the proceedings, contact MR. O. DUFOUR, Director, BUROTROP, 17 rue de la Tour, 75116 Paris, France.

CHAPTER NEWS AND EVENTS

Sunshine Coast (PACSOA) Meetings

At the August meeting, Robbie Kelly gave a fascinating account of his trip to Madagascar. His great collection of slides and interesting talk so enthralled the audience that time slipped away. The major raffle prize for the August meeting was a 12″ pot *Licuala grandis* approximately one meter (3 feet) high.

Will Kraa spoke on Cycads at the September 2nd meeting. He covered such topics as cultivation, pollination, toxicity, seed collection, characteristics and identification. Will is the President of the South Queensland Group of PACSOA and is noted for his knowledge of cycads. Some seedlings were available for sale at the meeting. The major raffle of the evening was a "*Cycas* sp. Marlborough Blue" in a ten-inch pot.

The upcoming November meeting will feature Peter Young as guest speaker. His topic "Biological Control of Diseases in Nurseries" promises to be a most stimulating talk for the environmentally conscious. Note that meetings are held on the 1st Monday of every month at the Nambour Band Hall, off Rundle Ave, Nambour, commencing at 7:30 P.M.

New Palm Journal from Australia: *MOOREANA*

In June 1991, the Townsville Botanic Gardens published the first issue of *MOOREANA, Journal of the Palmetum.* The following information is excerpted from the introductory editorial of the first issue. "*Mooreana* is dedicated to palm botany ecology and conservation. These aspirations are built in to the design concept of The Palmetum. The intention is not to encourage the use of palms as mere collectible items or ornamental objects but rather promote a wider understanding of them as cohabitants of our environment."

"*Mooreana* is named in honour of the late Harold E. Moore, Jr., longtime editor of the International Palm Society journal *Principes* and foremost palm taxonomist of the 20th century. A tribute is included in this [first] issue."

"A regular contribution from an author of note is intended. In this issue the guest contributor is John L. Dowe, author and editor of the book *Palms of the South-West Pacific.* John gives an account of the palms of Vanuatu and Fiji, their relationships and morphology."

The first issue of *MOOREANA* is 24 pages long, sized like *Palms and Cycads* (The P.A.C.S.O.A. journal). It is of good quality print, with quite a few black and white photographs. Those interested in further information on *MOOREANA* or Friends of the Palmetum should contact Robert Tucker (editor) via the Townsville Botanic Gardens, P.O. Box 1268, Townsville, Queensland 4810, Australia.

Activities in North Queensland

In addition to publication of *MOOREANA,* the Townsville Botanic Gardens recently held their Third Annual Plant Sale at the Palmetum on September 29th from 9 A.M. to 3 P.M. Food and refreshments were available on site, along with numerous palm specimens.

News from New Zealand

The Palm and Cycad Society of New Zealand (NZP&CS) has recently conferred Honorary Membership on two key individuals instrumental in the formation of the NZP&CS. Keith Boyer was perhaps the main driving force to generate enthusiasm for palms and cycads and Andrew Andrews was a tireless worker who was mainly responsible for the setting up of the Society. Both of these men spent a great deal of their time and energy to make the NZP&CS a reality.

Palm and cycad planting activities continue in the Alberon Reserve. In February, 1991, twelve residents surrounding Alberon Reserve met with Nicholas Chin of the Auckland City Council Parks and the NZP&CS Alberon Committee: Michael Poulgrain, Peter Money and Keith Boyer. Coming out of that meeting were an April 14 "planting day" preceded by a "learning day" where residents were shown the type of palms to be planted and what they could expect to look like in ten years. About 30 residents participated in the planting of palms and many native shrubs donated by the ACC Parks for the shaded perimeter of the reserve. On this planting day, residents planted 5 *Butia,* 14 *Washingtonia,* and two large *Howea* (one *H. forsteriana* and one *H. belmoreana*)—each about three meters (10 feet) tall. Other palms donated by Michael Poulgrain and Keith Boyer were given to residents to care for until the next planting date. These plants included *Brahea edulis, Livistona chinensis, L. decipiens, L.* sp. 'Blackdown

Tableland,' *L.* sp. 'Eungella Range', *Sabal causiarum*, *S. palmetto*, and *Archontophoenix* sp. 'Mt. Lewis' donated by members Tim Rowsell and Keith Boyer.

Also in April, the Annual Palm Sale was held at Dick Endt's nursery, Oratia and was a great success. The Society raised nearly NZ$500 and a number of society members attended, many from afar.

In October, 1991, The Palm and Cycad Society of New Zealand (NZP&CS) took a day trip to Tiritiri Matangi Island, located in the Hauraki Maritime Park and Wildlife Sanctuary. In addition to viewing the island the purpose was to participate in planting Nikau palms (*Rhopalostylis sapida*) as part of the conservation project for the island. An additional trip to Tiritiri Matanga for the same purpose is planned in October of the coming year.

[Jim Cain of the IPS Chapter Committee would like to express appreciation to the NZP&CS for providing numerous issues of *Magazine of the Palm and Cycad Society of New Zealand*, from which the above information was extracted.]

Louisiana Chapter and Gulf Coast Chapter Meetings

The Summer 1991 meeting of the Louisiana Chapter of the IPS took place on Sunday, August 25th, 1991 at the home of members Richard "Dick" and Jerrilyn Fillon, on the west bank of the Mississippi River in Algiers, located at 3730 Rue Nichole, New Orleans, Louisiana. The group met at noon for lunch at 12:30. Members and guests of the nearby Gulf Coast Chapter were also invited. It was reported that the local chapter funds built up from dues and palm auctions will enable the chapter to contribute to worthwhile projects of the IPS and to purchase palms to be planted in the proposed palm garden, with all such expenditures to be approved by vote of the members.

A joint meeting of the Louisiana and Gulf Coast chapters was planned for October at Maxwell Stewart's estate in Mobile, Alabama.

Houston (Texas) Chapter Meeting

On Saturday morning, August 17th, sixteen members and guests assembled at the Moody Gardens in Galveston to tour the facility's greenhouse and palm plantings, several of which have been donated by the Chapter and by individual chapter members. A guided tour of the greenhouse facility was conducted by John Kriegel, Director of Moody Gardens, followed by a tour of the grounds by Galveston member Henry Homrighaus. Attendance was lighter than expected. Weather wasn't particularly cooperative, with all having to wait out a particularly heavy thunderstorm under the beach pavilion. Almost all of the mature Queen Palms (*Syagrus romanzoffiana*) that Moody Gardens had installed 2–3 years ago (and protected with individual electric heat wraps) were gone—killed by the 1989 Christmas Freeze and subsequent fungus attacks. All of the mature *Brahea armata* and most of the large number of adult *Phoenix dactylifera* planted in 1988 and 1989 were quite healthy and attractive. The garden has recently put in several *Neodypsis decaryi* and a lovely *Roystonea* sp. in very protected locations near the Hope Center. These will be afforded quite a bit of protection during cold weather and stand some chance of survival. The mature clustering dwarf *Phoenix* sp. donated by the Chapter was doing very well but was so surrounded by other foliage plants that it was very difficult to see. Other palms of interest included plantings of *Livistona chinensis*, *Washingtonia filifera*, various *Sabal*, and *Ravenea*. Future Moody Garden plans call for a large Conservatory currently under construction, slated for completion in 1993, which will contain many adult sized tropical palm specimens.

The September meeting was held at the home of Horace and Cynthia Hobbs at 3 P.M. on September 28th. A palm sale to members only was held featuring numerous palms owned by the Houston Chapter and others owned by Horace and others. A number of variegated *Rhapis* specimens were also offered for sale by Lynn McKamey of Rhapis Gardens in Gregory. Following the plant sale, Lynn gave a presentation on care and cultivation of *Rhapis* palms and a tour of the Hobbs' garden was conducted.

The October meeting was held at the home of Jim and Elizabeth Cain in west Houston on Saturday, October 19, beginning at 4 P.M. The program featured a slide presentation by Jim from recent Caribbean trips to the southern Netherlands Antilles (Aruba, Curacao, and Bonaire) and to Anguilla, B.W.I., in the northeast Caribbean. There was a tour of the Cain garden, with several additions since last year, followed by a light dinner for all with Preserved Toddy Palm [*Arenga* sp.??] from Thailand over vanilla ice cream as a dessert. The Door Prize palm was a two-gallon specimen of *Thrinax morrisii* from Anguilla.

Don't forget, the next Houston Area Annual Palm Sale is set for Saturday, April 11, 1992 at the Houston Arboretum and Nature Center. All interested parties are invited.

Pacific Northwest Chapter Meetings

The Pacific Northwest Chapter of the IPS held their Third Annual BBQ on Sunday, July 28, 1991 at Carlos Felicella's home in West Vancouver. The August General Meeting was held on August 26th at the VanDusen Gardens and the group set up a Palm Society Booth at the PNE from August 18 to September 2, 1991. The next General Meeting will be held at the VanDusen Gardens in Vancouver, B.C., Canada, on November 25th.

The name of the group's quarterly publication has been modified to *The Hardy Palm—International*, following the Chapter's decision to solicit international temperate zone readership following the demise of the former *Palm Quarterly*. Thanks to Richard Woo and Nick Parker for their efforts on this behalf.

Mackay (PACSOA) Recent Activities

The Mackay Palm and Cycad Society (PACSOM) of PACSOA met in April at the Hampden Valley Nursery, home of Robyne and Allan Paskins. The meeting was attended by 19 members and 2 guests. Upon arrival, attendees caught a quick glimpse of some nice looking tall palms set out neatly in a lawn setting. Following the meeting and a very generous afternoon tea, a garden tour was held. The large collection of well advanced palms are all neatly set in rows. The palms are sun hardened and this seems to help in the control of fungal diseases. As you look closer, you discover some semi-scarce types, tucked neatly behind, i.e., spp. of *Dictyosperma*, *Neodypsis*, *Hyophorbe*, *Wodyetia*, *Ptychosperma*, and *Chamaedorea* plus lots more. Rob also has a nice lot of palm look-alike and complementary plants, including *Dracaena*, *Beaucarnea*, *Cycas*, and *Cyathea* as well as various tropical flowering and foliage plants. Much needed rain began to fall as the afternoon meeting drew to a close.

The May meeting at Lois McGregor's residence in Slade Point with twenty five members and ten visitors marked the fourth anniversary of PACSOM. Lois gave a detailed recap of the North Queensland excursion. The June meeting at Val and Percy Simonsen's Farmlet in Sarina featured an interesting and entertaining report

by Keith and Ailsa Boyden of their recent visit to Darwin and Bali. This was followed by Dr. John Luxton's presentation, focusing primarily on problems of soil erosion. A holiday mood prevailed with a BBQ picnic lunch and tour of the garden.

June 16th saw another working party at the Farleigh Plot, with ten participants. The garden has progressed very well and management is so impressed that PACSOM has been offered another 0.75 acre. There are currently 97 genera (262 species) in situ. PACSOM also met at Farleigh Plot on Sunday afternoon, July 21. The IPS commends this active group and their community service program.

PACSOM also participated in the Home and Garden Expo held by the Mackay Horticultural Society on August 15 and 16, 1991. The August meeting was held at EIMEO, home of Russ and Robyn King.

South Queensland Group (PACSOA) Meetings

The South Queensland Group (SQG) of PACSOA met on Monday, September 16th at Bread House. Jim and Shelly Gage gave a slide presentation of their recent visit to the new Palm House at Key Gardens. In addition, discussions were held on palms and cycads suitable (and not suitable) for growing in the South Queensland climate.

Previously the group had participated (in August) in the Royal National Association Exhibition with a display seeking to provide information on the education and interest in both palms and cycads.

The SQG members have regularly donated various plants and seeds for raffle and auction. It is worth noting that proceeds from any cycad that is auctioned are placed by SQG in the Cycad Research Fund. This fund is being built up so that the Society can establish a project on such things as, for example, a conservation study on a cycad in an endangered habitat, the ecology of a little known species, the mapping of a cycad species and its biogeography, pollination studies, or even cleaning up a weed infested cycad habitat such as Macrozamia Park at Mount Tamborine just south of Brisbane.

Central Florida Chapter Meetings

The Central Florida Chapter of the IPS met July 28, hosted by two enthusiasts with private collections in Melbourne and Grant, about 15 miles apart in Brevard County. The first stop was at the home of Joe Alf in Melbourne. After touring Joe's garden, a "bring your own picnic" lunch was enjoyed. Next the group went south to the fair city of Grant for a visit with Mike Dahme. Mike has an 8-acre site snaked with waterways and plenty of palms. Beer and snacks served by Mike and the regular chapter palm sale rounded out the afternoon.

Sydney Branch (PACSOA) Activities

The July meeting was held on Tuesday, July 16, at the JH Maiden Theatre, Royal Botanic Gardens, Sydney. Botanist and author Tony Rodd presented an educational talk on basic palm botany, coupled with slides of Southeast Asian Palms from his forthcoming book. The meeting also offered members the chance to purchase a limited number of an unusual suckering *Phoenix* sp. aff. *roebelenii*. The August 20th outing was held at the French restaurant Le Don Batu in Surry Hills.

The November 1991 meeting has been tentatively set for November 12, 7 P.M., to coincide with Len Butt's tour of New South Wales. Len will be talking on cycads and promoting his new booklet on Zamiads.

South African News

The South African Palm Society (S.A.P.S.) held a recent meeting in Pon-

gola. Friday morning after registration and tea at Pongola Palm Nursery, delegates wandered through Armand and Doulinas exquisite garden to tour the palm delights growing there. The group then left for the Rouilland garden where they were confronted by some outstanding mature palm specimens. The tallest *Livistona decipiens* outside Queensland greeted us at the entrance to the garden. With its great bunches of seed it was a sight to behold. A *Borassus flabellifer* drew gasps of admiration and other mature specimens were admired by all. After refreshments, the contingent left for Sally's Cycads to view the nursery there.

The interesting fare at suppertime is worthy of mention. The bushpig on spit as well as the ribbok wors (sausage) was delicious. Friday night ended early because of the full Saturday schedule.

On Saturday at the crack of dawn the group left for Kosi Bay in a convoy consisting of the Pongola school bus, three four-wheel drive vehicles, and Ralph Chadwick's volkswagen synchro. Breakfast was served at the Josini Dam wall. The trip to the *Raphia australis* habitat was spectacular and all returned tired and worn out. Slides of Bernard Fischer's visit to California, Ecuador, and Colombia were shown and palm seedlings exchanged. A good time was had to all.

A Pretoria members social was held on Saturday, July 13th at 3 P.M. at Rob Meyer's (Meyer's Palms) for drinks and to review Rob's garden and nursery. A talk on how to grow quality palms and a preview of Bernard Fischer's slides of Madagascar were included.

Activities in Western Australia

Although not currently affiliated with the IPS, the Palm and Cycad Society of Western Australia is active locally promoting palms and cycads. They have an exhibition and palm and cycad sale organized for November 9 and 10, 1991 at the South Perth Lesser Hall from about 9:00 A.M. until 4:00 P.M. on both Saturday and Sunday.

In addition the group has a significant palm planting project in Gascoyne Park. At the March 1991 meeting, members offered to donate about 130 palms. These along with palms not used last year, will bring the number to about 220 palms. Further donations are expected. The IPS commends such efforts from all palm lovers worldwide!

Northern Territory [Australia] Conservation Efforts

The Palm Society of the Northern Territory was formed in 1983, largely in response to publicity about the endangerment of *Ptychosperma bleeseri* in their only two known habitats. Since that time the group, now renamed the Northern Territory Palm & Cycad Society (NTPACS), has been involved in quite a few efforts focusing on conservation of this local species. In 1985, the group began growing seedlings for future reintroduction into wild populations. In 1986, a piece of ground at Freds Pass Reserve, 23 kilometers south of Darwin at Bees Creek, was given to the Society and at least 15 *P. bleeseri* were planted, including six from the Conservation Commission. Over the next two years, maintenance and planting at Freds Pass continued, along with planting of six large *P. bleeseri*, donated to the Conservation Commission to plant at Howard Springs Reserve. Several conservation articles were also written in *Palms & Cycads*, the P.A.C.S.O.A. quarterly journal.

In April 1987, members of NTPACS planted 37 *P. bleeseri* at the Territory Wildlife Park at Berry Springs. This new park is run by the Conservation Commission with a policy of keeping only endemic flora and fauna. The area is large and

relatively isolated from domestic gardens. Assurances were given that previously planted exotic *Ptychosperma* species would be soon removed to ensure seed integrity. In 1991, members visiting the site were disappointed to see the *P. bleeseri* diminished in number and left entirely to their own devices. More disturbing is the continued presence of other *Ptychosperma* species and even introduction of additional unrelated exotics such as *Neodypsis*, *Roystonea*, *Rhapis*, etc. since 1989. In May 1991, Black Jungle (portion 2990) was entered on the Register of the National Estate. Michelle Karter of the Australian National Threatened Species Network has shown an interest and been informed of progress—or lack thereof.

In June 1991, two Conservation Commission staff gave a presentation to the NTPACS. Topics discussed by David Liddle (Wildlife Management Unit, CCNT) included the distribution and population dynamics of *P. bleeseri*, and observations were made on regeneration and/or destruction by fire, feral animals, and grazing. Frank Van Der Sommen (Vegetation Management Unit, CCNT) proposed that the NTPACS prepare a submission to "Save the Bush Grants Scheme" for funding to finish fencing Banker's Jungle. Frank expressed the opinion that this would be favorably received. The CCNT would be pleased to provide technical assistance if asked. He then went further by proposing that NTPACS adopt Banker's Jungle fenced area. These proposals will be followed up by the NTPACS.

A strongly worded letter written by member Len Reddie was forwarded to the local member of Parliament, expressing dismay at finding exotic plants including other *Ptychosperma* spp. at the Wildlife Park. This letter was then forwarded to Mike Reed, the Minister for Conservation, who raised the issue in Parliament. Action appears likely as the head of the Wildlife Park has been firmly directed to follow the policy of native species only and remove any exotic species.

News from California

The Southern California Chapter of the IPS met on May 5, starting at the Huntington Library and Botanical Gardens. The meeting featured a slide presentation by Dr. James Folsom, Director, entitled "Conservatories of the United States." A tour of the palm garden was led by Ron Harris, Curator of the Palm and Jungle Garden. At 1:00 P.M., the group reconvened at the home of Jim and Debbie Folsom for a potluck picnic on the lawn, followed by visits to the gardens and galleries. The Southern California Chapter received a great compliment from the Folsoms, whose garden is used by many groups for various events. Apparently the palm meeting left the garden the cleanest. Thanks to Frankie and Frank Ketchum for leading the cleanup. They did a wonderful job.

The Chapter also met on July 13, starting at Lake Park in Huntington Beach with a potluck barbecue. The palm auction and raffle raised over one thousand dollars for the Chapter coffers. From Lake Park, the group headed north to the relatively young garden of Steve and Glenda Snyder in Seal Beach. Steve's garden had a number of rare, heat-loving palms that looked really good. His was a really well-cared for garden and one can tell he truly loves the palms. Steve had also just planted out a 15-gallon *Roystonea elata*, after observing Frank Ketchum's magnificent specimen in Huntington Beach. From there members split up, with some going to Frank Ketchum and Lois Rossten's garden and the others to Ralph and Nilda Velez' garden, then switching around. Probably one of the most rare palms that can be seen outdoors in California, *Juania australis*, is growing beautifully in Frank's garden. Frank and Nilda have a coconut in the greenhouse with 16-foot leaves, which he

plans to dig and sell to a shopping mall that has enough space and light to accommodate it.

On September 21st, the Southern California Chapter visited the exceptional gardens of Ed Moore and Jim Wright in San Diego. Both gardens are quite mature with huge towering palms and many unusual species, offering attendees the opportunity to see private gardens with several decades of growth. Highlights of the Moore garden tour in the morning included a double-headed *Livistona chinensis*, a large mature *Parajubaea cocoides*, a mature *Nannorrhops ritchiana*, *Lepidorrachis mooreana*, an unusual *Howea* variant, large *Sabal* species and a huge collection of cycads including more than thirty identified African species. The Wright garden, seen in early afternoon, featured huge *Rhopalostylis*, mature *Neodypsis decaryi*, *N. baronii*, *Hedyscepe canterburyana*, *Euterpe edulis*, a beautiful *Bismarckia*, mature *Chamaedorea* species, fruiting *Howea* and many other rare and unusual palms as well as an expansive collection of orchids and bromeliads. The meeting was completed with a huge palm raffle and auction. A meeting of the Southern California Chapter Board of Directors was also held following this meeting.

On November 16th, the Friends of the Ventura College Palm Garden met at and around Ventura College, with a plant sale featuring over 100 species starting at 8: 00 A.M. The chapter meeting began at 11 A.M. In addition to the business meeting and a presentation, there was a raffle and auction, followed by garden tours, which included a magnificent *Brahea clara* and various *Butia* and *Hyphaene* species.

JIM CAIN

U.S. Postal Service

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Palm Note

Good news from Sydney, Australia, where a rare and endangered species of *Pritchardia* is being pushed back from the verge of extinction. *Pritchardia maideniana* was about as close as you could get to being lost forever, the species being known only from two aging specimens in the Royal Botanic Gardens in Sydney. This handsome fan palm is thought to have been collected by Joseph H. Maiden on one of the Hawaiian islands around the turn of the century, but has never been relocated in the wild. Beccari described it in 1913 from these two plants, which though healthy are beginning to show signs of age. Fruiting has occurred in the past, but fertile seed has never been obtained.

Last year, the species was finally propagated successfully by seed, and four young plants are now growing near the Gardens' restaurant (Fig. 1). It has also been distributed to other botanical gardens around the world, to reduce its vulnerability by increasing its numbers in cultivation.

MARK WUSCHKE

1. Young seedlings of *Pritchardia maideniana*. The plaque commemorates their successful propagation, and the planting by the honorable Nick Greiner, premier of New South Wales, and Mrs. Greiner, on the occasion of the 100th anniversary of the Royal Botanic Gardens and Domain Trust, 26 February 1990.

Back Cover

Close-up of a staminate inflorescence of *Wettinia hirsuta* Burret growing on Cerro Jefe, Panama. Photo by Andrew Henderson.