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Contents for January

Cover Picture

Kerriodoxa elegans growing near Thalang in the Koa Pateau National Park on the island of Phuket. Photo by Jack Dane. See pp. 3, 11, 46.

PRINCIPES

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Principes, 27(1), 1983, pp. 3–11

Kerriodoxa, a New Coryphoid Palm Genus from Thailand

JOHN DRANSFIELD

Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, U.K.

When I began to rearrange the palm collections in the herbarium at Kew, I came across a collection from Thailand made in 1929 by A. G. F. Kerr, of a fan palm which had been tentatively named as *Livistona*, but which on a cursory investigation seemed not to belong to that genus. On checking Kerr's diaries, collecting books, and photograph albums preserved in the archives at Kew I discovered that there should have been two collections, one consisting of leaves and old pistillate inflorescences and one of an old staminate inflorescence. The latter eventually turned up thanks to Dr. B. C. Stone who rejected it from the Pandanaceae where it had been filed. The leaf of Kerr's collection bears a strong resemblance to that of *Borassodendron borneense* J. Dransf. in its discolorous lamina and razor-sharp petiole margins, but the inflorescences are coryphoid though without obvious affinity. Flowers are lacking, and the few fruit are so squashed as to show very few characters. However, Kerr's notes are meticulous and there is even a photograph of the palm in the forest, so that I had an excellent idea of the habit of the palm. I suspected this was an undescribed genus with possible affinity with *Trachycarpus*. In his diary Kerr described in considerable detail the locality and habitat of the palm on the island of Phuket off the west coast of Peninsular Thailand. A transcription follows:

"*Monday March 11th 1920*

8.15 a.m. left by car to go to Talang waterfall. At Talueen village (Talang), turned to right off the main road. At first through some rubber plantations, then some scrubby evergreen forest. Later descended into a small valley and soon reached waterfall (at 9.00 a.m.) where road ends in evergreen forest.

Left car and ascended along a series of waterfalls. For the lower ones, cemented steps had been made. High evergreen forest here. A *Vanilla* (with leaves) not uncommon on trees near stream, but not seen in flower. *Arenga saccarifera*[1] very common in this forest among other trees being *Spondias* sp, *Duabanga*, *Adenanthera*, *Randia exaltata*, *Sterculia campanulata*, *Alangium* sp., etc.

10.55 a.m.: At head of waterfalls there was some level ground with a hut and a Chinaman. This turned out to be a hut used by Chinese felling firewood. From the hut there were some timber paths running into the forest, along which the firewood is drawn on sleighs by buffaloes. The ground from here on for some way was fairly level, this part being in the nature of a plateau. Beyond the hut the path ran through bamboo (*Kriap*) for some way and then into evergreen again, where *Arenga* particularly abundant *as well as a fan-leaved palm, dwarf, not met with before*[2] (? possibly one at Watbuan, Bangkok is this species); there were other palms such as *Calamus* sp, *Pinanga*, *Zalacca*, *Caryota* etc. *Musa* sp also not uncommon, and there were quantities of *Donax*. . . ."

[1] Probably not *A. pinnata* (syn. *A. saccharifera*), but *A. westerhoutii*.

[2] Dransfield's italics.

Kerr's diary is so exact in its details that I felt sure that if forest still existed at Talang, then the palm might be relocated. A palm enthusiast friend in Bangkok, Commander Watana Sumawong, was contacted and he passed on the information and request to Mr. Charal Bhoonab, Director of the Khao Chong Botanic Garden near Trang in South Thailand. Charal relocated the palm and was able to take me straight to it 50 years and 1 week after Kerr's visit. The palm was in young fruit; despite an intensive search we could find no fresh flowers and only 2 more or less ripe fruit. Yet there were sufficient details to suggest we were indeed dealing with an undescribed genus. Then, early in 1981 Charal forwarded staminate and pistillate flowers in spirit, and Dr. Tem Smitinand forwarded a staminate collection from a second locality near Surat Thani. The palm is here described as *Kerriodoxa elegans*.

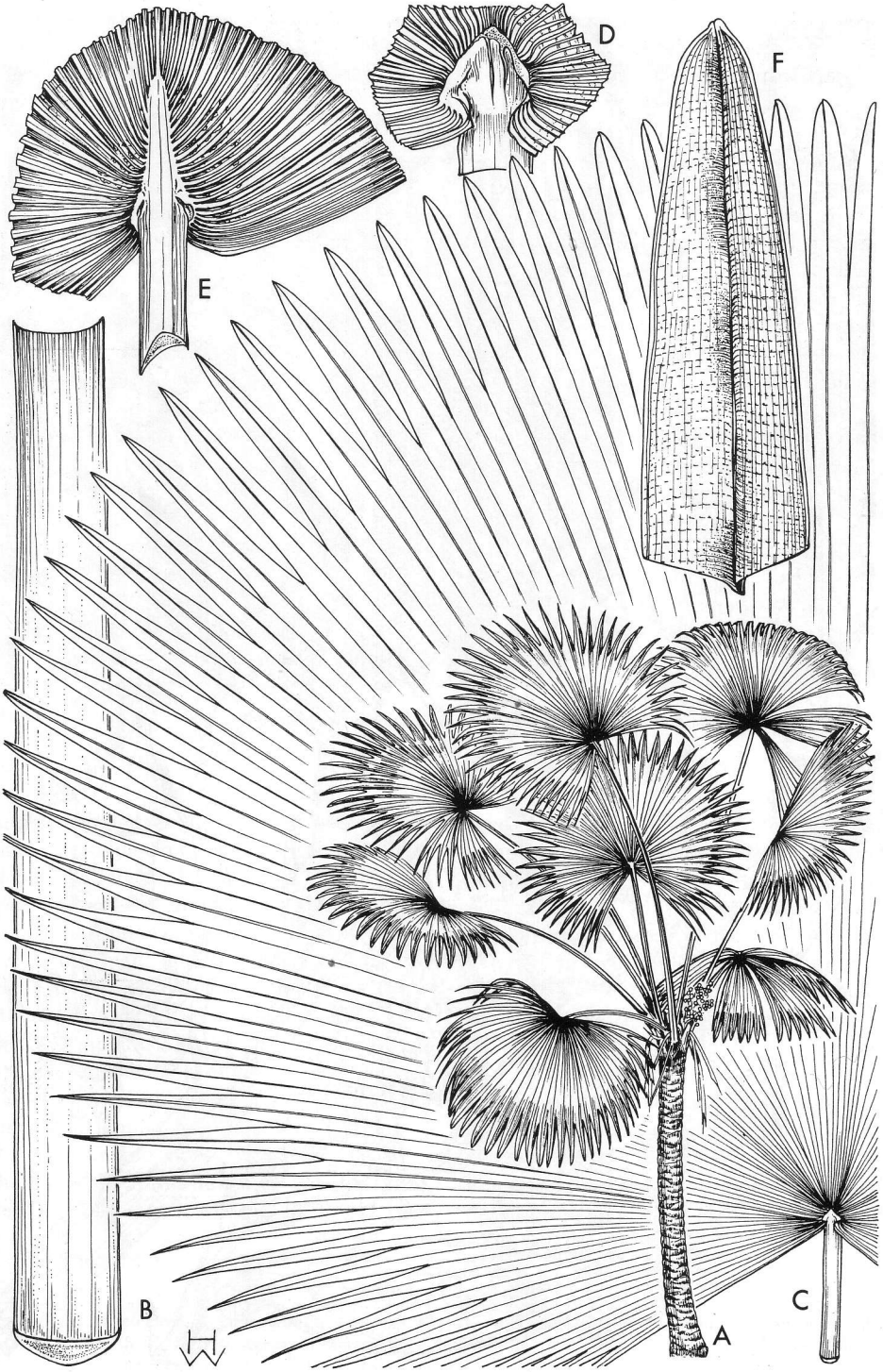
Kerriodoxa J. Dransf. gen. nov. Palma solitaria inermis acaulescens vel erecta dioica pleonantha foliis palmatis induplicatis ad Coryphoideas pertinens. Petiolus marginibus quam novaculis acutis, basi vaginanti primo integra dein contra petiolum findenti; hastula adaxialis conspicua. Inflorescentia staminata erecta dein arcuata, bracteis primariis conspicuis triangularibus spiraliter dispositis basi tubulosis, ramos subtendentibus quos in ordines 4 ramificantes turbam rachillarum tomentosarum facientes. Flores staminati in tuberculis demissis singulatim vel binatim dispositi, bracteolis minutis subtenti; calyx basi tubulosus lobis 3 angustis apiculatisque, corolla basi stipitata, petalis 3 anguste-triangularibus; stamina 6 filamentis gracilibus antheris latrorsis. Inflorescentia pistillata erecta quam staminata robustior, in ordines 2 ramificans, ramis ultimis tomentosis superficialiter articulatis. Flores pistillati in tuberculis demissis singulatim vel binatim dispositi; calyx tubulosus lobis 3 brevibus; corolla basi columnaris stipitata lobis 3 triangularibus: staminodia 6; ovarium carpellis 3 apicibus liberis ad centrum connatis, stigmatibus paulo reflexis; ovula anatropa singulatim in basi carpelli disposita. Fructus 1-seminalis (raro 2-vel 3-seminalis) epicarpio granuloso vel papilloso, mesocarpio spongioso, et endocarpio exili; vestigium stigmatis basali; endospermium vadoso-ruminatum, embryone sub-basali.

Kerriodoxa elegans J. Dransf. sp. nov. Palma formosa solitaria acaulescens aut erecta trunco dense annulato-cicatricoso usque 5 m alto, ca. 20 cm diametro; petiolus usque 2 m longus; lamina ± circularis ca. 2 m diametro, valde discolor; inflorescentia staminata usque 45 cm longa, floribus usque 3 mm longis; inflorescentia pistillata usque 75 cm longa, floribus ca. 5 mm longis. Fructus maturus globosus basi concavo-depressus aurantiacus ca. 4.5 cm diametro.
Typus: Thailand, Phuket, *Dransfield JD 5421* (holotypus K: isotypi AAU, BH, BKF, L).

Solitary dioecious, unarmed, moderate, pleonanthic induplicate palm, acaulescent or with a short grey erect trunk to 5 m tall, ca. 20 cm diam., with very close nodes, usually obscured by leaf bases, but ultimately becoming smooth. Leaf base sheathing at first, later splitting opposite the petiole, and not encircling the stem, not fibrous; petiole to 2 m, dark shiny green covered with grey indumentum when young, semicircular in cross-section when fresh, ca. 26 × 15 mm, distorting on drying, the two margins extremely sharp;

→

1. *Kerriodoxa elegans*. A, habit ×1/50; B, portion of petiole with sharp margins ×2/3; C, surface of part of lamina ×1/7; D, adaxial hastula ×2/3; E, abaxial view of insertion of lamina ×1/3; F, detail of tip of lamina segment ×2/3. A from a photograph, B–F from *Dransfield JD 5421*. Drawn by Heather Wood.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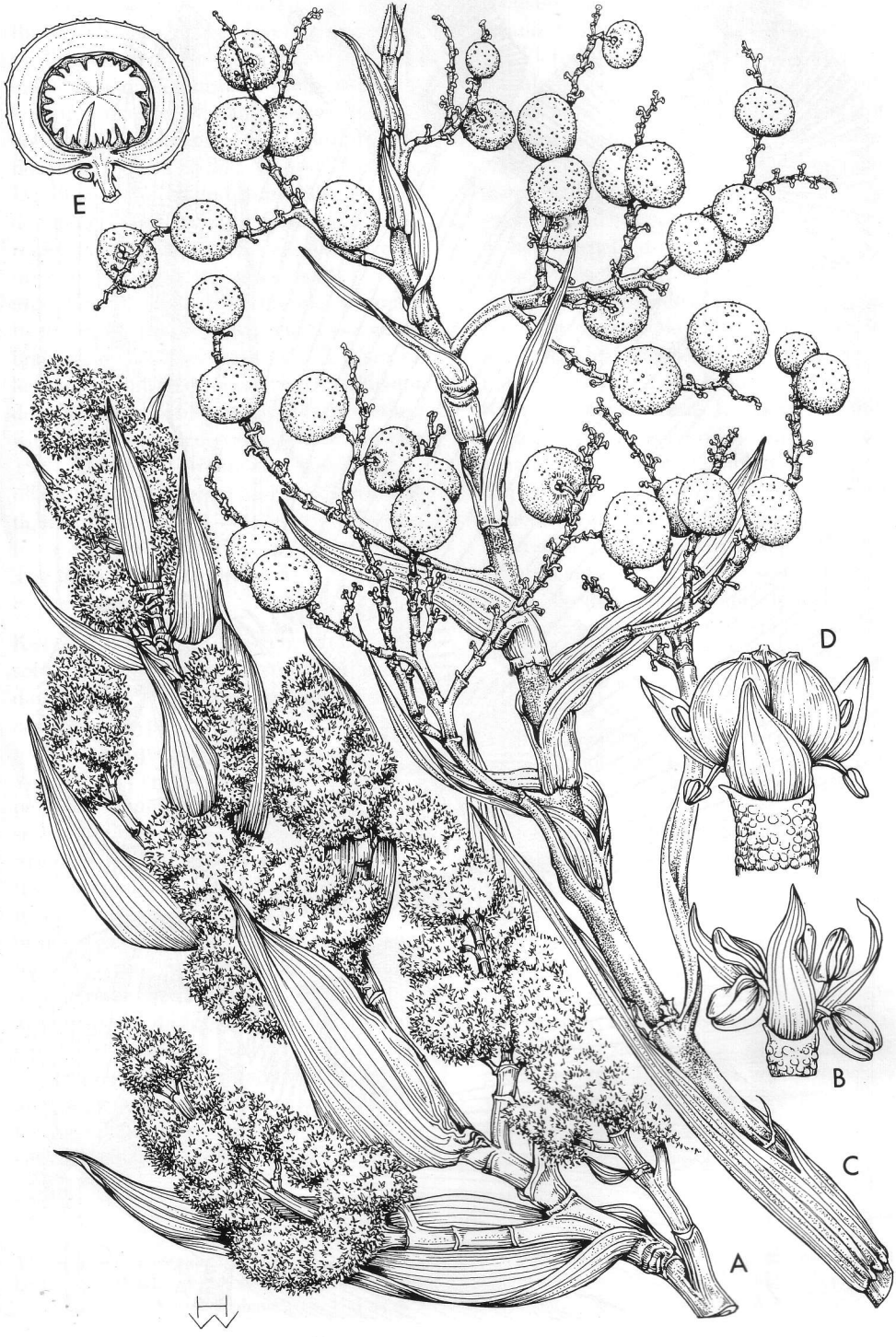
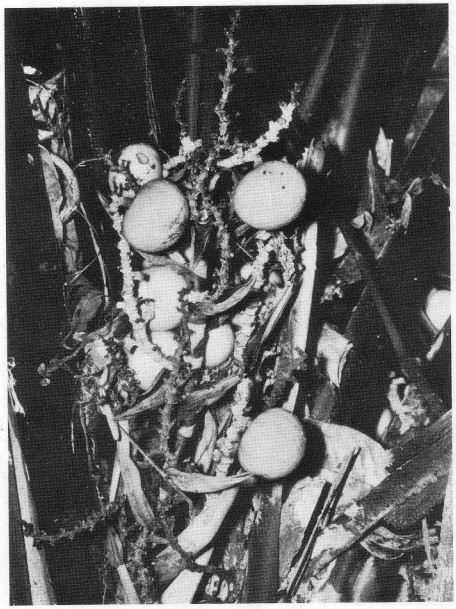

E
D
B
C
A

3. A pistillate plant of *Kerriodoxa elegans*. March 1979

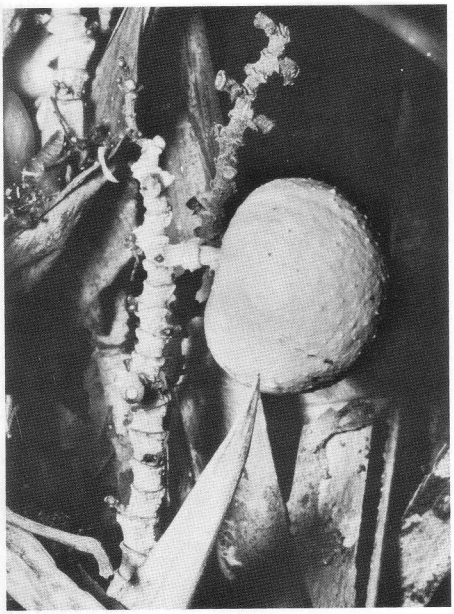
lamina palmate or very shortly costapalmate ± circular in outline, held ± strictly in one plane, ca. 1.5 m from petiole to apex and ca. 2.0 m wide at widest point; adaxial hastuala conspicuous ± triangular ca. 5 mm high; adaxial folds ca. 45 on each side of the mid-line, splitting to 10–40 cm to produce rather uniform stiff single fold segments, ca. 40 mm wide; brown interfold filaments present in expanding leaf, usually fast disintegrating; adaxial surface of lamina rich dark shiny green; abaxial surface densely covered with chalky white indumentum; transverse veinlets conspicuous; ribs and hastula covered with scurfy caducous indumentum when young. Staminate inflorescence erect at first becoming arcuate, to ca. 45 cm; peduncle ca. 20 mm diam., creamy white, drying brown, densely covered with pale greyish brown tomentum; peduncular bracts ca. 15 in all, conspicuously tubular in the basal ca. 1 cm, with an expanded ± triangular acuminate limb, the longest to 17 × 6 cm, decreasing in size towards the tip of the inflorescence, drying dull brown, with adaxial surface glabrous and abaxial surface densely greyish brown tomentose; each bract subtending a first order branch, adnate to the axis to just

←

2. *Kerriodoxa elegans*. A, staminate inflorescence ×⅔; B, staminate flower ×7½; C, infructescence ×⅓; D, pistillate flower ×5; E, vertical section of mature fruit ×⅔. A from *Dransfield JD 5423*, B & D from *Charal Bhoonab s.n.*, C & E from *Dransfield JD 5421*. Drawn by Heather Wood.



4. An infructescence of *Kerriodoxa elegans*. March 1979



5. Close up of a more or less mature fruit of *Kerriodoxa elegans*; note the jointed appearance of the rachilla, the persistent calyx, and the enlarged stipitate corolla base forming the fruit stalk, the scattered irregular papillae on the epicarp, and the abortive carpel remains at the base of the fruit. March 1979.

below the following bract; lowermost first order branch to 15 cm, decreasing in length towards inflorescence tip, branching to the fourth order to give a condensed mass of short rachillae, each branch subtended by a somewhat undulate tubular bract with a triangular apiculate tip; all inflorescence axes densely covered with greyish-brown tomentum; rachillae ca. 12 × 1 mm, somewhat zig-zag, bearing spirally arranged tubular bracts with undulate margins and short triangular apiculate limbs to 1 mm, each subtending a low tubercle to 0.5 × 0.5 mm bearing 2 flowers and a minute triangular bracteole to 0.3 × 0.1 mm. Staminate flower ± symmetrical creamy yellow at anthesis, soon turning brown; calyx with a basal trigonous tube to 0.5 × 1.0 mm densely covered in pale brown tomentum, and three narrow, triangular apiculate, keeled ± glabrous lobes to 0.5 mm, with somewhat undulate margins; corolla at the base forming a solid three-angled column to 1.0 × 0.5 mm; corolla lobes 3, triangular, to 2.5 × 1.0 mm, the margins and abaxial surfaces papillose, the adaxial surface rugulose; stamens 6 borne in two whorls of 3 with antesepalous filaments free, the antepetalous filaments joined together at the base and also partly fused to the petals; filaments of the two whorls ± equal in size ca. 1.0 × 0.2 mm at the base, tapering gradually; anthers oval in outline to 1.3 × 0.9 mm, latrorse, pollen grains spheroidal, L 25–27, l 24–27, monosulcate; sulcus slightly longer than L axis; exine c. 1.0 thick; ornamentation of thin, disjointed muri forming an incomplete, coarse reticulum; lumina 1.5–3.5 in diameter, 0.5, irregularly gemmate or granular; pistillode absent. Pistillate inflorescence ± erect to 75 cm, much more robust than the staminate; peduncle to 30 cm long, ca. 3.0 cm diam. at the base,

6. View from a roadside looking into forest at Thalang with abundant *Kerriodoxa elegans*. *Caryota* and wild bananas also visible.

creamy white at anthesis becoming green, densely covered in grey brown tomentum; peduncular bracts to ca. 17 in all, the longest 23 × 6 cm, tubular in the basal up to 7 cm, and expanded above as in the staminate, the basal 1 or 2 bracts empty, the rest subtending first order branches adnate to the main axis as in the staminate, the whole inflorescence branching to 2 orders; first and second order branches appearing articulated, owing to the dense tomentum on axes and the truncate ±

glabrous bracts; proximal first order branches to 20 cm, distal much shorter, bearing up to 5 rachillae; rachillae to 11 × 0.5 cm somewhat zig-zag, bearing bracts at intervals of 5–6 mm near the base, decreasing to 3–4 mm near the rachilla tip; bracts ca. 1 mm high except for the triangular tip to 3 mm, the margins ± glabrous, bract subtending a pair of flowers, borne on a short densely tomentose tubercle to 2 mm high, 2 × 3.5 mm diam. occasionally much larger near the base of the inflorescence; bracteoles if present, obscured by tomentum. Pistillate flower creamy-yellow at anthesis; calyx forming a tube ca. 1.25 mm long, 2.0 mm diam., tipped with 3 short narrow triangular lobes 0.5–0.8 mm, in the tubular part densely tomentose, the lobes and sometimes also the margins glabrous; corolla base forming a solid column 1.0 × 1.5 mm–2.0 × 1.5 mm; densely tomentose; corolla lobes 3, spreading at anthesis, triangular ca. 2.7 × 1.3 mm, glabrous, the margins ± hyaline and denticulate or papillose; staminodes 6, with filaments to 0.8 × 0.15 mm, and flattened empty anthers to 0.5 × 0.4 mm; ovary of 3 (rarely 4) carpels, free at their tips, partially fused along the middle, ca. 2 × 1.5 mm (just past anthesis), topped by short free, outward curving stigmas to 0.2 mm; ovules 1 in each carpel, anatropous. Corolla base enlarging after fertilization, increasing to 6 × 4 mm. Usually one carpel only maturing, rarely two, the abortive carpels and stigmatic residue persisting at the base of the fruit. Mature fruit spherical, concave-depressed at the base, to 4.5 cm diam. horizontally, 3 cm diam. vertically; epicarp orangey yellow, covered in short pustules; mesocarp ca. 7 mm thick, whitish, soft and spongy; endocarp thin, sparsely developed. Seed ca. 2.5–3.0 cm diam. covered in a thin pale brown testa; endosperm shallowly ruminate, the ruminations corresponding to the vascular supply of the testa; embryo subbasal. Seedling leaf not known.

THAILAND: Phuket, Thalang, Khao Pha Tail, *Dransfield & Charal Bhoonab JD 5421* (Holotype K; isotypes AAU, BH, BKF), *JD 5423* (BKF, BH, K), *Kerr 17448* (K), *17448a* (K), *Koyama et al. 15,303* (AAU); Surat Thani, Khao Sok, *Vithoon Peerawat* s.n. (25.1.81) (BKF, K).

VERNACULAR NAMES. "Ching Lang Kao," "Tang Lang Kao," "Thang."

HABITAT: *Kerriodoxa elegans* is a conspicuous abundant component of the undergrowth of the rather dry evergreen forest developed on underlying granite at Thalang, growing on hill slopes but apparently avoiding ridgetops and valley bottoms. With it grows an assortment of palms including *Caryota mitis*, *Arenga westerhoutii*, and *A. caudata*, *Orania sylvicola*, *Daemonorops tabacina*, *Calamus peregrinus*, and *Pinanga* sp. (aff. *P. adangensis*). Within the population of *Kerriodoxa* there seemed to be a preponderance of pistillate plants. Flowering occurs while the plant is still stemless. No observations have been made on pollination or dispersal, and the eophyll is as yet unknown. The area of forest at Thalang has recently been designated as a National Park.

Relationships with Other Genera

The partial fusion of the carpels confined to the central area and the free stigmas suggest an affinity of *Kerriodoxa* with the simpler apocarpic palms such as those belonging to the *Trithrinax* alliance, rather than to the palms of the Livistona alliance. (Moore 1973). The well developed stipitate base of the corolla in *Kerriodoxa* is also a feature of *Chuniophoenix* and, to a lesser extent, *Corypha* and *Nannorrhops* in the *Corypha* alliance, and some species of *Rhapis* (e.g. *Rh. micrantha*) in the *Trithrinax* alliance. The vasculature of the ovule is similar to that of *Corypha* (N. W. Uhl pers. comm.). Yet in habit there is no resemblance between *Kerriodoxa* and *Rhapis*, and neither is

there much in the habit to suggest relationships with *Corypha* or *Chuniophoenix*. *Kerriodoxa* combines several features which are unusual in the coryphoid major group, and because of this it appears to occupy a rather isolated position. I believe it should be accommodated in an alliance of its own in a position intermediate between the strictly apocarpic palms of the *Trithrinax* alliance and the fully syncarpic palms of the *Corypha* alliance.

Acknowledgments

I should like to thank Dr. Natalie Uhl for many stimulating comments on the structure of the flowers and generic relationships of this new genus. Without the cooperation of Dr. Tem Smitinand and Cmdr. Watana Sumawong in Bangkok it would not have been possible to relocate Kerr's palm so quickly, but most of all my thanks go to Mr. Charal Bhoonab who actually refound the palm and to whom I am greatly indebted for his hospitality and his perseverence in obtaining spirit-preserved flowers; his enthusiasm for Thai palms has done much to increase my knowledge of the flora of Peninsular Thailand. My visit to Phuket was made during an FAO rattan consultancy. The pollen description was prepared by Keith Ferguson. Heather Wood prepared the drawings.

LITERATURE CITED

MOORE, H. E., JR. 1973. The Major Groups of Palms and their Distribution. Gentes Herbarum 11(2): 27–140.

NEWS OF THE SOCIETY

Southern California

A two day meeting was held on July 24th and 25th by the Southern California chapter giving members an opportunity to visit many different gardens. Approximately sixty-five people attended.

The first day started at 9:30 AM in Oceanside at the home of Paul and Mary Grigsby. Paul conducted a tour of his 3½ acre garden and told us about his palms, the problems of growing them, and plans for the future. A pot luck was held upon completion of the tour. Next on the agenda was a short drive to Quail Gardens to see the palms growing there. A short meeting was held in the exhibition hall and followed by a palm auction. Final stop for the day was at the home of Bill Gunther. After touring his garden, refreshments and a buffet dinner including roast pig and corn were provided. To everyone's surprise we were then entertained by the Folklorica Los Amigos, a Mexican dance group. Their very good performance brought to a close the first day's activities.

The second day was spent in the San Diego area enjoying the hospitality and viewing the lovely gardens of Ed Moore, Jim Wright, Bob Cantos, Bill Clark, and Allan Bredeson.

On September 11th a beautiful sunny day for a meeting greeted everyone journeying to the home of Lynn and Juanita Muir at Dana Point. After a tour of the garden, snacks and refreshments were provided under a canopy set up for the occasion. A short meeting was held followed by a raffle of many choice palms which had been donated by members. A side trip to the home of Bob and Jennifer DeJong in San Clemente provided a fine ending to the day.

FRANK KETCHUM

New Address for Seed Bank

Ernie has moved. The correct address for the Seed Bank is now:

Mr. Ernest B. Chew, Correspondent
1965 Sheridan Ave.
San Diego, CA 92183

Principes, 27(1), 1983, pp. 12–17

The Use of Palms by Man on Siberut Island, Indonesia

ALAN P. N. HOUSE[1]

World Wildlife Fund, Jalan Ir H. Juanda 9, Bogor, Indonesia

Siberut Island, the largest of the Mentawai group, lies in the Indian Ocean off the west coast of Sumatra, between latitudes 0°55′S to 3°20′S and longitudes 98°31′E to 100°40′E (Fig. 1). The climate is virtually aseasonal; rainfall exceeds 100 mm in every month of the year (there is no appreciable "dry" season), with an annual total in excess of 4000 mm, and temperatures are high throughout the year (mean monthly maximum daily of 30°C). During two years spent on Siberut, I made a small collection of palms (27 numbers) which are deposited at the Herbarium Bogoriense in Java. This paper presents some notes on the uses to which the indigenous population put the palm species growing on their island. A further paper will outline ecological observations made on one of the most important Siberut palms, *Oncosperma horridum*.

Palm Species of Siberut

Table 1 lists the species of palms represented in a collection from 200 ha of primary rainforest in central Siberut (Saibi River basin). Other species previously recorded from the island (Ridley 1926) or seen elsewhere but not collected are included in the list. This list of 15 genera and 32 species is undoubtedly incomplete as only a small portion of the island was sampled and distinctive forest types such as beach forest and old secondary growth were omitted. Certainly the rattan flora is expected to be far richer than Table 1 suggests, especially in species of *Calamus* and *Daemonorops*. However, the known palm flora of Siberut does show some peculiarities. The absence of *Livistona*, *Plectocomia* and *Salacca*, and the paucity of *Licuala* species are perhaps the most striking phytogeographical anomalies. Suitable habitats for these genera appear to be present on Siberut, whereas palms such as *Cyrtostachys* which generally grows in peatswamps or *Corypha* and *Borassus* from seasonally dry regions may not find suitable habitats. Other genera not recorded but which may be present on the island are listed in Table 2.

Several species recorded from Siberut, such as *Cocos*, *Arenga pinnata*, *Areca catechu*, *A. triandra* and *Nypa fruticans* are widely distributed in Pacific areas. With the exception of the polymorphic *Areca triandra* these species represent economically valuable palms or palms dispersed by ocean currents. A few species have much more limited distributions, especially some of the rattans. *Daemonorops dracuncula* was first described by Ridley (1926) from Siberut and has not been collected elsewhere. Of the remainder, *Plectocomiopsis* is the most interesting. Of the five known species of the genus only two are recorded from Sumatra (*P. mira* J. Dransf. and *P. geminiflora* (Griff.) Becc.). The collected specimen from Siberut does not accord with either of these in terms of leaf and armature character-

[1] Present address: Department of Biogeography & Geomorphology, Research School of Pacific Studies, Australian National University, Canberra, A.C.T. 2600, Australia.

Table 1. Palm species recorded from Siberut Island, Indonesia

	Origin	Usage	Local Name[1]
ARECOIDEAE			
Areca catechu L.[2]	i		
A. triandra Roxb.	n		nappou
Nenga pumila (Mart.) Wendl.	n	4	nappou
Oncosperma horridum (Griff.) Scheff.	n	2, 4	ari ribbuk
O. tigillarium (Jack) Ridl.	n	2, 4	
Pinanga densiflora Becc.	n	4	nappou
P. coronata (Bl. ex Mart.) Bl. (as P. noxa Bl.)	n	4	nappou
CARYOTOIDEAE			
Arenga obtusifolia Mart.	n	3, 4	pola
A. pinnata (Wurmb.) Merr.	i	1, 3	pola
Caryota mitis Lour.	n		duruk
COCOIDEAE			
Cocos nucifera L.	i?	1, 3	toitet
CORYPHOIDEAE			
Licuala paludosa Griff.	n		
L. spinosa Thunb.	n		
Pholidocarpus sp. aff. *mucronatus* Becc.	n	4	saplap
LEPIDOCARYOIDEAE			
Calamus diepenhorstii Miq.	n		alibat
C. javensis Bl.	n	4	pelege
C. manan Miq.	n	4	bebeget
C. micranthus Bl.	n		oilab
C. polystachys Becc.	n		
C. rhomboideus Bl.	n		patupa
Daemonorops angustifolia (Griff.)	n	4	labi
D. crinita Bl.	n		uggei
D. dracuncula Ridl.	n		
D. hystrix (Griff.) Mart. var.	n		logui biau
D. spp.	n		
	n		taset
	n	4	sasa
Korthalsia echinometra Becc.	n		dangou
Metroxylon sagu Rottb.	i	1, 3	sagou
Plectocomiopsis sp.	n		
NYPOIDEAE			
Nypa fruticans Wurmb.	n	4	nipa

Origin n = native species, i = introducted species or species of uncertain geographical origin.
Usage: 1 = cultivated, food, 2 = exploited, food, 3 = cultivated, non-food, 4 = exploited, non-food.
[1] Local name (Saibi River basin), [2] occurs sporadically on Siberut—the Mentawaians are not betel chewers.

istics, and differs from the Malayan endemic *P. wrayi* Becc. in respect to the slender stem of that species. The Siberut *Plectocomiopsis* is possibly a new species.

Use of Palms on Siberut

The people of the Mentawai Islands are traditionally forest dwellers, combining hunting with bow and poisoned arrow, with basic 'garden' agriculture centered on a clan-house social system (Nooy-Palm, 1968). At present much of the population is undergoing fairly rapid integration with the rest of Indonesia (Hanbury-Tenison, 1974), but many of the traditional aspects of Mentawai culture are still functional, including extensive reliance on forest

Table 2. Palm genera not recorded from Siberut but which could occur there

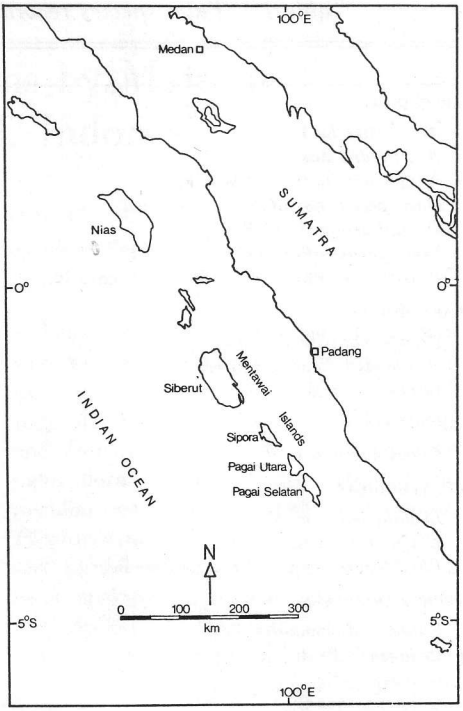
Borassus	*Johannesteijsmannia*
Corypha	*Livistona*
Cyrtostachys	*Orania*
Eleiodoxa	*Phoenix*
Iguanura	*Salacca*

products for food, shelter, and religion. With regard to the palms, uses may be classified into those of cultivated introduced species and exploited native forest species.

Cultivated Species—Food. The staple carbohydrate of the Siberut diet is sago made from the pithy inner tissue of stems of *Metroxylon sagu*. The geographical origin of *Metroxylon* as a genus is still unclear (Corner 1966), but it seems likely that its center of evolution is far to the east of Siberut; it is not clear how sago came to the Mentawai Islands. It could be a relatively recent arrival, as although ethnological evidence points to a gradual migration of people from north to south from Nias to Pagai, sago eating is confined to Siberut. On Sipora and Pagai taro (*Colocasia esculenta* L. Schott and *Alocasia macrorrhiza* L. Schott) is the staple. Taro is grown on Siberut but as a supplement to sago rather than as a major crop. Whitten (1981) has detailed the preparation of sago flour by the Mentawaians (see photos, *Principes* 25: 91–100).

Arenga pinnata is occasionally cultivated for its sugar, which is obtained by tying together rachillae of young inflorescences, bruising them, cutting off the tips, and tapping the exudate. This is often drunk without further preparation, usually hot. Solid raw sugar is not generally prepared from *Arenga*.

The third cultivated food palm is the coconut, *Cocos nucifera*. The uses of this palm are of course legion. Apparently until quite recently coconuts were not planted near Mentawaian villages as they would reveal the location to unfriendly tribes



1. Location of Siberut Island, Indonesia.

(Nooy–Palm, 1968). Hence the present inland distribution of the species along major rivers and near clan-houses is a recent phenomenon. Traditionally, usage of coconuts for food was possibly restricted to drinking the water of young fruits and mixing grated flesh with sago. As a result of increased cultural contact with Sumatra, coconut flesh is now extensively used to make sauces and is mixed with cooked taro to make confections. Copra (dried coconut flesh) is collected and exported to the mainland; there is also production of coconut oil from copra on the island itself. Every inhabited site has its coconut palms—they are often important constituents of bride-prices. It is interesting that the Mentawaians have a distinct vernacular name for *Cocos* (*toitet*), whereas they use the ubiquitous *sagu* or *sagou* for *Metroxylon*, further suggesting that the latter species is a much later arrival to the

2. Palms are abundant in Siberut rainforest understory. *Pinanga* and *Calamus* spp.

3. Large *Arenga pinnata* with ladder for access to sugar-bearing inflorescences.

island and postdates the arrival of man himself.

Exploited Species—Food. Of the native palms of Siberut, only two are occasionally exploited for their food values. The cabbage of *Oncosperma horridum* (and presumably *O. tigillarium*) is eaten raw or cooked in a coconut sauce, but apparently only when a stem has been felled for another purpose—the wood is perhaps too hard to risk shattering a jungle knife blade. Similarly, the fruits of *Calamus manan* are probably only eaten if the cane is collected and a stem happens to be fruiting, or when food runs short on a hunting expedition.

Cultivated Species—Other Uses. Each of the three cultivated palms has uses other than those of nutritional value. *Metroxylon* wood is used extensively for walkways and temporary walls. The leaves are the primary source of thatching material and are also used to wrap around sticks of sago during cooking. The stout petioles serve as makeshift *abak* (dug-out canoe) seats, while the broad leaf sheaths are flattened and sewn together to make sleeping mats and sun hats. The raw pith is given to semi-domesticated pigs and chickens as supplementary feed.

Coconut leaflets are used to weave baskets and mats, but these have only a limited life expectancy. The woody shells of the fruit are used as spoons and containers, and the dried outer husk is considered one of the best materials for carrying fire—the fiber smoulders for hours and is easily fanned into a flame. The somewhat aromatic smoke given off is useful as a mosquito repellent.

As *Arenga pinnata* is hapaxanthic and dies after flowering and fruiting; after the inflorescence is tapped for sugar, moribund stems are felled and used as house supports or fences. The fibrous material at the bases of the leaves is one of those

used to construct sieves for straining sago pulp. Nooy-Palm (1968) reports that on Sipora and Pagai, flowers of *A. pinnata* are used as part of the *katsaila* or floral bouquet used in religious ceremonies. I feel that the food value of *A. pinnata* is too great to be used in this way (the Mentawaians are very pragmatic people) and it is more likely that *A. obtusifolia* is used instead.

Exploited Species—Non-food. Oncosperma is perhaps the most useful palm in this category. Split trunks (with spines removed) are the universal flooring material and are also used as roof rafters. Kept dry the hard wood will not rot. The wood is used to fashion arrow heads. Half-trunks are driven into the ground to form pig-proof fences, and are laid along muddy ground as elevated walkways. The leaf sheaths, despined, are shaped to fit on to rattan baskets and act as back panels, and even the dried leaves have a use—they are considered the most reliable source of tinder in the forest and will even catch alight in heavy rain. Presumably the overhead canopy of palm crowns prevents fallen leaves from becoming saturated.

Of the other arecoid genera, *Pinanga* and *Nenga* are used to make temporary forest shelters, the petioles plunged into the ground at an angle to form a one-sided arch. In some regions (notably Sarareiket) small arecoid trunks are used to make traps to catch the Mentawai macaque (*Macaca pagensis*).

The native *Arenga* (*A. obtusifolia*) is of more significance. Mentawaian long bows are fashioned out of the hard black outer wood which combines strength and durability with just the right amount of plasticity. Apparently *Oncosperma tigillarium* wood is used for bows on Pagai (Crisp 1799). Twisted leaves of *Arenga* are used to construct temporary backpacks for carrying blocks of sago flour or trussed pigs. Split trunks make strong house supports and fences. The stiff midrib of old leaflets are bound together to make brooms, and the fibrous leaf bases are used with those of *A. pinnata* in the construction of sago sieves. These sieves may be the only use to which *Pholidocarpus* is put; the species is not common enough to create demands for its extremely hard wood.

Nypa fruticans is an important source of thatch for coastal villages. Recent increases in coastal population have thus created heavy pressures on stands of *Nypa*, but fortunately many areas in which the palm occurs also have low-lying swamps of *Metroxylon* behind the coastal belt of vegetation; *Metroxylon* is a better quality thatch. There seems to be no local manufacture of sugar from *Nypa* inflorescences (see Burkill 1935), although the tobacco-loving Mentawaians have learned to make cigarette papers from the unopened leaf batons—traditionally they use dried banana leaves.

Despite the abundance of rattans in Siberut rainforest, few species are used by the inhabitants. By far the most important species is *Calamus javensis*, which is used for a multitude of purposes that require a flexible tying material. Other species of similar dimensions are considered inferior and as a result some areas have very depleted stocks of *C. javensis*. Most of the basketry on Siberut uses *C. javensis*, and in house construction its principle use is in securing *Metroxylon* leaves to split bamboo to make thatch. Other rattans of local importance are *Calamus manan*—petioles of juvenile leaves are used as arrow shafts—and *Daemonorops angustifolia*, whose heavily armed petiole bases are used as coconut graters.

Commercial rattan collecting has now become of considerable importance in many parts of Siberut (see World Wildlife Fund 1980). The species of prime importance is *Calamus manan*; other smaller species are also sought by the Sumatra based companies, but as this form of forest exploitation is alien to Mentawaians there is some wastage when the wrong

species are collected. The Mentawaians themselves make little use of these economically important palms except for heavy duty tying jobs.

Conclusions

Although Mentawaian culture does not embrace the full multiplicity of uses to which Malesian palms can be put (see Burkhill 1935, Dransfield 1976), the reliance on forest palms for everyday requirements is great, despite the limitations imposed by a relatively impoverished palm flora. The recent introduction of commercial palm exploitation (sugar making, copra collecting, and rattan harvesting) may soon be fully integrated into the Mentawaian socio-economic system, and should not harm palm populations if sensible safeguards are applied. The Siberut biota studied thus far indicate the Mentawai Islands are unique (Whitten and Sardar 1981)—there is good reason to suppose the palms follow this trend.

Acknowledgments

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The Bogor Botanic Garden and Its Rich Collection of Palms

DIDIN S. SASTRAPRADJA AND T. A. DAVIS

Kebun Raya, Bogor, Indonesia
JBS Haldane Research Center,
Nagercoil 2, Tamilnadu, India

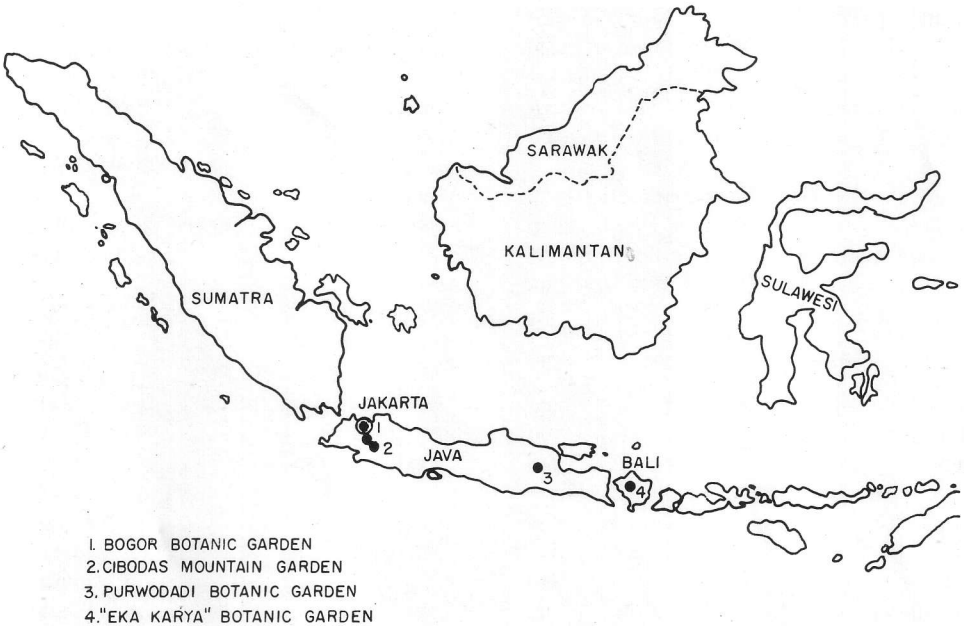
Bogor Botanic Garden, located about 60 km from Jakarta, the capital city of Indonesia, is situated on the lower slopes of Mt. Salak. Even though Bogor is only 260 m above sea level, it enjoys a cool climate throughout the year, the average mean temperature being 25° C. Bogor receives the nation's highest rainfall (about 4,000 mm/year) with the fantastic average of 322 cloud bursts per annum. The heavy rains, which usually greet Bogor in the evenings, help make the soil rich and support luxuriant plant growth. No wonder the country's, perhaps the world's, foremost tropical botanical garden is founded at this health-resort; it is visited by thousands of people every week.

Bogor is linked with Jakarta by a super highway (Jagorawi) and two busy roads. At present the Bogor Botanic Garden is proud of having approximately 5,000 species of indigenous and exotic trees within its securely protected iron fence. The most beautiful among the trees are the 300 odd species of palms that adorn practically all the 25 blocks of the garden. In this paper a brief history of the Gardens and a list of palms grown at the Bogor Botanic Garden are given.

Brief History of Bogor Botanic Garden

The Hortus Botanicus Bogoriensis was founded on May 18, 1817 by C. G. C. Reinwardt (just at the period when the British Administration had come to a close), and established by the Dutch Government behind the present Presidential Summer Palace which used to be the residential hill-resort of the Dutch Governor-General, Buitenzorg. The garden was expanded to the east and south of the palace in 1892 and 1927, and now covers an area of 87 ha which excludes the Palace Grounds.

J. E. Teysmann, the first Curator of the Gardens, collected 1,912 species of plants during its first five years. Many economic plants as well as a majority of widespread ornamental plants were imported by the gardens, the most important being oil palm, quinine, cocoa, tea, vanilla, cassava, guttapercha, ironwood, bougainvillea, and allamanda. The number of species increased considerably during the management of Teysmann. The garden expanded further and became multi-locational in 1880 when the capable Professor Melchior Treub became Director. A garden mainly for subtropical plants was established on 80 ha of land at Cibodas in West Java at an altitude of 1,450 m. Professor Treub served until 1905 and brought fame to the garden by attracting eminent botanists and biologists from all over the world. Thus the Bogor Botanic Garden became a world center in the tropics for biological and agricultural research. In 1884 a laboratory, now known as the Treub Laboratory, was set up in the garden to serve visiting scientists who wished to do research on tropical flora and fauna. Another very important contribution of Prof. Treub was the establishment in 1905 of the Agricultural Department of the Garden. This institution has grown into the Ministry of



1. Map of Indonesia showing position of Bogor and other botanic gardens.

Agriculture of Indonesia. The various regional gardens of the Bogor Botanic Garden are given below together with the years of their founding (Table 1, see also map, Fig. 1).

Functions of the Gardens

The gardens serve several purposes:

1. To explore indigenous plant species having economic potential or botanical interest. The potential of such germplasm could be exploited in plant breeding;
2. to conduct horticultural and botanical research;
3. to introduce useful plants from abroad and from inside the country for multiplication and/or breeding purposes;
4. to provide guidance and facilities for education; and
5. to make the gardens available for the public as places of recreation.

Indirectly the plant communities in the

Table 1. Government Botanic Gardens of Indonesia

Location	Year of Founding	Area
Bogor, West Java	1817	110 ha[a]
Cibodas, West Java	1862	80 ha[b]
Sibolangit, North Sumatra	1914	20 ha[c]
Malang, East Java	1941	85 ha
Setia Mulia, West Sumatra	1955	60 ha[c]
Eka Karya, Bali	1959	129 ha

[a] At present the area of the Botanic Garden is 87 ha (minus the Palace Ground).
[b] At present the area has increased to 100 ha.
[c] These gardens do not function actively and are administered by the Ministry of Agriculture.

gardens provide habitats for animal species which increase opportunities for zoological research and education. To the Bogor Botanic Garden is attached an excellent zoological museum with many research scientists working with living species of animals. The Deer Park where herds of beautiful white-spotted deer can be seen grazing undisturbed in the grounds of the Summer Palace is attached to the garden.

Research on Palms

A team of young scientists at the garden have initiated different aspects of research on several species of palms. Some of the ongoing studies include investigations on the morphology and utilization of *Arenga microcarpa* as an alternative source of edible sago, systematics and classification of the genera *Salacca* and *Arenga*, pollination biology of *Salacca*, rates of leaf-production and recording of the span of life of green leaves, morphology of palm spines, and floral biology and germination of seeds of many species of palms. Most of these investigators periodically make expeditions to the remote islands of the country to explore palms and expand the collection at Bogor.

List of Palms of the Bogor Garden 1980

Acoelorrhaphe
- wrightii (Griseb. & H. A. Wendl.) H. A. Wendl. ex Becc. ..... W. Indies

Acrocomia
- totai Mart. ..... S. America

Actinorhytis
- calapparia (Bl.) H. A. Wendl. & Drude ex Scheff. ..... Malesia
- poamau Becc. ..... Solomon Is.

Aiphanes
- caryotaefolia (H.B.K.) H. A. Wendl. ..... Colombia
- erosa (Linden) Burr. ..... Barbados Is.

Ancistrophyllum
- acutiflorum Becc. ..... Trop. W. Africa

Archontophoenix
- alexandrae (F. Muell.) H. A. Wendl. & Drude ..... Queensland

Areca
- catechu L. (Fig. 2) ..... S.E. Asia
  - var. alba Bl. ..... S.E. Asia
- laosensis Becc. ..... Thailand
- latiloba Ridl. ..... Java, Sumatra
- macrocalyx Zipp. ..... New Guinea
- oxycarpa Miq. ..... N. Sulawesi; Minahassa
- triandra Roxb. ..... S.E. Asia
- vestiaria Giseke ..... Sulawesi
- spp. ..... Irian Jaya, Sumatra, Ternate

Arenga
- australasica (H. A. Wendl. & Drude) S. T. Blake ..... Australia
- borneensis (Becc.) Dransf. (Fig. 3) ..... Borneo
- caudata (Lour.) H. E. Moore ..... Thailand
- engleri Becc. ..... Taiwan, Ryukyu Is.
- microcarpa Becc. ..... New Guinea, Maluku: Kai
- obtusifolia Mart. ..... Sumatra, Malay Pen., Java
- pinnata (Wurmb.) Merr. ..... Java, Sulawesi
- porphyrocarpa (Mart.) H. E. Moore ..... Java, Sumatra
- tremula (Blanco) Becc. ..... Philippines
- undulatifolia Becc. ..... Borneo
- spp. ..... Java, Malay Pen., New Guinea, Sulawesi: Gorontalo

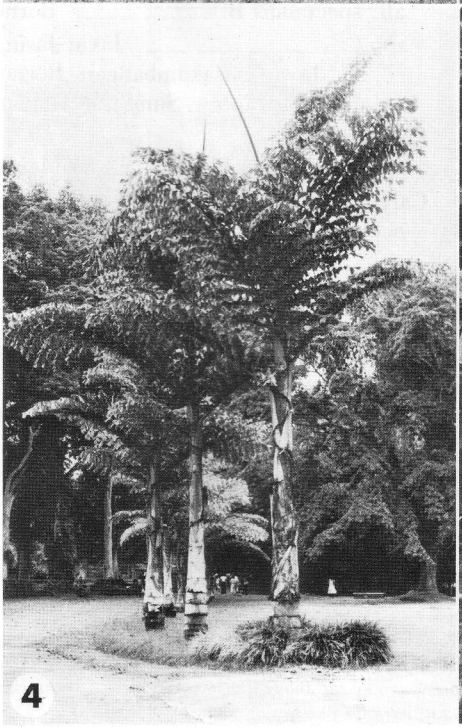
Astrocaryum
- aculeatum Meyer ..... Guiana

→

2. Two unusual specimens of *Areca catechu*, the betel palm, which bear cream-colored fruit. 3. *Arenga borneensis*, an elegant dwarf palm from Borneo; 4. *Caryota no*, an attractive non-clustered fishtail palm, native to Borneo; 5. *Ceratolobus glaucescens*, a very rare, endangered rattan of W. Java.


2


3


4


5

gynacanthum Mart. ..... Brazil
malybo Karst. ..... Colombia
murumuru Mart. ..... Brazil
vulgare Mart. ..... Brazil
sp. ..... S. America

Attalea
sp. ..... Colombia, Venezuela

Bactris
cruegeriana Griseb. ..... Surinam
gasipaes H.B.K. ..... C. & S. America
guineensis (L.) H. E. Moore ..... C. America
major Jacq. ..... C. & S. America
pallidispina Mart. ..... Surinam
sp. ..... S. America

Bentinckia
nicobarica (S. Kurz) Becc. ..... Nicobar Is.

Bismarckia
nobilis Hild. & H. A. Wendl. ..... Madagascar

Borassodendron
borneense Dransf. ..... Borneo
machadonis (Ridl.) Becc. ..... Thailand, Malay Pen.

Borassus
flabellifer L. ..... India

Brahea
serrulata H. A. Wendl. ..... Mexico

Brassiophoenix
drymophloeoides Burr. ..... New Guinea

Butia
capitata (Mart.) Becc. ..... Brazil

Calamus
arborescens Griff. ..... India
caesius Bl. ..... Borneo, Sumatra, Java, Malay Pen., S. Thailand, Philippines
cambojensis Becc. ..... Indochina
caryotoides A. Cunn. ex Mart. ..... Australia
castaneus Griff. ..... Malay Pen., Sumatra
ciliaris Bl. ..... Java, Sumatra
erectus Roxb. ..... India
var. schizospathus (Griff.) Becc. ..... India
exilis Griff. & Mart. ..... Sumatra, Malay Pen.
flagellum Griff. ..... India
heteroideus Bl. ..... Java
inopinatus Furtado ..... Cult.
insignis Griff. ..... Sumatra, Malay Pen.
javensis Bl. ..... S.E. Asia
leptospadix Griff. ..... India
manan Miq. ..... Malay Pen.
ornatus Bl. ..... S.E. Asia
palustris Griff. ..... India, Andamans, S.E. Asia
polystachys Becc. ..... Sumatra, Java, Malay Pen.
scipionum Lour. ..... S.E. Asia
unifarius H. A. Wendl. ..... India: Nicobar Is. Sumatra, Java
usitatus Blanco ..... Philippines
aff. pseudomollis Becc. ..... Sulawesi
aff. spectabilis Bl. ..... Borneo
spp. ..... Java: Jasinga Java: Nusakambangan, Borneo, Singapore, Sumatra, Thailand

Calyptrocalyx
spicatus (Lam.) Bl. ..... Maluku

Calyptronoma
occidentalis (Swartz) H. E. Moore ..... Jamaica

Caryota
cumingii Lodd. ex Mart. ..... Philippines
mitis Lour. ..... S.E. Asia
var. selebica Becc. ..... Sulawesi
no Becc. (Fig. 4) ..... Borneo

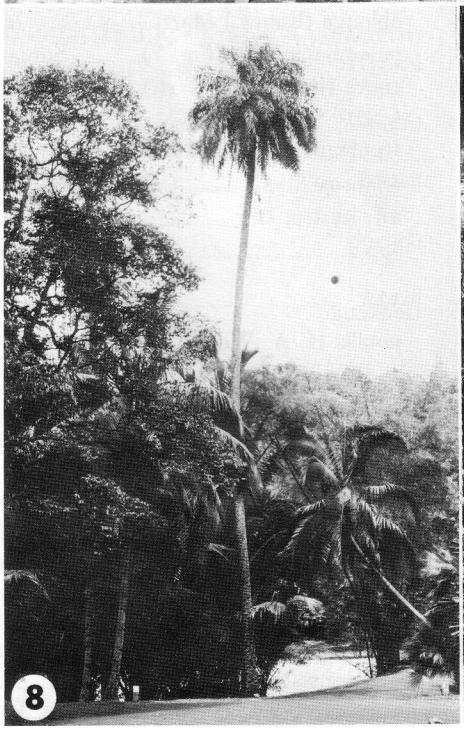
Ceratolobus
glaucescens Bl. (Fig. 5) ..... Java
pseudoconcolor Dransf. (Fig. 6) ..... Java

→

6. *Ceratolobus pseudoconcolor*, a very rare rattan of W. Java and S. Sumatra; 7. *Daemonorops palembanica*, one of the many Indonesian rattans; 8. *Elaeis guineensis* (oil palm). The very first oil palm specimen introduced from Mauritius in 1848. Inflorescences are still regularly produced, though rarely set fruits; 9. *Livistona chinensis* (the tall trees) and *L. rotundifolia* (the young plants).

6

7



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9

Chamaedorea
erumpens H. E. Moore ..... Honduras, Guatemala
geonomiformis H. A. Wendl. ..... Honduras
glaucifolia H. A. Wendl. ..... Mexico
oblongata Mart. ..... Mexico, Nicaragua
oreophila Mart. ..... Mexico
tepejilote Liebm. ..... C. America
Chrysalidocarpus
lutescens (Bory) H. A. Wendl. ..... Madagascar
madagascariensis Becc.
var. lucubensis (Becc.) Jum. & Perr. ..... Madagascar
Coccothrinax
dussiana L. H. Bailey ..... Barbados Is.
Cocos
nucifera L. ..... Cult. Tropics
(Kelapa Aren Hijau) ..... Cult. Java
(Kelapa Bali) ..... Cult. Java
(Kelapa Bengkulu) ..... Cult. Sumatra
(Kelapa Bol) ..... Cult. Java
(Kelapa Deli) ..... Cult. Java
(Kelapa Genjah) ..... Cult. Java
(Kelapa Genjah Gading) ..... Cult. Java
(Kelapa Genjah Hijau) ..... Cult. Java
(Kelapa Genjah Manis) ..... Cult. Java
(Kelapa Genjah Puyuh) ..... Cult. Java
(Kelapa Hijau) ..... Cult. Java
(Kelapa Jepun) ..... Cult. Java
(Kelapa Jepun Besar) ..... Cult. Java
(Kelapa Jeruk) ..... Cult. Java
(Kelapa Matahari) ..... Cult. Maluku: Ambon
(Kelapa Merah) ..... Cult. Java
(Kelapa Parang Hijau) ..... Cult. Java
(Kelapa Parang Merah) ..... Cult. Maluku: Ambon
(Kelapa Pinang) ..... Cult. Java
(Kelapa Tikeh) ..... Cult. Java
(Kelapa Tikeh Merah) ..... Cult. Java
Corypha
umbraculifera L. ..... India, Sri Lanka
utan Lam. ..... S.E. Asia
sp. ..... —
Cryosophila
warscewiczii (H. A. Wendl.) H. H. Bart ..... C. America
Cyrtostachys
elegans Burr. ..... New Guinea
renda Bl. ..... Sumatra, Borneo, Malay Pen.
sp. ..... New Guinea
Daemonorops
angustifolia (Griff.) Mart. ..... Malay Pen.
binnendijkii Becc. ..... Sumatra
calicarpa (Griff.) Mart. ..... Malay Pen., Sumatra
didymophylla Becc. ..... Borneo, Sumatra, Malay Pen.
fissa Bl.
var. cinnamomea Becc. ..... Borneo
var. minor Becc. ..... Borneo
geniculata (Griff.) Mart. ..... Sumatra
hygrophila (Griff.) Mart. ..... Malay Pen.
hystrix (Griff.) Mart. ..... Malay Pen., Sumatra, Borneo
jenkinsiana (Griff.) Mart. ..... India
longipes (Griff.) Mart. ..... Sumatra
longispatha Becc. ..... Borneo
melanochaetes Bl. ..... S.E. Asia
var. microcarpa T. & B. ..... S.E. Asia
oblonga (Reinw.) Mart. ..... Java
palembanica Bl. (Fig. 7) ..... Sumatra
rubra (Reinw. ex Mart.) Bl. ..... Java, Sumatra
treubiana Becc. ..... Cult.
trichroa Miq. ..... Borneo, Sumatra
aff. hystrix Bl. ..... N. Sumatra
spp. ..... Sulawesi, Sumatra
Deckenia
nobilis H. A. Wendl. ex Seem. ..... Seychelles Is.
Desmoncus
polyacanthos Mart. ..... Kalimantan
Dictyosperma
album (Bory) H. A. Wendl. & Drude ex Scheff. ..... Mascarene Is.
Drymophloeus
pachycladus (Burr.) H. E. Moore ..... Solomon Is.
Elaeis
guineensis Jacq. (Fig. 8) ..... Cult. W. Africa

10. The elegant wheel shaped leaves of *Licuala spinosa*.

oleifera (H.B.K.) Cortes × guineensis Jacq. ..... Hybrid

Eremospatha
cuspidata (G. Mann & H. A. Wendl.) G. Mann & H. A. Wendl. ..... Trop. Africa

Eugeissona
utilis Becc. ..... Borneo

Euterpe
oleracea Mart. ..... Brazil

Gronophyllum
microcarpum Scheff. ..... Maluku: Bacan I.

Heterospathe
elata Scheff. ..... Guam, Maluku, New Guinea
salomonensis Becc. ..... Solomon Is.

Hydriastele
rostrata Burr. ..... New Guinea
sp. ..... New Guinea

Hyophorbe
lagenicaulis (L. H. Bailey) H. E. Moore ..... Mascarene Is.

Hyphaene
coriacea Gaertn. ..... E. Africa, Madagascar
petersiana Klotz. ..... Congo
thebaicą (L.) Mart. ..... N. Africa

Iguanura
macrostachya Becc. ..... S. & E. Kalimantan
polymorpha Becc. ..... Perak
wallichiana (Hook. f.) Benth. & Hook. f. ..... Malay Pen.

Korthalsia
echinometra Becc. ..... Malay Pen. Sumatra, Borneo
ferox Becc. ..... Borneo
junghuhnii Miq. ..... Java
laciniosa Griff. ex Mart. ..... Java
robusta Bl. ..... Sumatra, Borneo, Palawan
rostrata Bl. ..... Borneo, Sumatra, Malay Pen.
sp. ..... S. Kalimantan

11. A group of sagu palm (*Metroxylon sagu*) grows healthily on the bank of Ciliwung, the river that flows right through the middle of the garden.

Latania
loddigesii Mart. ..... Mascarene Is.
lontaroides (J. Gaertn.) H. E. Moore ..... Mascarene Is.
verschaffeltii Lem. ..... Mascarene Is.
sp. ..... —
Licuala
gracilis Bl. ..... Java: Ujung Kulon
grandis H. A. Wendl. ..... New Hebrides
paludosa Griff. ex Mart. ..... Sumatra, Borneo, Malay Pen.
petiolulata Becc. ..... Borneo
pumila Bl. ..... Java
rumphii Bl. ..... Sulawesi: Manado
spinosa Thunb. (Fig. 10) ..... S.E. Asia
spp. ..... Java: Peucang I., New Guinea
Linospadix
sp. ..... New Guinea
Livistona
australis (R. Br.) Mart. ..... Australia
chinensis (Jacq.) R. Br. ex Mart. (Fig. 9) ..... S.E. Asia
drudei H. A. Wendl. ..... Australia
hasseltii Hassk. ex H. A. Wendl. ..... Borneo, Sumatra, Java, Malay Pen.
inermis R. Br. ..... Australia
jenkinsiana Griff. ..... India
mariae F. Muell. ..... Australia
muelleri F. M. Bailey ..... Australia
rotundifolia (Lam.) Mart. (Fig. 9) ..... S.E. Asia
saribus (Lour.) Merr. ex A. Cheval. ..... S.E. Asia
speciosa Kurz ..... Burma, Malay Pen.
spp. ..... New Guinea, Thailand
Lodoicea
maldivica (Gmel.) Pers. ..... Seychelles Is.
Maxburrettia
furtadoana Dransf. ..... Thailand
rupicola (Ridl.) Furtado ..... Malay Pen.
Maximiliana
maripa (Correa) Drude ..... Trinidad, S. America
Metroxylon
sagu Rottb. (Fig. 11) ..... Cult. S.E. Asia, Malesia

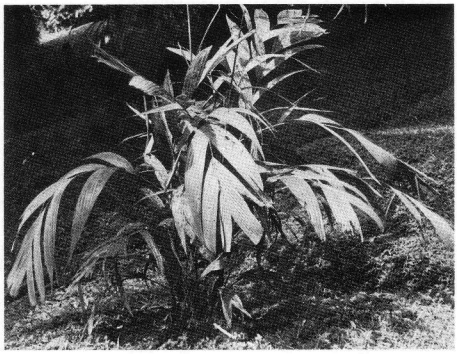
12. Nipah (*Nypa fruticans*), commonly found in mangrove swamps. Its potential has not been fully exploited.

13. A vigorously growing specimen of *Oncosperma horridum*. It is widely distributed in S.E. Asia.

Nenga
gajah Dransf. ..... Sumatra
pumila (Mart.) H. A. Wendl. ..... Java
Nephrosperma
vanhoutteanum (H. A. Wendl.) Balf.f. ..... Seychelles Is.
Normanbya
normanbyi (Hill) L. H. Bailey ..... Australia
Nypa
fruticans Wurmb. (Fig. 12) S.E. Asia
Oenocarpus
bacaba Mart. ..... Brazil
panamanus L. H. Bailey ..... Panama
Oncosperma
fasciculatum Thw. ..... Sri Lanka
horridum (Griff.) Scheff. (Fig. 13) ..... Malay Pen., Sumatra, Borneo
tigillarium (Jack) Ridl. ..... S.E. Asia
Opsiandra
maya O. F. Cook ..... Guatemala
Orania
aruensis Becc. ..... Maluku: Aru Is.
regalis Bl. ..... New Guinea
sylvicola (Griff.) H. E. Moore ..... Java, Sumatra, Malay Pen.
Orbignya
cohune (Mart.) Dahlgren ex Standl. ..... Honduras
lydiae Drude ..... Brazil
martiana Barb. Rodr. ..... Brazil
spectabilis (Mart.) Burr. ..... Brazil
sp. ..... Brazil
Paralinospadix
caudiculatus (Becc.) Burret ..... Irian Jaya
petrickianus Burr. ..... Unknown

14. *Pigafetta filaris* grows abundantly in North Sulawesi where it is known as "wanga". The shiny slender stems are quite attractive. The palms illustrated were planted in 1974.

Pelagodoxa
henryana Becc. ex Bois ..... Marquesas Is.
Phoenicophorium
borsigianum (C. Koch) Stuntz ..... Seychelles Is.
Phoenix
canariensis Hort. ex Chabaud ..... Canary Is.
dactylifera L. ..... Cult. N. Africa
farinifera Roxb. ..... India
loureirii Kunth ..... India to Vietnam and Taiwan
pusilla Gaertn. ..... Sri Lanka
reclinata Jacq. ..... Madagascar
var. ..... Senegal
roebelenii O'Brien ..... Laos
sylvestris (L.) Roxb. ..... India
sp. ..... Egypt, Germany, India, Italy, Surinam
Pholidocarpus
macrocarpus Becc. ..... Malay Pen.
mucronatus Becc. ..... Sumatra
Phytelephas
macrocarpa Ruiz & Pavon ..... Colombia
Pigafetta
filaris (Giseke) Becc. (Fig. 14) ..... Sulawesi, Maluku, New Guinea
Pinanga
coronata Bl. ..... Java, Sumatra
densiflora Becc. (Fig. 15) N. Sumatra



15. *Pinanga densiflora* has beautifully mottled leaves.

16. Pinanga (*Pinanga kuhlii*) a clump forming species, up to 7 m high. It is grown as an ornamental plant in many parts of the country.

disticha (Roxb.) Bl. ..... Malay Pen., Sumatra
grandis Burr. ..... N. Sumatra
javana B. ..... Java
kuhlii Bl. (Fig. 16) ..... Java, Sumatra
var. sumatrana Scheff. ..... Sumatra
latisecta Bl. ..... Sumatra
patula Bl. ..... Sumatra
aff. scortechinii Becc. ..... Malay Pen.
spp. ..... Bali I, Sulawesi: Minahassa, Sumatra: Besitang, Borneo

Plectocomia
elongata Mart. ex Bl. ... Java, Sumatra

Pritchardia
pacifica Seem. & H. A. Wendl. ..... Fiji Is.

Ptychococcus
paradoxus (Scheff.) Becc. ..... New Guinea

Ptychosperma
ambiguum (Becc.) Becc. ... New Guinea
elegans (R.Br.) Bl. ..... Queensland
keiense (Becc.) Becc. ..... New Guinea
macarthurii (H. A. Wendl.) Nichols. ..... Maluku, New Guinea
propinquum (Becc.) Becc. ..... New Guinea
sanderanum Ridley ..... New Guinea

Raphia
farinifera (Gaertn.) Hyland. ..... Madagascar, Africa
gentiliana De Wildem. ..... Congo
hookeri G. Mann. & H. A. Wendl. ..... W. Africa
laurentii De Wildem. ..... Congo

Reinhardtia
gracilis (H. A. Wendl.) Drude ex Dammer
var. gracilior (Burr.) H. E. Moore ..... Honduras

Rhapis
excelsa (Thunb.) Henry ex Rehd. ..... S. China, Japan
sp. ..... Thailand

Rhopaloblaste
augusta (Kurz) H. E. Moore ..... Nicobar Is.

17. *Verschaffeltia splendida* from Seychelles Islands. Notice the aerial roots which are continuously produced at the bottom of the stem.

ceramica (Miq.) Burr. ..... Maluku: Bacan I.
elegans H. E. Moore ..... Solomon Is.
singaporensis (Becc.) J. D. Hooker ..... Malay Pen.

Roystonea
elata (Bartr.) Harper ..... Cuba, Florida
oleracea (Jacq.) O. F. Cook ..... W. Indies
sp. ..... Brazil
sp. (hybrid) ..... Cult. Philippines

Sabal
domingensis Becc. ..... San Domingo
mauritiiformis (Karst.) Gris. & H. A. Wendl. ..... Colombia
mexicana Mart. ..... Guatemala, Mexico
minor (Jacq.) Pers. ..... S.E. U.S.A.
palmetto (Walt.) Lodd. ex Schult. & Schult.f. ..... S.E. U.S.A.
sp. ..... —

Salacca
affinis Griff. ..... Malay Pen., Sumatra, Kalimantan
dubia Becc. ..... Unknown
zalacca (Gaertn.) Voss ..... Java
sp. ..... Java

Scheelea
insignis (Mart.) Karst. ..... Brazil, Colombia
martiana Burr. ..... Brazil
sp. ..... —

Serenoa
repens (Bartr.) Small. ..... S.E. U.S.A.

Socratea
durissima (Oerst.) H. A. Wendl. ..... C. America

Syagrus
flexuosa (Mart.) Becc. ..... Brazil

Synechanthus
fibrosus (H. Wendl.) H. A. Wendl. ..... Guatemala

Thrinax
parviflora Sw. ..... Jamaica, San Domingo
radiata Lodd. ex Schult. & Schult.f. ..... C. America
sp. ..... California, Jamaica

Veitchia
merrillii (Becc.) H. E. Moore ..... Philippines
montgomeryana H. E. Moore ..... Cult.

Verschaffeltia
splendida H. A. Wendl. (Fig. 17) ..... Seychelles Is.

Wallichia
densiflora (Mart.) Mart. ..... India
disticha T. Anders. ..... India

Washingtonia
filifera (Linden) H. A. Wendl. ..... S. California

Principes, 27(1), 1983, pp. 31–33

40 Years After Chaos: Guadalcanal Has Beautiful Palms

MELVIN W. SNEED
8107 S.W. 72nd Ave., 113-E, Miami, Florida 33143

Guadalcanal, keystone of the Solomon Islands, a little wisp of land out in the far western Pacific, became known to the world when U.S. marines waded ashore there after Japan attacked the United States at Pearl Harbor. Despite the war's devastation years ago, not much of which now is evident, this small island has palms in abundance, which makes it attractive for collectors.

Also, the Palm Society is blessed by having there, in Honiara the main hub of the islands, a long-time and very active member, namely, Geoff (Mr. G.F.C.) Dennis. He made our visit in late July 1980, not only a delightful experience but, from a seed collector's point of view, a productive one as well. We had arrived there by air from Port Moresby, Papua New Guinea, touching down at Henderson Field, which dates back to the war days. Honiara has a good hotel but Geoff Dennis saw to it that we were not to be stranded in it.

Right away we were motored to Honiara's interesting botanical garden, not far from the hotel, which has a good diversity of plants, including some splendid palm specimens. It should be said that Geoff Dennis, originally from Australia, not only laid out the plan for this garden but has grown up with it and supervised its development and maintenance.

For many years we had been led to believe that *Pelagodoxa henryana*, presumably indigenous to the Marquesas, couldn't be found, or at least, one shouldn't go exploring for it away from the Marquesas-Tahiti area of the South Pacific. But see the beautiful, perhaps perfect, specimen of *Pelagodoxa henryana* which Geoff Dennis has cultivated in the Garden at Honiara (Fig. 1). *Principes* (24: 37–38, 1980) has some notes on how *Pelagadoxa* got to the Solomon Islands. But your author is not entirely convinced, especially after Palm Society member, Dick Phillips, guided us to long-established, prolifically fruiting plants of *Pelagadoxa* in nearby Suva, Fiji. The Honiara

1. Geoff Dennis introduces your author to a magnificent *Pelagodoxa* in the Honiara Botanical Garden, Guadalcanal.

2. *Elaeis guineensis* in cultivation near Honiara.

garden has other exotic species of palms, as well as indigenes, that can be seen in outer recesses of the garden, which one must reach by trudging up and down some well laid out pathways.

Interesting as the garden is, Guadalcanal has many more attractions for palm enthusiasts. For economic reasons, the oil palm (*Elaeis guineensis*) is being cultiveated on the island (Fig. 2).

Geoff Dennis took us out of Honiara to places he knew palms were growing. In fact, we suspected that he had a hidden computer, which at the touch of a button would "home" him in on a palm! After a bit of driving we came to a river which could be forded, and along its bank, somewhat obscured by other tall trees, was a fine stand of mature *Actinorhytis calapparia* (Fig. 3). This palm is not indigenous to the Solomon Islands and how it got established on Guadalcanal we don't know. But the trees were fruiting when we were there, and with Geoff's help we collected a good number of these large, heavy seeds for The Palm Society Seed Bank. Many of them from fallen fruits in moist ground cover were already germinating.

Geoff took us into other areas which were fascinating as well as fruitful. Back in Honiara, he showed us his palm garden at home. His property is level in front but somewhat precipitous in the rear. It has a fine collection of exotic plants in addition to palms (see Fig. 4).

But one never leaves Guadalcanal with-

3. *Actinorhytis calapparia* on Guadalcanal.

4. *Pritchardia* in Geoff Dennis' home garden, Honiara.

out a boat trip around the bay and up the river, during which the utterly delightful "locals"—both young and older—clamber aboard and join in, just for the fun of it. During the voyage one can see, at the bottom of the clear waters of the bay, the rusted remains of fallen aircraft and other implements of war that belie the beauty of the palms on shore, nearby. Thank goodness palms don't rust, and they are still there on Guadalcanal!

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Aseptic Storage of Elaeis guineensis form pisifera Seeds

BENJAMIN A. NWANKWO* AND ABRAHAM D. KRIKORIAN

Department of Biochemistry, Division of Biological Sciences, State University of New York at Stony Brook, Stony Brook, NY 11794

There is a gene in the African oil palm (*Elaeis guineensis*) that controls the type of fruit produced. In the homozygous state one allele yields the *dura* form with a thin shell (stony endocarp) and relatively little pulp (mesocarp). In the homozygous state the other allele yields the *pisifera* form with a substantial amount of pulp but no shell. A *dura* × *pisifera* cross gives rise to the heterozygote or intermediate form —the *tenera*. This form has a thin shell, produces a substantial amount of pulp and comprises the oil palm of commerce (see Hartley, 1977 and references there cited). *Pisifera* palms are of importance not only because they yield oil but because they are used as the pollen parent in breeding programs (Obasola, 1973).

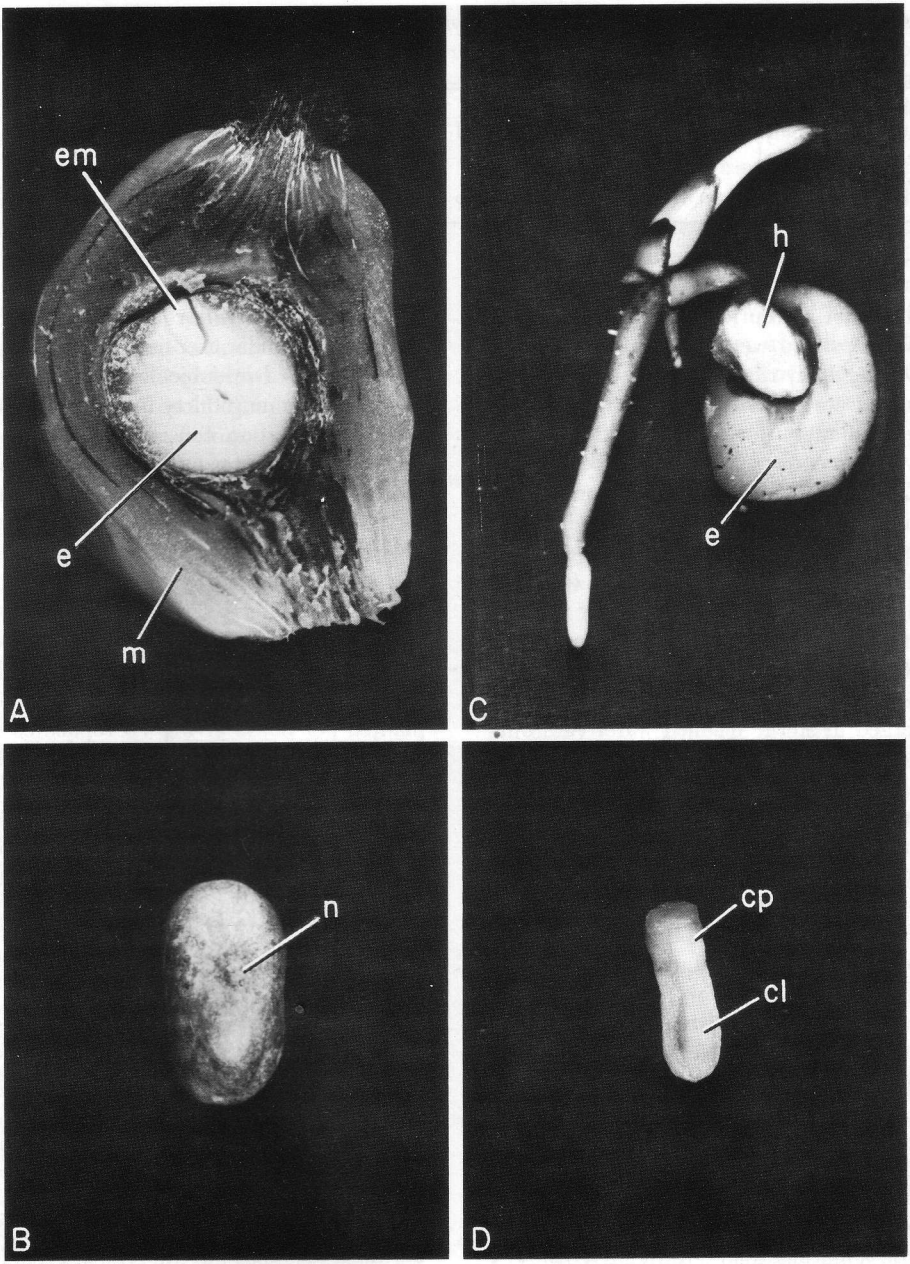
Unfortunately *pisiferas* are frequently female-sterile and their seeds usually have a much reduced level of germination. Moreover, the lack of a stony endocarp (cf. Fig. 1A) renders the seeds very prone to desiccation and microbial contamination. This problem is so extreme that much of the difficulty encountered in the germination or storage of the seeds derives from it. A relatively simple technique which permits an increased level of germination has recently been described (Nwankwo, 1981). The method involves aseptically de-operculating the seed so as to expose the germinal end of the embryo and in this way facilitate germination. Even so, all published work on *pisifera* seed germination has thus far involved the use of freshly harvested seeds, because of the lack of an effective means of storage. This has restricted seed studies to that relatively limited period of bunch availability (e.g. in Nigeria ripe bunches are more abundant during the dry season—November to March) and to the geographical area of production.

In this report we describe a reliable method for prolonging the life of *pisifera* seeds. The procedure can also greatly facilitate inter-continental transport and germplasm exchange with regions outside the area of normal availability. It may well be that seeds of other palms which present difficulties of microbial contamination or have limited viability could be handled in a similar way and for this reason we wish to draw special attention to it.

Procedures

Preparation of Seeds. Mature seeds (=kernels comprised of the testa, endosperm and embryo) obtained from open-pollinated bunches at the Nigerian Institute for Oil Palm Research were extracted from fruits by cutting the mesocarp with a sharp knife and ejecting the contents. Up to this point ordinary laboratory or field conditions are satisfactory. When the required number of kernels are obtained they are taken to a "clean room" where they are surface-sterilized and prepared for shipment. The seeds are first submerged for 5 minutes in a 0.2% aqueous

* Address: Plant Physiology, Nigerian Institute for Oil Palm Research, P.M.B. 1030, Benin City, Nigeria.



1. *Pisifera* oil palm fruit, seed, embryo and seedling. A. Fruit in vertical median section showing fleshy mesocarp (m), endosperm (e) and embryo (em). The endocarp is comprised of fibrous tissue but lacks the stony components found in the *tenera* and *dura* forms. (Magnified 2.1×). B. External appearance of a *pisifera* kernel or seed. The line points to the "notch area" (n) from which the germinal end of the embryo would emerge during germination. (Magnified 2.3×). C. Aseptically stored and germinated seed cut so as to expose the haustorium (h) and endosperm (e). (Magnified 1.94×). D. Embryo excised from *pisifera* kernel such as that shown at B. The germinal end or petiole limb or cotyledonary petiole (cp) is separated by a slight constriction from the cotyledonary limb (cl) or haustorial end. (Magnified 8.3×).

Table 1. Effect of the length of storage on the appearance and percent germination of pisifera *seeds stored aseptically in water for 15, 30, and 60 days*

Storage (in days)	15	30	60
External appearance of seeds	Normal	Normal	Normal
No. of seeds planted	30	30	30
No. of seeds infected	0	0	0
% Germination	90.0 ± 7.5	82.0 ± 6.5	68.4 ± 7.2

15 replicates (2 seeds each bottle).

solution of mercuric chloride containing a few drops of a wetting agent (e.g. *Tween 20*) and then rinsed 3 times with sterile distilled water. The seeds are then submerged again for 5 minutes in a 5% (v/v) aqueous solution of Chlorox (i.e. 0.264% v/v sodium hypochlorite) and rinsed 3 times in sterile distilled water. The seeds are then transferred aseptically into plastic screw-cap containers (ca. 500 ml) which can be pre-sterilized by treating with mercuric chloride solution and then exhaustively rinsed with sterile water. After the seeds have been completely submerged in sterile distilled water (use only enough to cover the seeds), the bottles can be tightly twisted shut and the lids sealed with parafilm strips to keep the seals clean. The bottles can then be packed into a plywood box or other suitable container and transported by air. This has been repeated 3 times between Murtala Mohammed Airport, Lagos, and John F. Kennedy Airport, New York. An interval of up to ten days between seed processing and its receipt in New York has been recorded.

Re-sterilizing Seeds upon Receipt. Upon receipt, the bottles were wiped with 70% ethyl alcohol, opened and the water decanted in a clean room. The contents were re-sterilized first using 0.2% mercuric chloride followed by a 10% v/v aqueous solution of Chlorox (i.e. 0.525% v/v sodium hypochlorite). The seeds were again covered with sterile distilled water, the bottles tightly sealed and stored in a growth chamber at 30 ± 1° C in darkness.

Viability Tests. Samples of 40 seeds each were taken after 15, 30, and 60 days storage under aseptic conditions. Ten were employed in subjective examination and the remaining thirty in viability tests. Visual observation consisted of examination of the seeds for any abnormality that may have developed during storage and for microbial contamination. This was followed by embryo excision from the seed and visual examination of the embryo (cf. Fig. 1D). The thirty seeds for viability tests were de-operculated by cutting the notch from which the embryo would normally emerge (cf. Fig. 1C). Two seeds were then planted per bottle giving 15 replicates on sterile foam rubber moistened with sterile distilled water and placed in darkness at 30 ± 1° C. Emergence of the plumule and radicle from the embryonic axis was taken as evidence of germination (see Fig. 1B for an embryo about 18 days from "planting").

Results

After the first fifteen days of storage the aseptically treated seeds remained fresh and no microbial contamination could be observed. The untreated controls (i.e. those which had not been re-sterilized upon arrival had become contaminated. Embryos excised from re-sterilized seeds were turgid and looked healthy with the germinal end showing the typical greenish yellow coloration (see Fig. 1D for an excised embryo, unfortunately it is not in color). Up to 90 percent germination (see Table 1) was recorded after 15 days storage out of thirty seeds planted. These gave rise to healthy seedlings (see Fig. 1B).

Viability tests conducted after 30 days storage gave similar results. There was no contamination. The greenish coloration of the embryos appeared even more conspicuous and 82.0 ± 6.5% germination was recorded. Tests carried out after sixty days storage gave similar results but with a slight reduction in response. There was no contamination. The embryos looked healthy and a germination record of 68.4 ± 7.2 percent was obtained. Embryos of seeds which did not germinate were mostly white or brownish and probably died as a result of intrinsic abnormalities such as failure in haustorium development etc. and not due to contamination.

Discussion

No effective means that we are aware of has hitherto been described for the storage of *pisifera* seeds. Until recently germination has had to be carried out promptly after harvesting. Even in Nigeria investigations involving *pisifera* seeds have been hampered during that time of year when *pisifera* supply is limited. The intrinsic value of a simple method such as the one described lies in the ability to store seeds under aseptic conditions, thus making them available at all seasons and facilitating equally successfully their transportation to distant places. The relatively high germination response of *pisifera* obtained even after 60 days storage derives from the elimination of microbial contamination from the germinating seeds. No doubt the length of storage could be extended beyond 60 days but the level of viability is likely to diminish.[1] However, even *dura* and *tenera* seeds which are protected by a shell and hence are not seriously affected by micro-organisms during storage are not completely trouble-free. These seeds can be and are stored at controlled temperatures (usually at about 21° C and about 18–20% moisture content) without surface sterilization for over 12 months. But losses as high as 40% have been reported due to the so-called "brown germ" disease wherein the embryo darkens and dies. This is especially prevalent when seeds are germinated under conditions of high moisture and temperature (i.e. the "wet heat treatment", Aderungboye, 1977). Using the technique of storage reported here *pisifera* seeds can be maintained in a moist environment thus precluding desiccation and permitting their vigorous germination on "planting" in aseptic culture.

[1] Over 50 percent germination has been reported from *pisifera* seeds stored in unaerated sterile distilled water for six months (Nwanko and Krikorian, 1982).

Acknowledgements

This work was carried out when one of us (B.A.N.) was on study leave from the Nigerian Institute for Oil Palm Research, Benin City. The support of the Institute and its Director, Dr. B. E. Onochie are gratefully acknowledged. A.D.K. acknowledges a grant from the National Aeronautics and Space Administration as a prime source of support for his laboratory.

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Developmental Morphology of Desmoncus isthmius, a Climbing Colonial, Cocosoid Palm

FRANCIS E. PUTZ

Department of Botany, University of Florida, Gainesville, Florida 32611

Palms lack a vascular (lateral) cambium and thus lack the capacity for secondary thickening. Palm stems which increase in girth below the crown (above the ground) do so through cell expansion and the formation of schizogenous lacunae (sustained primary growth; Waterhouse and Quinn 1978). Most palms pass through a rosette or "establishment growth" period (Tomlinson and Zimmermann 1966) during which the stem base thickens without internodal elongation forming an inverted cone-shaped (obconical) stem base. In stilt-rooted palms, stem diameter growth and internodal expansion proceed simultaneously thus the obconical stem base is much elongated. *Desmoncus isthmius* Bailey is an exception to these general developmental patterns because stems making up the clone, i.e. ramets or branches, are successively larger in the fashion of bamboos (McClure 1966), *Ripogonium scandens* (Smilacaceae; Tomlinson and Esler 1973), and perhaps some climbing lepidocaryoid palms (Dransfield 1978).

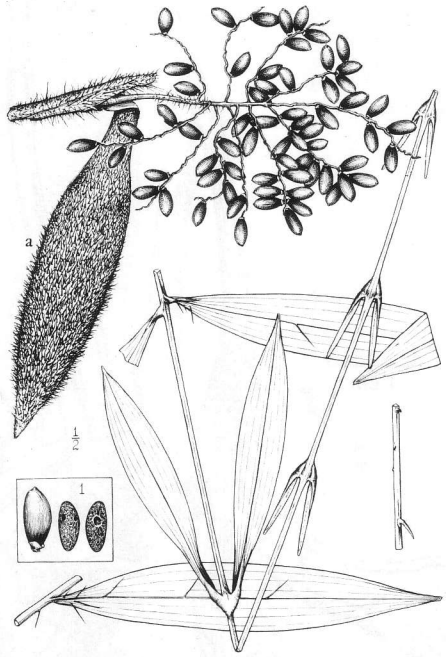
During the seedling stage, palms suffer low light conditions and hazard the depredations of terrestrial terminal-bud-eating animals, such as peccaries. In the forest, small increases in height can lead to substantial increases in available light. Some palms reach these improved light conditions while the bud and incipient trunk are still at or below ground level by producing large leaves which grow upward into the light; leaves from a rosette of *Scheelea zonensis* Bailey, for example, can be 8 m long and weigh 10 kg (fresh weight). These huge leaves grow upward as a sword, open, bend over, and in the process create their own openings (gaps) in the understory; such leaves increase the effective height of the as-yet stemless palm. This growth habit allows palms to thrive in areas where tangles of herbaceous vines, lianas, and fallen trees interfere with the regeneration of plants not endowed with gapmaking capabilities. Internodal expansion during primary thickening leads to relatively rapid height-growth in stilt-root palm seedlings. In addition to rapidly attaining height and light by growing vertically, the stems of some stilt-rooted palms supported by prop roots sometimes grow laterally towards light (Bodley and Benson 1980); this is another developmental modification that serves to ameliorate the conditions encountered during the establishment growth period. *Desmoncus isthmius* has a greater degree of flexibility in its ability to grow laterally than stilt-rooted palms and it is not at all hampered by establishment growth.

Desmoncus Mart. (Greek: *desmos* (band) *Ogkos* (hook)) is an entirely New World genus of approximately 40 species (Burret 1934). C. F. P. von Martius

described the genus in 1824 in his "Palmarum Familia" (p. 20). *D. isthmius* (Fig. 1) is a slender monoecious climber locally known in Panama as "matamba." Because of its fiercely spiny leaf sheaths, petioles, rachises, and leaflets, and the long barbed whip at the end of the each leaf (cirrus), this species suffers a notorious but well deserved reputation among travellers in secondary (disturbed) forests where it abounds. I studied the morphology of *D. isthmius* on Barro Colorado and surrounding islands in the Panama Canal.

The fruits of *Desmoncus isthmius* are bright red, 1.8–2.2 cm long, single-seeded drupes which are often eaten by large frugivorous birds. The seed is enclosed by a woody endocarp. Germination occurs after approximately 6–8 weeks and follows the *Archontophoenix* (adjacent ligular) pattern described by Gatin (1906) and reviewed by Tomlinson (1960). After two plumular leaves develop, the first true leaf has a 5 cm long petiole and two 9 cm long and 3 cm wide leaflets. The second and third leaves have 14 and 25 cm long petioles but still have only two leaflets. The third and all subsequent leaves are spiny. The fourth leaf has two pairs of leaflets and it takes approximately one year for a well watered seedling under partial (50%) shade to produce four leaves. The tenth leaf is usually the first to develop a rudimentary cirrus.

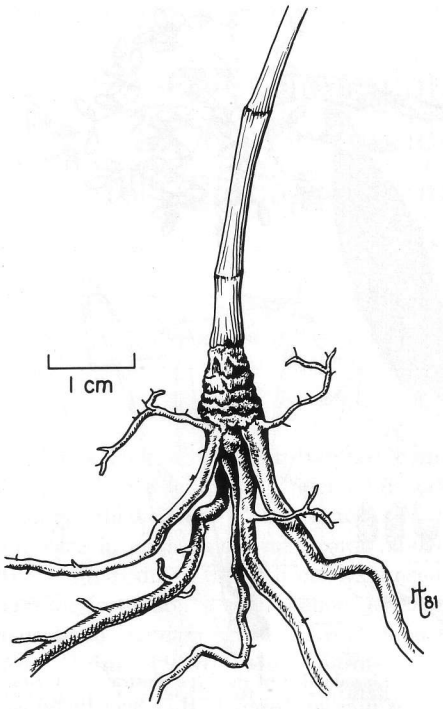
The developmental morphology of *Desmoncus isthmius* is remarkable because its seedlings do not pass through an extended rosette stage. The internode between the second and third true leaves extends 2–3 cm; internodes on the first stem become increasingly longer until the stem is 2–3 m long above which point fully extended internodes are approximately 20–30 cm long. The first stem is only 0.3–0.4 cm in diameter at a point midway between nodes approximately 10 cm from the base. The first stem in an incipient clone seldom reaches more than 4 or 5 m before it dies (Fig. 3) but when



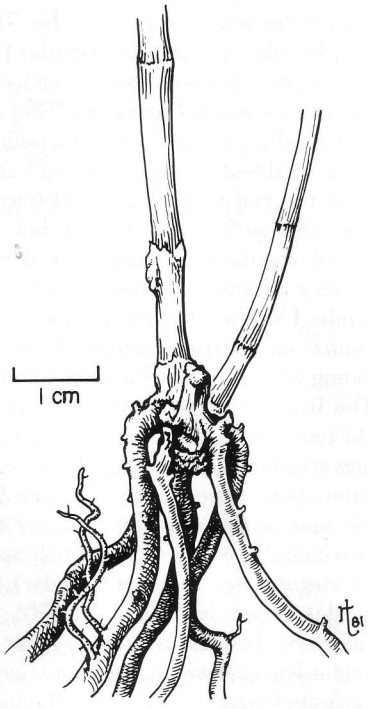
1. A reproduction of the type illustration of *Desmoncus isthmius* (Bailey, L. H., Gentes Herbarum VI:212), leaf and infructescence.

only 35–40 cm long a bud on its first or second node begins to swell; this will represent the first branch, i.e., the second stem in the clone. When the second stem starts to elongate, its base is laterally displaced from the first stem by only 1.0–1.5 cm.

Stems emanating from expanding clones are successively larger in diameter until the tenth or fifteenth stem is produced. After a clone reaches this size, subsequent stem diameters (10 cm from the base) range from 1.3 to 1.5 cm. Along with being larger in diameter, the first internodes on successively produced stems are successively longer (Fig. 6). There is a marked relationship between the stem diameter and the maximum observed stem length (Fig. 5); stems less than 2 cm in diameter often reach more than 40 m in length. Large stems generally increase in diameter from base to approximately the tenth internode by a factor of two.



2. A single plant.

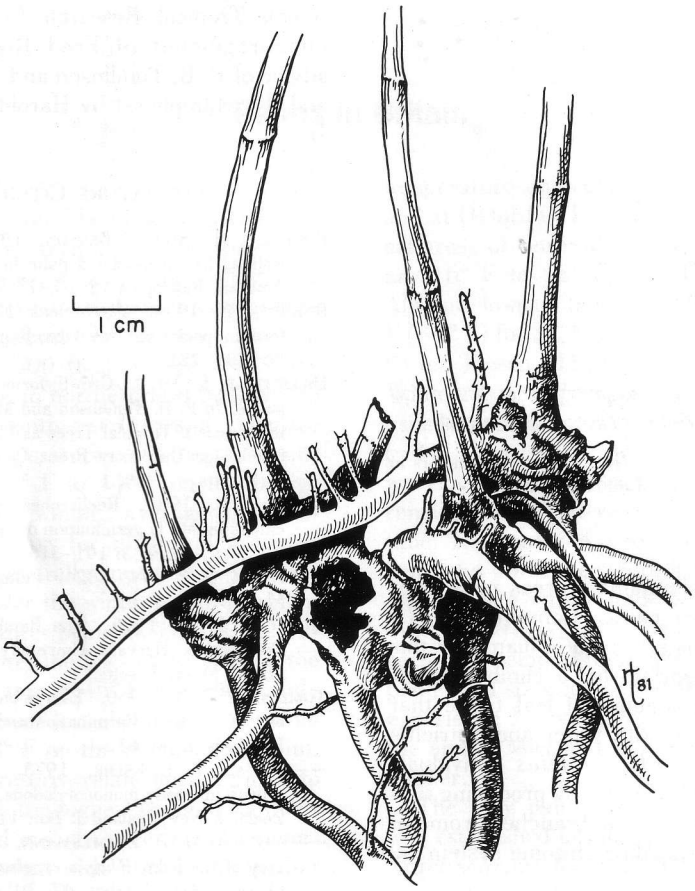


3. An early stage in clone development.

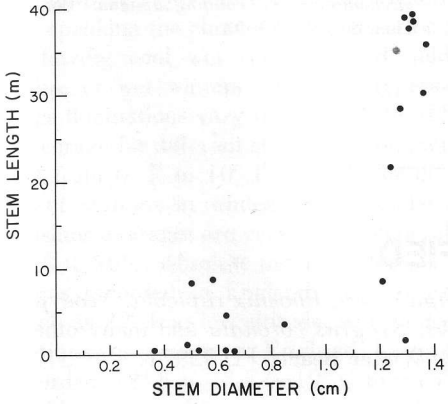
As is the case in all rhizomatous palms, erect stems in *Desmoncus isthmius* clones are basal branches of other stems (Figs. 2, 3). Each branch grows horizontally 1–2 cm before commencing vertical growth. The subterranean portions of stems in a clone comprise the short segments of a sympodial rhizome system. The solid rhizomes grow to be 5 cm thick and become covered with roots (Fig. 4). One large clone had 32 live aerial stems and rhizomes covering 0.3 m² of ground area.

Lacking the capacity to thicken, the radicle (primary root) is soon incapable of supplying the growing shoot with water and nutrients and lateral (adventitious) roots are produced from the stem base. Although the first adventitious roots are smaller than the radicle, subsequent roots are increasingly larger in diameter (Fig. 7); the largest clones have both the largest diameter stems and the largest diameter roots. Large adventitious roots have a solid woody core covered by a spongy cortex. Emerging from the solid core and growing through the cortex are small (1 mm diameter) branch roots. Many of these small roots grow directly upwards to a height of 4–5 cm, in the fashion of pneumatophores (breathing roots). Aeration of roots and rhizomes may indeed be one of their functions but *Desmoncus isthmius* is common on well drained soils. These small, negatively geotropic roots in turn produce numerous rootlets; this suggests that they are important in absorbing nutrients leached from the abundant leaf litter trapped at the base of the caespitose clusters of stems.

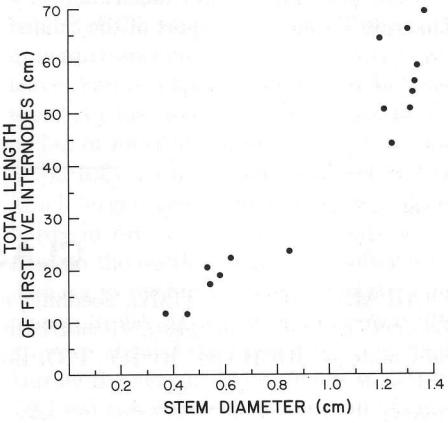
Desmoncus isthmius stems are not delayed in height growth by a long period of establishment growth and consequently



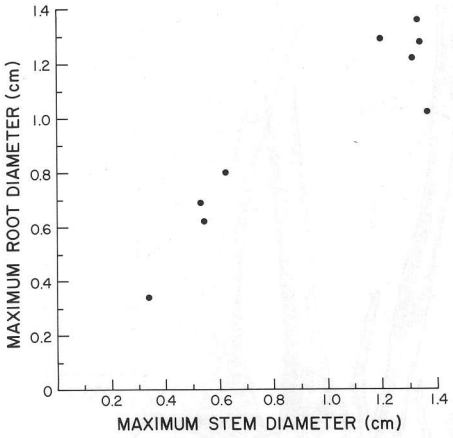
4. A clone at a later stage.



5. Stem length and diameter of stems in nine clones. Diameter measured at a point midway between nodes approximately 10 cm from the ggound.



6. Total length of the first five internodes plotted against stem diameter.



7. Maximum recorded root and stem diameters in clones of different size.

reach better illuminated areas more rapidly than other palms. Consequently, *D. isthmius* stems are small in diameter; this may be appropriate for a climbing plant but limits the amount of leaf tissue that can be supplied with water and nutrients from the roots. *D. isthmius* individuals increase their leaf areas by producing successively larger basal branches from an indefinitely expanding rhizome system.

Acknowledgments

I am grateful for the illustrations by Roxanne Trapp, the support of the Smithsonian Tropical Research Institute, the encouragement of Fred Rickson, the advice of P. B. Tomlinson and N. W. Uhl, and the example set by Harold E. Moore, Jr.

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Principes, 27(1), 1983, pp. 43–49

LETTERS

Palms in Britain

Dear Editors:

I think it would be of interest to fellow palm fanciers trying to grow palms in colder climates, to offer an insight into conditions here in Britain. Mean annual average temperatures for low elevation areas under 500 ft above sea level vary from 46.5° F in northernmost Scotland to 52.5° F in southwest Cornwall. Average January temperatures at low elevations vary from 37° F to 44° F on the British mainland. In winter, average temperatures hardly vary for all central and eastern areas. Generally speaking the further west the milder the winters, with the highest temperatures being in southwest Cornwall. Off-shore, the Isles of Scilly have the warmest winters at 45° F in January. July temperatures at low elevations vary from 56° F to 63° F on the mainland. In summer, temperatures relate fairly strictly to latitude, with the highest being in southern England and a slight lowering of temperatures consistent with latitude the further west the station. Only on very rare occasions has the temperature reached 100° F anywhere in southern England. Generally speaking the climate can be described as having cool wet summers and mild damp, or wet winters. Diurnal temperatures fluctuations vary from 12° F to 18° F average for different stations in summer and from 6° F to 10° F average for different stations in winter. In December, sunshine averages are very low, in general 15% to 20%. Absolute minimum temperatures recorded in England vary by as much as 22° F at low altitude, with many stations in southern England having recorded −2° F to 5° F (−19° C to −15° C) this century. In many areas these low values were recorded in the winter of 1962/63. At Witney I believe the lowest temperature on record is 1° F (−17° C) and at Oxford 0° F (−18° C). In the mildest areas of Cornwall, absolute minimums are 16° F to 18° F (−9° C to −8° C). Absolute lows on the Scilly Islands are 23° F (−5° C) for St. Marys and 26° F (−3.5° C) for Tresco Abbey Gardens on Tresco. Winters in most parts of southern England usually record a low of 12° F to 16° F (−11° C to −9° C), with occasional cold waves of up to a week with temperatures remaining below freezing for much of the time. The winter of 1962/63 is stated as being the worst ever recorded in the south and east of England (some records go back over 250 years), with many stations not recording temperatures over the freezing point for a six week period. From my own experience I have known frost as late as the end of May and as early as mid September.

The only palm which has been fairly well established in most parts of Britain is *Trachycarpus fortunei*. The plant grows best in the south to southwest of England where the relatively warmer summers promote more growth to the extent that a height of 20 to 30 feet can be expected in mature specimens. Four to five new fan leaves can be expected each year in these areas. In my area plants with crowns 30 inches or more above soil level can be said to be fully hardy in semi-exposed areas. Much larger specimens are probably fully hardy in rather exposed windswept areas open to the north and east but suffer wind damage to the leaves. I have found young plants to be most vulnerable when the crown is about 3–24 inches from soil level. During the very bad long winter of 1978/79 I lost two young specimens out of eight planted in the ground. Planted in tubs, specimens in sheltered sites will not sur-

vive a very cold winter because the root ball becomes frozen solid for long periods. My largest palm is approximately 22 years old and is planted in a windswept northwesterly site by my house and is approximately 9′6″ tall. In the summer of 1980 it flowered for the first time, but as this species is dioecious there is no chance of any seed. In the milder southern and western areas this palm is hardy in all stages of its growth and seeds will germinate freely in the ground, albeit a little slowly. In Cornwall I have seen a specimen growing wild in the bottom of a valley. I am a member of the "Exotic Collection" which is primarily a private collection of cacti and other succulent plants (largest in Europe with over 10,000 species) based at Worthing on the coast of Sussex. Apart from the greenhouses which house nearly all of the succulents, a very limited number are grown outside. There are a number of *T. fortunei*, 15–20 feet tall, growing in the garden. The plants are up to 40 years old and regularly produce seed which germinates in the ground each year. Some of these specimens are of an unnamed variety with shorter more compact and stiffer leaves, which remain intact in exposed windswept conditions. Needless to say I have procured two plants for spot planting.

My knowledge of the habitat of *T. fortunei* is gleaned from textbooks. As far as I am aware it is found in central and coastal central eastern China, the Chusan Islands off Eastern China, southern Japan and the extreme south of Korea. It is found growing in areas with similar winter conditions to those of southern England and is familiar with snow and hard frosts in habitat. Mr. Brian Lamb of the "Exotic Collection" states that in the wild it is known to withstand −10° F (−24° C). This temperature is probably recorded in its coldest locality such as for example Shanghai which is at the same latitude as the Chusan Islands and has recorded a low of only 13° F (−10.5° C) but has average January temperatures the same as those of Witney. This limited extreme from average minima applies also to stations much further inland in China as far as I am aware. It would certainly be interesting to have a complete map of the distribution and climatic conditions where *T. fortunei* grows naturally. This may prove that this palm has varying hardiness according to provenance.

The accompanying photographs were taken in mid May and as you can see the flowers are emerging.

Different palm genera and species will withstand differing amounts of frost according to atmospheric and ground conditions. A striking example is *Washingtonia filifera* and to a lesser degree its sister *W. robusta*. I have grown these plants from seed and in the damp cold of our winter they are susceptible to only a few degrees of frost before being killed outright. Yet according to information from the U.S.A. in letters printed in *Principes* they are capable of withstanding much lower temperatures in drier conditions. In contrast to this I have wintered outside *Livistona australis* seedlings in a 6″ pot placed on concrete in sheltered conditions, when the temperature has dropped to 12° F (−11° C), the pot has frozen solid but the seedlings all survived. *L. australis* is supposed to be much more tender than *W. filifera*, but is probably fully hardy in mild parts of Cornwall (probably depending on seed provenance), whereas that latter certainly would not be. *L. chinensis* is also reported to be quite hardy in Cornwall. An example of conflicting experience is *Sabal palmetto* which Plantimpex of Belgium state has been wintered outside with adequate shelter from wind, snow and damp for a number of years. In such conditions they state that along with *Butia capitata*, *Jubaea* (*J. chilensis*), *Sabal minor*, *Trachycarpus martianum*, *Chamaerops humilis* and *Brahea edulis* etc. it has withstood 1° F (−17° C). According to Brian Lamb of the

"Exotic Collection" *S. palmetto* failed to survive average winters with protection at Worthing and did not survive at Tresco Abbey Gardens either. Yet according to a British publication, *Sabal* spp. are hardy in sheltered well-drained sites in southern England. I understand that in the wild *S. palmetto* can withstand low temperatures for very brief periods. Perhaps ground temperature is an important factor. From palms obtained from Dr. David Griggs (*S. minor, S. louisiana* and *Rhapidophyllum hystrix*) and Plantimpex (*S. palmetto* and *S. etonia*), I shall try to unravel the truth in the years to come. Also I am experimenting with *Jubaea chilensis, Butia capitata* and *Trachycarpus martianus.*

Chamaerops humilis is hardy in the milder areas of England and can be cultivated successfully (although damaged in severe winters) in coastal Sussex. Inland it may be grown if protected in severe winters. Mr. Spinks of Thornton Hall Gardens, Ulceby, South Humberside states that with protection *C. humilis* withstood the winter of 1978/79 (the longest cold winter since 1947/48) with temperatures down to 5° F (−15° C) undamaged. In addition he states that both *J. chilensis* and *Butia capitata* survived the same winter under open-ended cloches with only slight leaf tip browning at 18 months old. He recalls seeing a plant of *T. martianus* growing in an area by the coast as a mature specimen. *Phoenix canariensis* is much more tender than the aforementioned pinnate palms; in my experience it is not able to withstand temperatures of less than 15° F (−9.5° C) in protected conditions as young plants. Three *Jubaea chilensis* are known to be growing in a garden in south Devon and in 1973 the largest was stated to be 23′ to the crown with a 10′ trunk girth. Growth must be fairly slow as these plants were apparently planted between 1900 and 1910. A large specimen is recorded to have been growing at the entrance to the Royal Botanic Gardens, Kew in the 1880's; subsequent attempts to grow it outside have apparently failed. I wonder if seed provenance has a part to play in determining hardiness of this palm. If any Palm Society member has any information on this point it might be of interest. *Phoenix canariensis* will probably survive in the mildest parts of southwest Cornwall and is certainly fully hardy at Tresco Abbey Gardens (Isles of Scilly) where I have seen several large specimens 30–40 ft tall along with at least one other pinnate palm of which I do not know the name. At this garden there are numerous other tender plants such as tree ferns (*Dicksonia, Cyathea*), some lower altitude Eucalypts and Acacia etc. from Australia, many species of *Agave, Aloe, Mesembryanthenum, Opuntia,* and many other plants which cannot stand much frost and damp. One large shrubby *Aeonium* (succulent) has been naturalized in the Scilly's which is probably the most northerly latitude at which any *Aeonium* can be grown outside (around 50° north).

G. T. B. COOPER
Turley Farm, Delly End
Hailey, Nr. Witney
Oxon, England

Euterpe macrospadix

5 November 1981

Dear Natalie:

I suggested when we last talked that certain comments from Bob Wilson's letter of September 8 to me ought to be excerpted for the next letters column or at least for the column sometime! Here are the excerpts:

". . . in reference to the palm which you feature in Figure 6 (*Principes* 25: 51) as, 'Another dwarf *Chamaedorea* of the Punta de Arenas montane forest.' I have given this species the provisional name of *C.* 'dwarf pumila' as it is a miniature form of the true *C. pumila* (as iden-

tified by Hal Moore). However, the species in question retains its miniature stature and is found at higher altitudes (including Fila Las Cruces near here and on Turrialba above the city of Turrialba; both at about 5,000 feet).

"While the fruit of *Synechanthus warscewiczianus* is certainly white in the developing stage, they are a clear red upon maturity.

"*Euterpe macrospadix* was a point of contention between Hal Moore and myself for many years. I have contended for some time that the reason why this species shows only a single trunk is due to the depredations of a certain beetle. While this beetle damages many palm species, it appears to prefer young succulent offshoots. In its activities it probably eliminates a great many offshoots and seedlings in their initial growth. However, in the botanical garden itself, where there has been only minimal spraying to control such problems, we now have a number of specimens that have from six to ten trunks and more coming. Hal belatedly admitted that we have a 'strain' of *Euterpe macrospadix* that is many trunked."

I think these comments of Bob Wilson are of interest, particularly those about the edible palmito, *E. macrospadix*, which is a prime contender for plantation culture and potential growers, etc. should be aware of the fact that this supposed "solitary palm" is apparently a suckering type (in some 'strains') which may make it of even more commercial interest.

WALTER HODGE

Kerriodoxa

Dear Natalie,

I just returned from my around-the-world collecting trip which I am happy to report was a great success.

On the top of the list are the seeds of *Kerriodoxa elegans* which you and Dr. Dransfield asked me to collect. I have already given some seed to the seed bank and to the Pacific Tropical Botanical Garden in Hawaii.

The white elephant palm as it is called in Thailand was collected near Thalang on the island of Phuket. They are the most beautiful palmate palms I have ever seen! The palm is medium-sized to twenty feet with huge undivided leaves, resembling a giant *Licuala grandis*. The underside of the leaves are white and the tops are a dark glossy green. The white elephant palm is so named because they are rare and beautiful, not meaning useless as the phrase implies in America.

Collection data is as follows: elevation 340 meters, rainfall 2,000 mm per year (there is a five month dry season in the winter), temperature minimum 23° C, maximum 34° C, average 28° C, in wet, well drained clay growing on the slopes of hills, in deep shade with no wind, germination within thirty days, fruit twice a year. Germination is almost 100% so hopefully this palm will now be established in cultivation.

JACK DANE

Genera Palmarum

September 25, 1982

Dr. Natalie W. Uhl,
L. H. Bailey Hortorium
467 Mann Library
Cornell University
Ithaca, NY 14853-0271

Dear Natalie:

The Palm Society is happy to contribute toward the completion of GENERA PALMARUM.

Enclosed is our check in the amount of $380.00 payable to L. H. Bailey Hortorium for palm work by Drs. Uhl and

Dransfield. This combined with the generous $1,000.00 grant from the Hunt Foundation (through the good offices of our Palm Society member Jack Dane) to cover one year's payment on lease of a Xerox 820 word processor. Each successive year's payments of $1,380.00 is to be billed to the Palm Society. The full lease is to cover four years. (In the event other Palm Society donations or grants are received for this work such monies shall be applied to payments as stated above).

The Palm Society Inc. agrees to fund the salary of your assistant Mr. A. J. Bednarick for the period from January 5, 1983 through July 6, 1983 in the following manner . . . . Checks payable to the L. H. Bailey Hortorium for palm work by Drs. Uhl and Dransfield will be forthcoming as follows: December 1982—$2,200.00; February 1983—$2,200.00; April 1983—$2,153.00 . . . total $6,553.00.

We are doing this as our contribution toward GENERA PALMARUM and in appreciation of the great efforts put forth by Dr. Harold E. Moore, yourself, Dr. John Dransfield, and the entire staff of the Bailey Hortorium in finishing this monumental work.

Sincerely,
PAUL A. DRUMMOND, President
The Palm Society, Inc.

25 October 1982

Mr. Paul A. Drummond, President
The Palm Society
9540 Old Cutler Road
Miami, FL 33156

Dear Mr. Drummond:

The continued and substantial support The Palm Society has given to the L. H. Bailey Hortorium for palm studies is greatly appreciated. The funds that The Palm Society has committed to support Mr. Bednarick and to lease word processing equipment will certainly facilitate the completion of *Genera Palmarum.*

Adequate funding is an important element in the success of any program, but equally important, if not more so from my perspective, is the concern of individuals who are involved in the program. The dedication of Drs. Uhl and Dransfield and Mr. Bednarick in preparing manuscript for *Genera Palmarum* and in other matters related to studies of the palms is notable. Their interests, however, go far beyond the immediacy of their tasks. There seems to be a fraternal relationship among palm enthusiasts that ties an individual's efforts to the broader needs of all in the palm community. Thus, I view the production of *Genera Palmarum* as a result of the labor and love of many individuals from around the world who have given so freely of their time and talents in the study of palms. In a sense, The Palm Society is the palm community, and through its gifts to the Hortorium, all with interest in palms have become collaborators and supporters of our research program.

On behalf of the Hortorium I would like to thank you personally for your support of our programs. Over the years you have been enormously helpful to Drs. Moore and Uhl and others involved in palm studies, and we are deeply appreciative. It is a pleasure to so many friends and colleagues to share in the excitement of palms.

Sincerely,
DAVID M. BATES
Professor of Botany and Director

Spruce and Wallace

May 7, 1982

Dear John,

While working in the archives at Kew, a rich source of palm ethnobotanical lore, I found a letter from Richard Spruce addressed to Sir William Hooker, dated 1855. The postscript to this letter offers some very interesting comments on Wal-

lace's well known book, "Palm Trees of the Amazon and Their Uses" which may be of interest to members of the Palm Society. It appears that Spruce had offered to collaborate with Wallace in a study of the Amazonian palms, but as Wallace was returning to London much earlier than Spruce, Wallace declined and worked up the material under his own name. The correspondence indicates that upon Spruce's learning that Wallace was so heavily involved in the palms, Spruce felt he should "relax in my study of the tribe." The letter also offers some insight as to why subsequent to reading Wallace's book, Spruce went ahead and published a more botanically-oriented work on the palms of the Amazon, "Palmae Amazonicae sive Enumeratio Palmarum in Itinere suo per Regiones Americae Aequatoriales Lectarum" (1871). I offer my comments on this correspondence from Spruce to Sir William Hooker, in a brief note in the *Botanical Museum Leaflets of Harvard University* (28(3): 263–269. 1980).

Subsequent to the publication of this letter, Dr. James L. Zarucchi, now on NATO postdoctoral study in England, rightly pointed out to me that the postscript had originally been published in *Hooker's Journal of Botany and Kew Garden Miscellany* (7: 213. 1855). However, this section of the letter was used to support the fact that there appear to be two kinds of "piassaba" fiber produced in the Amazon, one from the *Attalea funifera* Martius, and the other from *Leopoldinia piassaba* Wallace. There is no discussion of the conflict between the two men that this letter suggests, the point of my own note in the *Botanical Museum Leaflets*. The postscript reads as follows:

> "You asked me about Wallace's Palms. When he came down the Rio Negro in Sept. 1851 he showed me a few figures of palms. I pointed out to him which seemed to be new, and encouraged him to go on; I also proposed that we should work them up together, I taking the literary part and he the pictorial, which he declined. As I had also met with some of his palms and had my names for them, this caused me to relax in my study of the tribe, seeing myself likely to be forestalled in the results of my labors.
>
> He has sent me a copy—the figures are very pretty, and with some of them he has been very successful. I may instance the figures of *Raphia taedigera* and *Acrocomia sclerocarpa*. The worst figure in the book is that of *Iriartea ventricosa*. The most striking fault of nearly all the figures of the larger species is that the stem is much too thick compared with the length of the fronds, and that the latter has only half as many pinnae as they ought to have.
>
> The descriptions are worse than nothing, in many cases not mentioning a single circumstance that a botanist would most desire to know; but the accounts of the uses are good. His *Leopoldinia Piassaba* and *Mauritia Carana* are two magnificent new palms, both correctly referred to their genus; but the former has been figured from a stunted specimen. I have got a series of specimens for your museum, showing the way in which the Piassaba grows on the tree."

MICHAEL J. BALICK
The New York Botanical Garden
Bronx, N.Y. 10458

Palms of Southeastern Australia

Dear Editors,

The reason for this letter is my reaction to a Palm Brief (Some notes on Two Native Palms of Southeastern Australia) contributed by Eike Jakobasch and appearing PRINCIPES, 25(3), 1981 pp. 130–132.

Mr. Jakobasch states that *Livistona australis* "will never—repeat never—

penetrate the rainforest" doubly emphasizing the notion so as to give added weight; however this is clearly untrue. *Livistona australis* is an opportunistic species; it can accommodate itself to a range of habitats from open to closed swampforest, rainforest on any degree of slope and a variety of plant associations, such as moist sclerophyll forests on varying slopes and soils, and even semi-closed and closed littoral forests. In areas around the Tweed River, Mt. Nebo, Frazer Island, Tewantin and Caloundra, *L. australis* can be seen as a rainforest and sclerophyll forest component, and relic, where such forests have been removed. An undetermined *Livistona* on the Eungella Range (which is probably the northernmost occurrence of *L. australis*) grows in rainforest in association with treeferns.

L. decipiens, *L. drudei*, *L. benthamii* and *L. muelleri* can also be found in rainforest, swampforest and vine forests, although they also occur in more open habitats. Indeed the habitat tolerances of these species are truly remarkable.

Mr. Jakobasch also states that "nothing can really surpass the powerful aura of a virgin rainforest filled with Bangalows (*Archontophoenix cunninghamiana*) of all sizes"; this would appear to be either a personal opinion or one based on a very limited experience with the indigenous palms. Surely *Gulubia costata*, *Nypa fruticans*, *Licuala ramsayi*, *Caryota rumphiana*, *Corypha elata*, *Orania appendiculata*, *Livistona eastonii* etc. etc. have been insulted!

Finally, the part about *Archontophoenix* being a genus of only two species deserves comment. Mr. Jakobasch is not incorrect here as only two species have been published. However a revision of the genus is likely to reveal at least two new species and several varieties, particularly from certain montane forests of the Atherton Tableland, Mt. Lewis and the lowland rainforests of the Iron and McIllwraith Ranges.

Mr. Jakobasch's Palm Brief was valuable if only for the cover photo and accompanying photo of *Livistona australis*; these are amongst the best I have seen published. Interestingly the photo of *L. australis* illustrates an important point, that the palm does not regenerate in cleared sites. The nearest tree seems to be in fruit but no juveniles are obvious, only scattered towering adults and a few sorry remnants of moist sclerophyll or rainforest communities.

Sincerely,
ROBERT TUCKER

Anderson Park Botanic Gardens
Wellington St. Mundingburra
Townsville, Qld., 4812
Australia. 8-4-82

Principes, 27(1), 1983, pp. 49–51

PALM LITERATURE

STANTON, W. R. AND M. FLACH (eds.) Sago: The Equatorial Swamp as a Natural Resource. 244 pp. The Hague. 1980. $44.50 hardcover.

The starch-yielding palms, particularly *Metroxylon sagu*, appear ready to join the ranks of the major commercially cultivated palms as evidenced by the fourth book on the subject since 1977.[1] This latest contribution is made up of papers from the Second International Sago Symposium held in Kuala Lumpur, Malaysia in September 1979, and represents a follow-up to the first symposium held in that country three years earlier.

The book opens with a concise sum-

[1] The three other books are: Tan, K. (ed.) *Sago-76: Papers of the First International Sago Symposium.* 330 pp. Kemajuan Kanji, Kuala Lumpur. 1977; Ruddle, K. *et al. Palm Sago: A Tropical Starch from Marginal Lands.* 207 pp. University Press of Hawaii, Honolulu. 1978 (see review in *Principes* 23(2): 88–90, 1979); and Schindlbeck, M. *Sago bei den Sawos.* 566 pp. Basler Beiträge sur Ethnologie, Band 19, Basel. 1980.

mary chapter of specific recommendations generated by the papers and discussions during the symposium. (How much more effective it is to place the recommendations at the front of the book.) These are concerned with starch palms and their environment, ecological adaptation, rural development and plantation agriculture, agronomy, production technology, carbohydrate extraction, and food production. The seventeen chapters following deal with these topics and provide considerable technical detail in terms of production of the starch and its industrial processing for food, feed, and ethanol for fuel. The papers are broad in scope and examine, for example, the current state of industrial starch technology as applied to palm starch, and advances in vegetative propagation, especially of the oil palm, which could be adopted for sago palms. The sago-producing countries of southeastern Asia receive good coverage and the book provides the information necessary to place palm starch within a realistic context for future development planning and research.

DENNIS JOHNSON

STEWART, LYNNETTE. 1981. Palms for the home and garden. Angus & Robertson Publishers, Australia. 72 pp., 14 color plates, ca. 33 figures Price: U.S. $10.95 (from the Palm Society Bookstore)

This is a very attractive popular introduction to growing palms in Australia and New Zealand, aimed at the complete novice. Palms are placed in a historical context (from an Australian viewpoint), their structure very briefly described, and their use as indoor and outdoor subjects discussed. A short chapter on growing palms for profit precedes the main part to the book which is devoted to a selection of palms suitable for cultivation in Australia and New Zealand—a familiar selection suitable for many areas besides the Antipodes. Each palm is described and its suitability discussed and is accompanied by an ink wash drawing. A chapter entitled Collectors' Palms lists 41 palms which require rather more careful cultivation than the common species listed earlier. The book ends with "Palm Imposters", plants commonly confused with palms. There are fourteen, unusually designed and very pleasing color plates.

Veteran palm enthusiasts are unlikely to learn much from this book, but it was not written for them; on the other hand a neophyte, browsing through a bookshop, might easily become seduced by the neat drawings and excellent color plates, and end up growing palms. A few points might be considered for a second edition. The *Licuala* illustrated in color as *L. elegans* is in fact *L. peltata*, true *L. elegans* being a synonym of *L. pumila*, and the handsome palm of S. Thailand with undivided leaf illustrated being a form of *L. peltata*. I can see no good difference between *Cyrtostachys lakka* and *C. renda*, and the sealing wax palm hence should correctly be called *C. renda*.

"Palms for the home and garden" is indeed a very pleasing book and is likely to produce palm converts—unfortunate, then, that Lynnette Stewart should give an out-of-date address for general enquiries to the Palm Society, when she kindly introduces the Society and Principes to the general reader.

JOHN DRANSFIELD

ST. JOHN, HAROLD. 1981. New Species from Kauai, Hawaiian Plant Studies 97. Pacific Science 35: 97–99.

A new species of *Pritchardia*, *P. napaliensis*, is described from recent collections on Kauai in Hawaii. Seeds of this palm were collected and sent to the Palm Society Seed Bank in 1976 as *Hodel 100* from Hoolulu Valley, Jauai. Those who have this palm in their collection should note the new name on their labels and inventories.

TISSERAT, BRENT. 1981. Date Palm Tissue Culture. U.S. Department of Agriculture, Agriculture Research Service, Advances in Agricultural Technology. AAT-W-17. 50 pp.

Procedures to propagate rapidly the date palm through tissue culture and to transfer successfully plantlets from *in vitro* to free-living conditions are presented. In addition, an extensive review of micro-culture techniques used for micro-propagation of various species of Palmae is included. A copy of this publication is available upon request from Vegetable Chemistry Laboratory, 263 South Chester Avenue, Pasadena, CA 91106.

DON HODEL

NEWS OF THE SOCIETY

Texas

Members of the Houston Area Chapter met on September 16, 1982 at the home of Jim and Clarice Cain, 11230 Hendon. After a tour of their palms and a business meeting, Horace Hobbs gave an interesting and informative talk on growing palms. He uses large styrofoam boxes from the local florist as incubators, covering the boxes with plastic and adding a 100 watt light bulb as a heater. His soil mix is a combination of pine bark mulch and perlite with the proportion of perlite gradually increaed for smaller palms. Plants are fertilized every two weeks with a liquid fertilizer at 1½ times recommended strength.

Seedings of *Trithrinax acanthocoma* were distributed and past seedlings of the month were compared and discussed. We are adding a member consignment sale or trade to our meetings. Those with palms to exchange are to bring the plants and provide a 30% donation to the chapter from any transactions. The chapter has donated four copies of "Palms of the World" to the Houston Public Library, and "Palms for Home and Garden," "Flora of Panama," "Flora of Peru" have been added to our chapter library.

The next meeting will feature a report on the Biennial Meeting of The Palm Society at the home of Bonny and Erwin Ruhland. A spring show and sale will be held May 7th and 8th, 1983, at the Houston auditorium.

BONNY RUHLAND

Northern California

Northern California has concluded their 1982 meetings. Our August meeting was co-hosted by Dick Douglas and Ruth Bancroft. Eighty members and guests enjoyed a walk through Ruth and Phil Bancroft's 5 acre garden, featuring Mediterranean plants, succulents, cacti, and palms set in a sea of rock. Dick's 1 acre palm garden features more than 50 species of palms, beautifully grown despite 20° F minimum temperatures. Refreshments were served at the poolside bar, and canapés were followed by hot hors d'oeuvres and a chilled salmon. We celebrated Charlotte Sibley's 80th with a cake decorated with miniature palm trees. Our auction netted the chapter $777.50, and we were honored by the presence of Paul Drummond, Miami; Lois and Kurt Rossten, Huntington Beach; and Al and Sylvia Bredeson, San Diego.

Our October meeting was hosted by the chapter at our public palm garden in Lakeside Park. Fifty members and guests enjoyed a garden walk. Potluck snacks turned into a grand buffet, highlighted by Charlotte Sibley's Smithfield ham plus a dazzling array of chicken teriyaki, quiche, frittata, salads, cakes, and cookies. Professor Rudolf Schmid, Dept. of Botany, U.C. Berkeley chronicled his expedition to Lord Howe Island. His narrative and beautiful pictures thrilled us all. Our palm auction netted $620. In 1982 we had four very succeessful and enjoyable meetings.

JIM MINTKIN

Nina M. Woessner

BOOKSTORE

INDEX TO PRINCIPES (Vols. 1–20, 1956–1976, H. E. Moore, Jr., 68 pp.) ..... $ 3.00

CULTIVATED PALMS OF VENEZUELA (A. Braun, 1970, 94 pp. and 95 photographs.) 4.50

THE INDIGENOUS PALMS OF SURINAME (J. G. W. Boer, 1965, Part of Flora, 172 pp.) 42.00

PALMS OF SOUTH FLORIDA (G. B. Stevenson, 1974, 251 pp.) 6.00

PALMS OF THE WORLD (J. C. McCurrach, 1960, 290 pp.) 19.00

SUPPLEMENT TO PALMS OF THE WORLD (A. C. Langlois, 1976, 252 pp.) 25.00

THE MAJOR GROUPS OF PALMS AND THEIR DISTRIBUTION (H. E. Moore, Jr., 1973, 115 pp.) 4.50

THE GENUS PTYCHOSPERMA LABILL (F. B. Essig, 1978, 61 pp.) 5.50

PALM SAGO (K. Ruddle, D. Johnson, P. K. Townsend, J. D. Rees, 1978, 190 pp.) 7.50

HARVEST OF THE PALM (J. J. Fox, 1977, 244 pp.) 16.50

THE DATE PALM (H. Simon, 1978, 155 pp.) 8.95

FLORA OF PANAMA (Palms) (R. E. Woodson, Jr., R. W. Schery, 1943, 122 pp.) 17.00

FLORA OF PERU (Palms) (J. F. MacBride, 1960, 97 pp.) 3.50

INDEX OF AMERICAN PALMS (B. E. Dahlgren) Part 1 Text 1976 (revised ed. by S. Glassman, 294 pp.) 65.00

Part 2 (Herbarium Plates, original, 1959, 416 pp., 412 plates) 18.95

PALEM INDONESIA (in Indonesian) (Sastraprdja, Mogea, Sangat, Afriastini, 1978, 52 illustrations beautifully done, 120 pp.) 5.50

PALMS OF MALAYA (T. C. Whitmore, 1973, 132 pp.) 16.95

THE PALM FLORA OF NEW GUINEA (F. B. Essig, 1977, 46 pp.) 5.50

COCONUT PALM FROND WEAVING (Wm. H. Goodloe, 1972, 132 pp.) 3.95

THE MINIATURE PALMS OF JAPAN (U. Okita, J. L. Hollenberg, 1981, 135 pp.) 19.95

PALMS FOR THE HOME AND GARDEN (L. Steward, 1981, 72 pp.) 10.95

PALMS OF BRITISH INDIA & CEYLON (Blatter 1926, reprinted in India 1978, 600 pp.) 75.00

A MANUAL OF THE RATTANS OF THE MALAY PENINSULA (J. Dransfield, 1979, 270 pp.) 19.00

MAJOR TRENDS OF EVOLUTION IN PALMS (H. E. Moore, Jr., N. W. Uhl, 1982, 69 pp.) 6.00

PALM PAPERS (Postage Included)

THE HARDIEST PALMS (J. Popenoe, 1973, 4 pp.) 1.25

FURTHER INFORMATION ON HARDY PALMS (J. Popenoe, 1973, 4 pp.) 1.25

NOTES ON PRITCHARDIA IN HAWAII (D. Hodel, 1980, 16 pp.) 2.00

PALMS—ANCESTRY AND RELATIONS (B. Ciesla, 1979, a chart) 4.50

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

The palm books listed above may be ordered at the prices indicated plus $1.25 extra per book to cover packaging and postage. (California residents please add 6% sales tax.) Send check in US currency payable to The Palm Society to Pauleen Sullivan, 3616 Mound Avenue, Ventura, California 93003, USA. We also buy and resell old palm books. ALL SALES FINAL.

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C. Total paid circulation	1449	1646
D. Free distribution by mail carrier		
1. Samples, complimentary	18	32
2. Copies distributed to news agents	None	None
E. Total distribution	1467	1678
F. Office use, left-over	433	222
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I certify that the above statements made by me are correct and complete. Signed, Dr. Natalie W. Uhl, Editor.