



# PRINCIPES

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THE PALM SOCIETY

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Cover Picture

Pinanga Kuhlii eight feet high in the Darian living room. See page 25. Photo by Ken Foster.

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JOURNAL OF THE PALM SOCIETY

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# Maxburretia rupicola

T. C. WHITMORE

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The limestone hills of the Malay peninsula are natural features of great beauty, relicts of an ancient calcareous mantle, now rising sheer from flat alluvial plains. The lower parts are mostly precipitous cliff; on the tops is a dense low forest quite different in composition from the rain forests of the rest of the country.

In Selangor state, a few miles north of the capital Kuala Lumpur, arise three limestone hills, Batu Caves, Bukit Takun and Bukit Anak Takun,\* which until 1968 were thought to be the southernmost limestone outcrops on the mainland of Asia, a distinction which now goes to an outcrop near Kota Tinggi in Johore, only 20 miles north of Singapore.

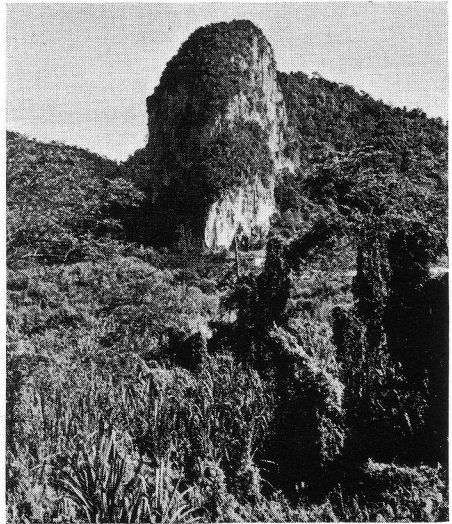
These three limestone hills in Selangor are the habitat of *Maxburretia rupicola* (Ridley) Furtado, a dainty little coryphoid fan palm, named for Dr. Max Burret of Berlin by Furtado in 1941, following his discovery that Ridley (1904) had been wrong to put the species into *Livistona*, and wrong to include with it the other Malayan limestone palm now known as *Liberbaileya gracilis* (Burret) Burret & Potzta (see Moore, 1967, Whitmore, 1970).

*Maxburretia* grows in the black humic soil of crevices in the limestone, sometimes in the open, sometimes under light forest shade. The stems grow to about 1 m. (3 ft.) tall, rarely more, are erect or leaning, and are entirely swathed in a thick mass of finely fibrous black old leaf sheaths; they are usually solitary but clumps of up to three have been found. The fronds are stiff, deeply and

narrowly divided, and slightly smoky green below. The inflorescences are erect panicles ca.  $\frac{1}{2}$  to  $\frac{3}{8}$  m. ( $1\frac{1}{2}$ –2 ft.) tall, with usually five or six partial inflorescences of numerous slender branchlets. The flowers are corn yellow and fragrant. Mature fruits are ellipsoid, ripening shiny black, thinly fleshy, 6 mm. long; young ones are 4 mm. long, green and finely whiskery; the endosperm is homogeneous.

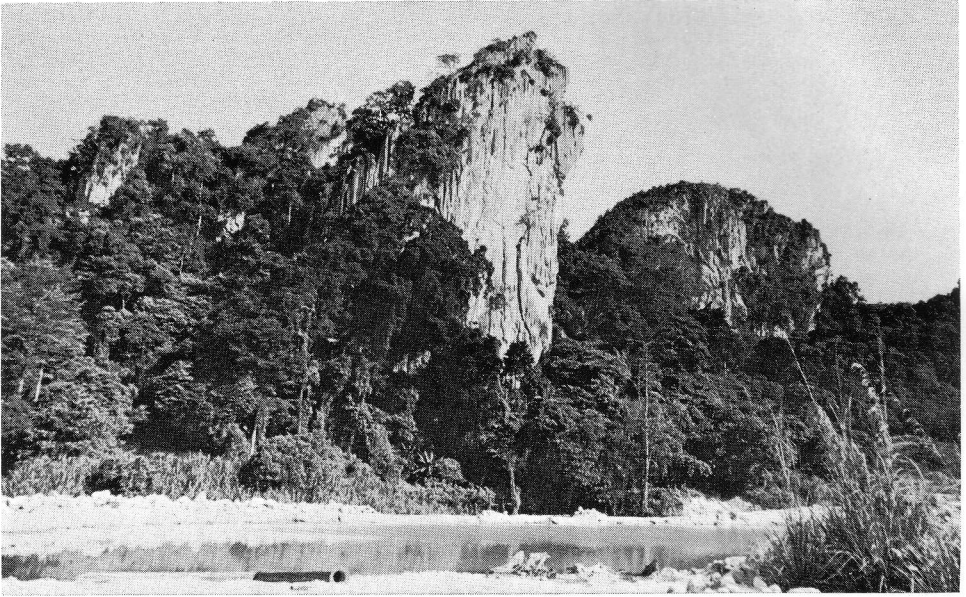
Furtado described both *Liberbaileya* and *Maxburretia* in the same paper and as dioecious species, *i.e.* with separate male and female plants. In his discussion, but not the Latin descriptions, he mentions "traces of polygamous spadicis."

When I discovered recently (Whitmore, 1970) that *Liberbaileya* actually



1. Bukit Takun rising sheer from the valley floor, as seen from the trunk road.

\* Malay: *bukit*—hill, *anak*—child.



2. Bukit Anak Takun and (right) Takun itself. In the foreground a tin mine within the Templer Park.



has hermaphrodite flowers, which incidentally is by far the commonest condition in this subfamily, it was natural to have a careful look at *Maxburretia*. Examination of all the collections at the Kepong and Singapore Botanic Garden herbaria, followed by a morning on Bt. Anak Takun, led to the discovery that *Maxburretia* has both male plants and hermaphrodite ones, with the latter much more abundant on Bt. Anak Takun. Furthermore there is a difference in inflorescence structure. The hermaphrodite panicles have two orders of branching in the partial inflorescences and the branchlets are fairly straight. The male ones have three orders of branching except in the topmost partial inflorescences, with the branchlets slender, finely zigzag and forming a dense mass somewhat reminiscent of a witches' broom.

←

3. *Maxburretia*, an exposed plant on the summit crags of Bt. Anak Takun.





4. *Maxburretia*, an unusually tall specimen; with Gi.



5. *Maxburretia*, a branched plant showing the dead fibrous leaf sheaths (photo P. R. Wycherley).

The flowers differ in size and shape. Hermaphrodite flowers are campanulate and ca. 2.5 mm. long by 2 mm. broad; the petals are broadly triangular. The anthers are oblong to triangular-oblong and ca. 5 mm. long, later shrivelling. Male flowers are oblong, and slightly smaller, ca. 2 mm. long by 0.9 mm. broad, with oblong, acute petals. There is either no trace of a pistillode at all (*SFN 34370* inflorescence b), or a tiny knob (*KEP 39585*), or 3 tiny discrete vestigial carpels (*KEP 56257*, *KEP 99501*). In both types of flower the petals are coriaceous and finely striate on the outer surface.

The type collection of *Livistona rupicola* (*Ridley 8285*) at Singapore has no flowers or fruits left; the inflorescence is of the hermaphrodite type and was presumably in flower because Ridley does not mention fruit. Furtado based his description of *Maxburretia rupicola* on the only other sheet at Singapore, *Nur SFN 34370*. This collection has three separate detached inflorescences; nearly all the flowers have dropped off and are preserved in a capsule. I dissected a few of the remaining attached flowers. Inflorescences (a) and (c) are of the hermaphrodite type and have old hermaphrodite flowers in very young fruit, the anthers are 0.3–0.5 mm. long and

empty, with signs of deep splits along the lateral faces. Inflorescence (b) is male with the finer branching described above and with well developed male flowers bearing fat anthers 0.5 mm. long not yet dehisced.

Furtado had only two collections to work on, one with no flowers remaining, the other a mixture from several plants. My interpretation differs from his in regarding his "female" flowers as old hermaphrodite ones in which the anthers have dehisced and shrivelled. He did not notice that there are two kinds of inflorescence associated with the different kinds of flowers. I have found no trace of the "polygamous spadices" mentioned *en passant* in his discussion.

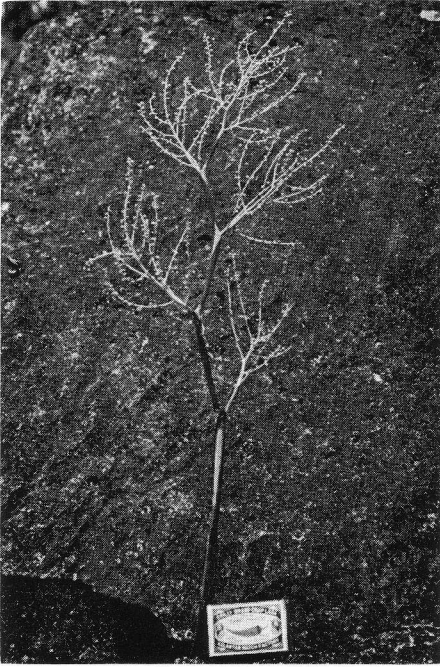
On Bt. Anak Takun I observed that hermaphrodite panicles are strongly acropetal in flower development: the lower partial inflorescences are often in young fruit while the upper ones are in flower. On male plants the flowers drop after opening leaving bare panicles which slowly wither away. Most of the plants were in flower when I visited the hill on 13 June 1970.

*Maxburretia* is easy to see on the cliffs at Batu Caves, a well known tourist spot (though quarrying is fast removing the habitat) and also on the two Takun outcrops, a few miles further north in the Templer Park and further from the road. It is a tough scramble to reach any of these plants, and local guides should be employed. It is curious that this palm has never been found on any of the other limestone hills in Malaya, some of which have their own peculiarities. *Maxburretia*, the outstanding plant of the Selangor limestone, in fact epitomizes the fantastic richness and local endemism of the flora of Malaya, and it is fortunate that at least the part of its habitat in Templer Park is fairly secure from destruction.



6. *Maxburretia*, hermaphrodite plant in flower (photo P. R. Wycherley).





7. *Maxburretia*, hermaphrodite panicle.

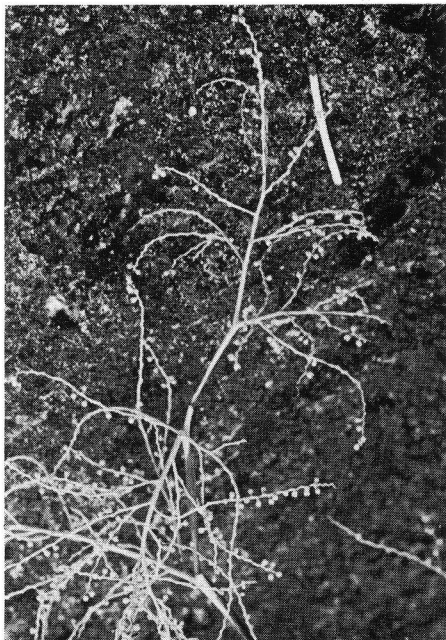


9. *Maxburretia*, male panicle.

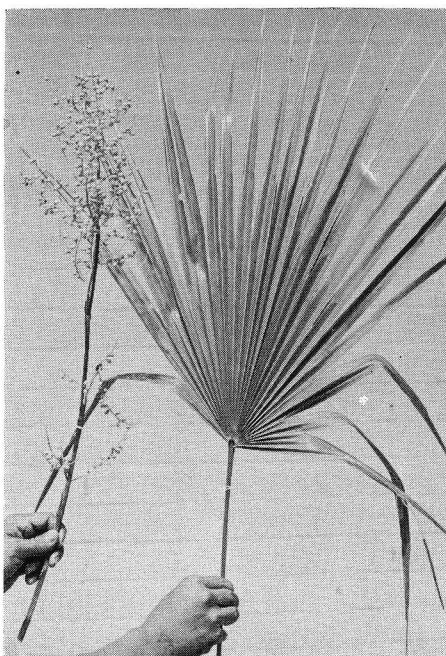


8. *Maxburretia*, hermaphrodite partial inflorescence with two orders of stiff branchlets.





10. *Maxburretia*, end of male panicle showing three orders of sinuous branchlets except at tip with two orders only.



11. *Maxburretia*, leaf and infructescence.

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### Maxburretia in Thailand

While sorting through the unmounted palm material in the Herbarium Bogoriense, Bogor, I came across a collection of a small fan palm from a limestone ridge in South Thailand near Surat Thani. The locality and habitat details are as follows: Surat, Khao Phra Rahu, 300 m. Common on limestone ridge. 4th Unesco Training Expedition. Leg. *T. Smitinand & H. Sleumer, No. 1230, 22.9.1963.*

The collection obviously represented *Liberbaileya*, *Maxburretia* or another new coryphoid genus. Close examination of the flowers (male) and vegetative structures have shown it to be *Maxburretia rupicola* (Ridley) Furtado. This remarkable collection about 400 miles north of the only other locality of *Maxburretia* in Selangor, Malaya, goes to emphasize how little is known of the palm flora of South Thailand. Maybe we can expect further localities of *Maxburretia* and possibly *Liberbaileya* in the future. The distribution of *Maxburretia* is shown to be extremely disjunct.

J. DRANSFIELD,  
*Herbarium Bogoriense,*  
*Bogor, Indonesia.*

# The Genus *Synechanthus* (Palmae)

HAROLD E. MOORE, JR.

*L. H. Bailey Hortorium, Cornell University, Ithaca, New York*

*Synechanthus* is a distinctive genus of small undergrowth palms encountered with some frequency in the wet forests of southern Mexico, Central America, and northwestern South America. It is related to several other genera (*Gaussia*, *Opsiandra*, *Wendlandiella*, *Hyophorbe*, *Chamaedorea*) that together form an alliance to be considered in detail elsewhere. As in several of these genera, the flowers are borne in an unusual arrangement termed an acervulus in which the lowest flower is usually female with two to several male flowers borne above it in a line (Fig. 1a).

The genus was described over a century ago, has been cultivated intermittently ever since, and seven species have been described largely from differences in foliage and in fruit. The problem of differentiating among these species in the field and herbarium has intrigued me since 1949 when I first became acquainted with the genus. Twenty years of experience have demonstrated, at least to me, that the division of the leaf, and size and shape of fruit and seed are very variable and do not correlate well with other morphological characters nor with geography or elevation. When leaves with undivided blades, with irregularly divided blades, and with regularly divided blades occur on sometimes adjacent plants in a limited area of a small island in the bay off Buenaventura, Colombia, characteristics of leaf division are clearly seen to be unreliable in distinguishing species. Equally, when ellipsoid and globose fruits are encountered together, the shape of the fruit and seed becomes less convincing as a specific criterion.

The nature of the inflorescence and of the staminate flower, however, is constant, though dimensions may vary. When reliance is placed on these more stable characteristics, two clear-cut groups emerge as contrasted in the synoptic key. Leaf and fruit vary within each group and it is conceivable that intensive field study may reveal some infraspecific correlation between, for example, color of nerves on the leaves with elevation. Present materials and experience do not permit this but they do permit the following treatment of *Synechanthus* as a genus of two species.\*

***Synechanthus*** H. Wendland, *Botanische Zeitung* 16: 145. 21 Mai. 1858.

Lectotype: *S. fibrosus* (H. Wendland) H. Wendland (vide Moore, *Gentes Herbarum* 9: 273. 1963).

*Reineckea* H. Karsten, *Wochenschrift für Gärtnerei und Pflanzenkunde* 1: 349. 4 Nov. 1858 ('*Reineckia*') corr. *op. cit.* 377. 2 Dec. 1858 non *Reineckea* Kunth (1844).

Type: *Reineckea triandra* H. Karsten.

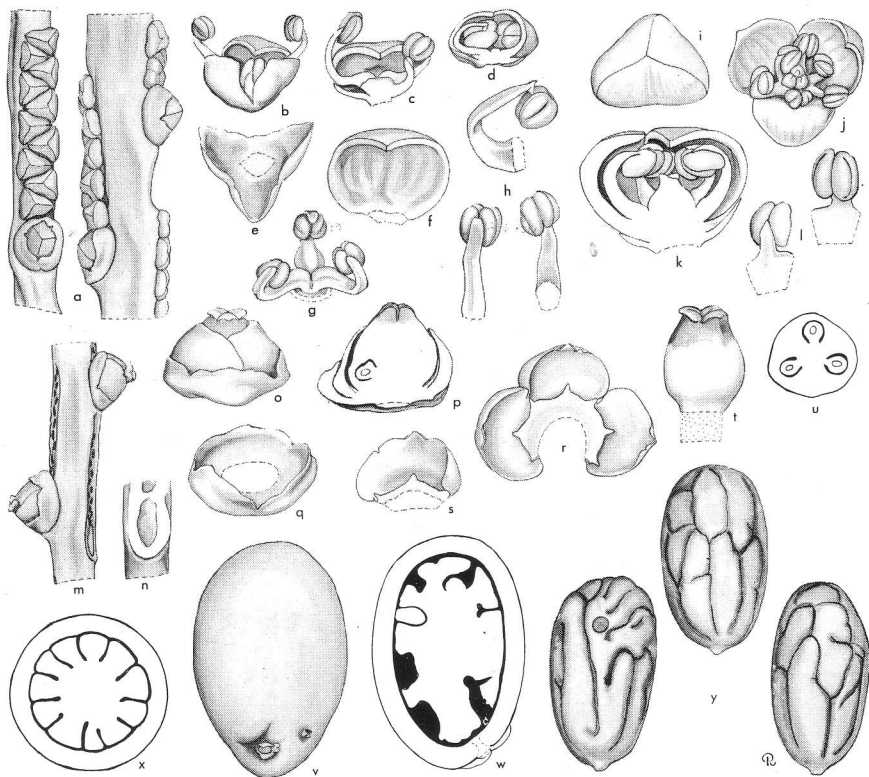
*Rathea* H. Karsten, *Wochenschrift für Gärtnerei und Pflanzenkunde* 1: 377. 2 Dec. 1858 *nom. illeg.*

Type: *R. fibrosa* (H. Wendland) H. Karsten.

Solitary or cespitose, unarmed, slender, monoecious palms.

Leaves pinnate; sheath elongate on new leaves but soon splitting opposite the petiole and differentiated from it

\* From work related to National Science Foundation Grant GB-7758 and previous grants.



1. *Synechanthus Warscewiczianus* (a-h, m-y) and *S. fibrosus* (i-l). a, portion of rachilla with acervuli in two views  $\times 4$ ; b, staminate flower  $\times 8$ ; c, staminate flower in vertical section  $\times 8$ ; d, staminate bud in vertical section  $\times 8$ ; e, staminate calyx, interior view  $\times 16$ ; f, staminate petal, interior view  $\times 16$ ; g, androecium  $\times 16$ ; h, stamens in three views  $\times 16$ ; i, staminate bud  $\times 8$ ; j, staminate flower  $\times 8$ ; k, staminate bud in vertical section  $\times 16$ ; l, stamens  $\times 16$ ; m, portion of rachilla at pistillate anthesis  $\times 4$ ; n, portion of rachilla with scar of pistillate flower  $\times 4$ ; o, pistillate flower  $\times 8$ ; p, pistillate flower in vertical section  $\times 8$ ; q, pistillate calyx  $\times 8$ ; r, pistillate petals and staminodes, interior view, expanded  $\times 8$ ; s, pistillate petal and staminodes, interior view  $\times 8$ ; t, pistil  $\times 8$ ; u, pistil in cross-section  $\times 8$ ; v, fruit  $\times 1$ ; w, fruit in vertical section  $\times 1$ ; x, fruit in cross-section  $\times 1$ ; y, seed in three views  $\times 1$ . a-h from material of *Moore & Parthasarathy* 9486 preserved in liquid; i-l from dried material of *Hernandez X. & Sharp X-1287* (BH); m-u, w from material of *Moore & Parthasarathy* 9466 preserved in liquid; v, x, y from material of *Moore & Parthasarathy* 9409 preserved in liquid.

only by a narrow, usually fibrous, dry strip along each margin; petiole convex below, concave above; rachis convex below, angled above; pinnae broadly reduplicate at insertion, acute to acuminate, slightly to markedly sigmoid or, when broad-based, the apex falcate, with 1 to

several principal nerves, these elevated above, or the blade sometimes undivided except at the bifid apex.

Inflorescence interfoliar or becoming infrafoliar, once- or twice-branched, erect at anthesis, arcuate or pendulous in fruit, solitary in the leaf-axil, long-

pedunculate; bracts (5-) 6, tubular-sheathing, ultimately disintegrating into fibers, the prophyll short, open apically, successive bracts longer and inserted at increasingly greater distances, the uppermost usually somewhat exceeding the peduncle; rachis usually elongate; branches all simple or the lower branches again once-branched; rachillae slender, nearly quadrate to markedly flattened and more or less flexuous, the tips usually slender and appearing spinose.

Flowers borne in mostly distichously arranged cincinni (acervuli) of a proximal pistillate and 5-13 distal biseriate staminate, the distal flower opening first and flowering basipetal in the acervulus; staminate flowers green in bud, golden-yellow at anthesis, depressed-triangular in bud, sepals connate in a low, acutely 3-lobed cupule, petals 3, valvate, very prominently nerved in bud *when dry*, spreading at anthesis, stamens 6 with short filaments incurved in bud, erect at anthesis or 3 with long filaments markedly incurved and inflexed at the apex in bud, horizontally exerted at anthesis, anthers basifixed, shallowly bifid at apex and base, dehiscent by lateral slits, pistillode small, deltoid-ovoid, apically 3-lobed or lacking; pistillate flowers yellowish

at anthesis, sepals 3, connate in a 3-lobed cupule, petals 3, imbricate, twice as long as the sepals or more, staminodes apparently lacking, or perhaps sometimes 3 and minute, or evident and connate in a 6-lobed ring and partially adnate to the petals, pistil ovoid, drying 3-angled, with 3 short recurved stigmas, trilobular, triovulate, ovules laterally attached, anacampylotropous, integuments 2.

Fruit red at maturity, with basal stigmatic residue; exocarp smooth; mesocarp fleshy, with few slender, loosely anastomosed flat fibers against the membranous endocarp, this non-operculate; seed not adherent to endocarp, with inconspicuous basal hilum, raphe-branches ascending adaxially from the base, little anastomosed, curving laterally and descending abaxially to the lateral embryo, this above the middle to subapical; endosperm homogeneous or minutely ruminate marginally to markedly ruminate.

Chromosome complement:  $n = 16$  for *S. fibrosus* (as *S. mexicanus*), fide Read, *Principes* 10: 59. 1966.

Distribution: southern Mexico, Central America, and northwestern South America, most frequently at low elevations but up to 1200 m. in the mountains.

### Key to Species

1. Stems solitary: pinnae, except the usually broader terminal pair, all with 1 principal nerve and 2 lateral secondary nerves, these elevated above, dull yellow-brown below, usually borne in disjunct groups, rarely regularly arranged along the rachis: lower branches of the inflorescence usually divided into several rachillae, rarely unbranched but rachillae always minutely scaberulous when dry, branches and rachillae with a prominent pulvinus basally, this enlarged in fruit: staminate flowers with 6 stamens, the filaments incurved but not inflexed at the apex in bud, erect at anthesis, the anthers about as long as the filaments, not exerted: staminodes lacking, or if present then minute and perhaps only 3: seed with homogeneous or minutely and marginally ruminate endosperm. Southern Mexico, British Honduras, Guatemala, Honduras, Costa Rica. -----  
----- *S. fibrosus*
1. Stems cespitose or very rarely solitary and then probably with suppressed basal shoots: pinnae variously arranged and with 1 or often more principal nerves



or the blades sometimes undivided, the nerves elevated above, often bright straw-colored below when dry: inflorescence once-branched, the rachillae always simple, not minutely scaberulous when dry, the pulvinus less prominent and scarcely enlarged in fruit: staminate flowers with 3 stamens, the filaments markedly incurved and inflexed at the apex in bud, horizontally exerted and bearing the anthers erect at anthesis: staminodes apparently usually present in pistillate flowers, connate in a 6-lobed ring partially adnate to the petals: seed with prominently ruminant endosperm. Costa Rica, Panamá, Pacific coast of Colombia and Ecuador. ----- *S. Warscewiczianus*

***Synechanthus fibrosus*** (H. Wendland) H. Wendland, *Botanische Zeitung* 16: 145. 1858.

?*Chamaedorea fibrosa* H. Wendland, *Index Palmarum* 57. 1854.

Type: cultivated Hort. Herrenhausen (destroyed) (photos Field Museum negs. 20759, 20759a, BH, F)

*Rathea fibrosa* (H. Wendland) H. Karsten, *Wochenschrift für Gärtnerei und Pflanzenkunde* 1: 377. 1858.

*Synechanthus mexicanus* L. H. Bailey ex H. E. Moore, *Gentes Herbarum* 8: 199. 1949.

Type: *E. Hernandez X.* & *A. J. Sharp X-1287* (BH)

Stems solitary, slender, smooth, green, prominently ringed, rarely as much as a 5-6 m. high, 2-3 cm. in diam., usually much lower and often commencing to flower before an emergent stem develops or the stem sometimes decumbent.

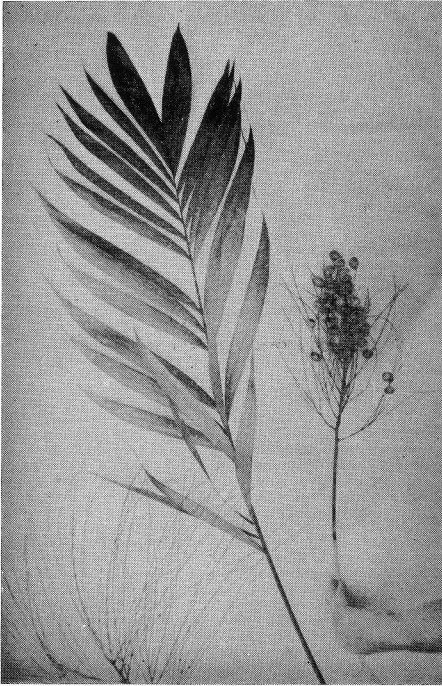
Leaves few, glossy deep-green; sheath and petiole together to 1.1 m. long or more, the sheath tubular and the petiole short on new leaves (fide O. F. Cook) but the sheath soon splitting opposite the



2. *Synechanthus fibrosus* grown from seed in the garden of A. C. and M. Langlois, The Retreat, Nassau, Bahamas, 1952.



3. Closer view of plant in Fig. 2 to show leaf-bases and inflorescences. Mr. A. C. Langlois provides scale.



4. A leaf and inflorescences of *Synechanthus fibrosus* from British Honduras. Photo Langlois, 1941.

petiole, functioning as and differentiated from the petiole only by the deeply channelled upper surface and a narrow, usually fibrous strip along the margin; petiole convex below, concave above; rachis convex below, angled above, ca. 7.4–12.5 dm. long; pinnae 10–23 on each side of the rachis, rarely regularly arranged but usually in 2 or more separated groups of 2–4 or more, basal pinnae 13–31 cm. long, 0.3–2.2 cm. wide, median pinnae 29–50 cm. long, 2.5–4.4 cm. wide, apical pinnae 19–30 cm. long, 4.2–8 cm. wide and with 3–7 principal elevated nerves, all pinnae slightly to markedly sigmoid, acute to acuminate, all but the several-nerved apical ones with 1 midnerve and 2 lateral nerves prominent and elevated on the upper surface, dull yellow-brown on the lower surface.

Inflorescence to ca. 1 m. long; peduncle to 7.2 dm. long; rachis to 22 cm. long; branches and/or rachillae to 30 cm. long, subtended by a low, often acute bract, with a pulvinus much thickened and calloused in fruit between branch or rachilla and axis, lower branches divided into several (to 6) rachillae, all rachillae very slender, ca. 1 mm. in diam., minutely scaberulous.

Acervuli of a pistillate and usually 5–9 staminate flowers; staminate flowers ca. 0.6–0.8 mm. high in bud, lobes of the calyx acute, about half as high as the petals, petals very prominently nerved when dry, at anthesis horizontally spreading and slightly recurved at the margins, forming a triangle basally about the apex of the pistillode, stamens 6, filaments short, incurved in bud but not inflexed at the apex, erect, about as long as the anthers and the petals at anthesis, pistillode shorter than the stamens, deltoid-ovoid, conic and shallowly 3-lobed apically; pistillate flowers ca. 1 mm. high, lobes of the calyx about half as high as the petals or somewhat more, petals strongly nerved when dry, staminodes lacking, pistil as high as the petals, stigmas recurved.

Fruit globose to ellipsoid, very fleshy and slippery when bruised, changing from yellowish-green to yellow, orange, and finally scarlet, 14–21 mm. long, 10–14 mm. in diam. when dry (obovoid and ca. 1.5 cm. long, 1.0 cm. in diam. when fresh fide Steyermark); seed ellipsoid to globose, 12–14 mm. long, 7–12 mm. in diam.; endosperm nearly homogeneous or minutely ruminant marginally.

Distribution: wet forests of the Atlantic slope from near sea-level to ca. 1200 m. alt., southern Mexico to Costa Rica.

Specimens examined: MEXICO. EDO. OAXACA: from Finca "La Gloria" (on río Negro watershed) back over the sierra to río Grande (n. Niltepec), 3

April 1946, *E. Hernandez Xolocotzi & A. J. Sharp X-1287* (BH, holotype of *S. mexicanus*). BRITISH HONDURAS. Roaring Creek—Stann Creek Rd., 15 mi. S. of Sibun River bridge (30 mi. S. of Roaring Creek), 1957, *J. E. Smith 5* (BH); TOLEDO DISTR.: Esperanza Trail, 1500 ft. alt., May 1960, *J. Turner 64* (BH). GUATEMALA. DEPT. ALTA VERAPAZ: near the Finca Sepacuite, Mar. 15, 1902, *Cook & Griggs 11* (US); Mar. 21, 1902, *Cook & Griggs 88* (US); road between Panzos and Sepacuite, Apr. 17, 1904, *Cook & Doyle 38* (US); Sepacuite, May 6, 1904, *Cook & Doyle 129* (US); mountain forest above Trece Aguas, 2700 ft. alt., April. 29, 1914, *Cook & Doyle 2* (US); dense wet limestone forest near Chirriacté on the Péten highway, alt. ca. 900 m., Apr. 9, 1941, *P. C. Standley 91641* (F); DEPT. IZABAL: wooded rocky slopes between Piciu and road to Senahi, about 20 miles from Puerto Barrios on road to Guatemala, alt. 100 m., 8 Nov. 1959, *H. E. Moore & M. Cetto 8218* (BH); between Virginia and Lago Isabal, Montaña de Mico, 50–500 m. alt., Apr. 5, 1940, *J. A. Steyermark 38834* (F); Cerro San Gil, along río Frio, 50–75 m. alt., Dec. 19, 1941, *J. A. Steyermark 41599* (F, US). HONDURAS. YORO: rain forest, Sierra de Sulaco, 4100 ft. alt., July 1937, *C. & W. von Hagen 1025* (F). COSTA RICA. PROV. CARTAGO: forêts de Tuis, 650 m. alt., *A. Tonduz 11373* (US); PROV. LIMON: wooded slopes about 5 km. beyond Central of Hacienda Moravia, 1000–1200 m. alt., 13 Apr. 1953, *H. E. Moore 6696* (BH). CULTIVATED. The Retreat, Nassau, New Providence, Bahama Islands (probably from British Honduras), 16 Feb. 1952, *H. E. Moore 6046* (BH); Fairchild Tropical Garden, Coral Gables, Florida, as FG 58-159 in plot 119A, 30 Apr. 1965, *R. W. Read 1421* (BH, voucher for chromosome count), as FG 58-159A from

seed collected by MacDougal west of Isthmus of Tehuantepec, Mexico, 18 Apr. 1966, *H. E. Moore 9369* (BH).

*Synechanthus fibrosus* was originally described in 1854 as a species of *Chamaedorea* from plants cultivated at the Royal Gardens in Herrenhausen, Hannover, Germany. The native country was noted as eastern Guatemala and the collector was apparently von Warscewicz, Garteninspektor at Krakow, Poland, who visited Central America in 1847. Wendland later removed the species from *Chamaedorea* and erected a distinct genus for it and *S. Warscewiczianus* only months before two other generic names—*Reineckea* and *Rathea*—were proposed independently.

The species appears to have been grown in a number of European gardens and a specimen sent to Kew by Wendland was figured in *Curtis's Botanical Magazine* 107: pl. 6572, 1881. More recently, *S. fibrosus* has been grown in the Western Hemisphere in the Bahama Islands, Florida, and perhaps elsewhere.

Foliage of *S. fibrosus* is variable. The pinnae, except for the apical pair, are always slender with one principal nerve and most often are borne in groups of two or more in varying patterns, although they are rarely regularly arranged along the rachis. The fruit and seed also appear to vary in size and shape—the subglobose fruit and seed of acaulescent plants from Mexico at one time seemed sufficiently distinctive to call for description of a new species, but similar fruits are now known from plants of British Honduras which otherwise are good *S. fibrosus* and a similar pattern of variation occurs in *S. Warscewiczianus*.

There has been some question about the presence or absence of staminodes in the pistillate flowers of *S. fibrosus*. Karsten noted six staminodes in his material at Berlin while Wendland found none or only three very minute stami-

nodes in his material (*Wochenschrift für Gärtnerei und Pflanzenkunde* 2: 15, 1859). I have not been able to discern staminodes clearly in the dried material at my disposal; certainly, if present, they are not prominent as they are in *S. Warscewiczianus*.

An apparently constant feature of this species is the solitary stem. Nowhere has there been any indication that stems cluster as in *S. Warscewiczianus*, though plants have been said to be "gregarious." My own field notes clearly indicate solitary stems only for plants in Guatemala and Costa Rica, and Hooker described the plant at Kew as single-stemmed.

*Synechanthus fibrosus* has been less frequently collected than *S. Warscewiczianus* and certainly appears to be rare in Costa Rica where the ranges of the two species overlap.

***Synechanthus Warscewiczianus* H.**  
Wendland, *Botanische Zeitung* 16: 145. 1858.

Type: cultivated Hort. Herrenhausen (destroyed) (photos Field Museum negs. 20760, 20760a, F, BH).

*Reineckea triandra* H. Karsten,  
*Wochenschrift für Gärtnerei und Pflanzenkunde* 1: 349. 1848.

Type: cultivated Hort. Decker (probably destroyed).

*Synechanthus angustifolius* H. Wendland, *Wochenschrift für Gärtnerei und Pflanzenkunde* 2: 15. 1859.

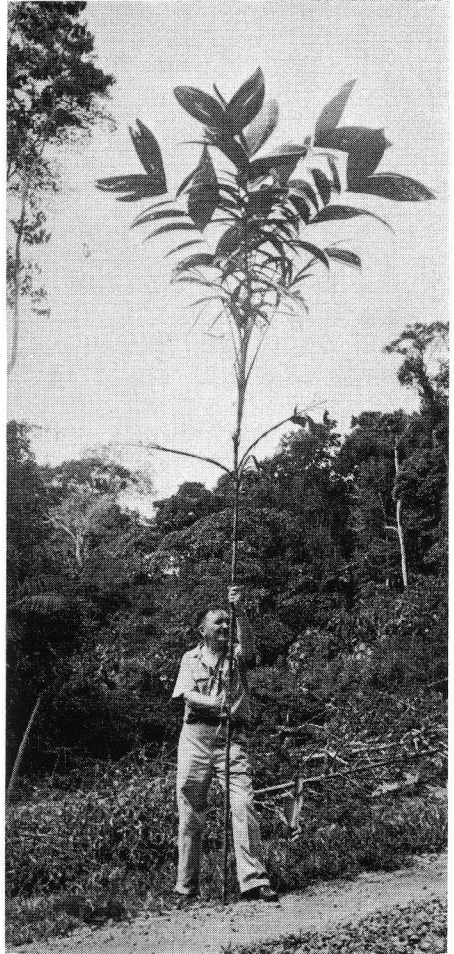
Type: cultivated Hort. Herrenhausen (destroyed) (photo Field Museum neg. 20761, BH, F).

*S. ecuadorensis* Burret, *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 13: 339. 1936.

Type: *H. Schultze-Rhnhof 1890* (B, destroyed).

*S. panamensis* H. E. Moore, *Gentes Herbarum* 8: 201. 1949.

Type: *P. H. Allen 4376* (MO).

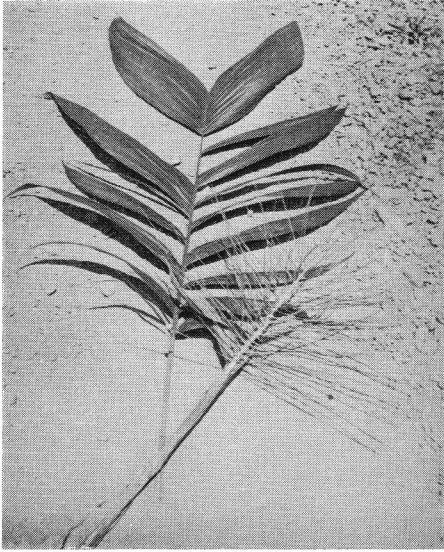


5. A stem of *Synechanthus Warscewiczianus* collected at Caimito, Panama, 1949. Photo by M. Langlois.

Stems slender, erect, rarely solitary with short adventitious prop roots, most often cespitose with one principal stem and several subordinate stems or several stems, sometimes with short vegetative branches at the nodes, to 6 m. high, 5 cm. in diam., dark olive-green except for light-green new growth, internodes elongate, 6–8 cm. long.

Leaves to ca. 10, spreading; sheath and petiole to 9.2 dm. long; rachis to 17





6. A leaf and inflorescence of *Synechanthus Warscewiczianus* collected at Caimito, Panama, 1949. Photo Langlois.

dm. long with blade undivided and about 18-nerved on each side or with 2-31 pinnae on each side, these dark green above, slightly paler below, all or nearly all with one principal nerve except the apical and regularly arranged, or variously 1- to 17-nerved and variously disjunct along the rachis, the basal pinnae to 45 cm. long, 1.8 cm. wide or more, median pinnae to ca. 57 cm. long, 2.3 cm. wide or more, apical pinnae ca. 22 cm. long or more, 3.2 cm. wide or more, the principal nerve and secondary nerves elevated above, bright straw-colored and conspicuous below when dry.

Inflorescence to ca. 1 m. long, interfoliar or often infrafoliar; peduncle to 7.3 dm. long; rachis to 3.5 dm. long; rachillae numerous, always simple, with the basal pulvinus not much enlarged in fruit, not scaberulous, to 30 cm. long.

Acervuli with a basal pistillate and (3-) 6-13 biseriate staminate flowers; staminate flowers ca. 0.6 mm. high, lobes of the calyx usually much less than half

as long as the petals, petals less strongly nerved when dry than in *S. fibrosus*, stamens 3, the filaments elongate, markedly incurved and inflexed at the apex in bud, horizontally exerted at anthesis and bearing the anthers erect, pistillode lacking; pistillate flowers ca. 1 mm. high, lobes of calyx less than half as long as petals, staminodes usually present, minute, connate in a 6-lobed ring and partially adnate to the petals, pistil as high as the petals.

Fruit subglobose to ellipsoid, maturing yellow to orange and finally to bright red, 15-32 mm. long, to 15 (-30) mm. in diam. and very soft when ripe, shrinking to ca. 11-27 mm. long, 5-11 mm. or more in diam. when dry; mesocarp fleshy and ca. 3 mm. thick when fresh but drying very thin; seed depressed-globose to obpyriform to ellipsoid, 11-19 (-25) mm. long, 5-9 (-14) mm. in diam.; endosperm prominently ruminant; embryo above the middle or subapical.

Chromosome complement: not known.

Distribution: wet forests, mostly at low elevations but up to 1200 m., eastern and western Costa Rica, Panamá, Pacific coast of Colombia and Ecuador.

Specimens examined: COSTA RICA. PROV. CARTAGO: vicinity of Pejivalle, alt. about 900 m., 7-8 Feb. 1926, *P. C. Standley & J. Valerio 47238* (US); virgin forest, Pavones, 25 Apr. 1953, *H. E. Moore 6756* (BH); PROV. HÉREDIA: Finca La Selva, Puerto Viejo de Sarapiquí, alt. 100 m., 27 June 1959, *L. R. Holdridge 5114* (BH); five miles from San Miguel towards La Virgen, Sarapiquí Valley, 12 Mar. 1945, *A. C. & M. Langlois 1* (BH); río Cuatro, Mar. 1945, *A. C. & M. Langlois 1a* (BH); Finca La Selva, on río Puerto Viejo above junction with río Sarapiquí, 110 m. alt., 28 Jan. 1967, *H. E. Moore & M. V. Parthasarathy 9409* (BH); Puerto Viejo, hillside tract opposite Miramar Bar, ca. ½ mile north of town, 15 Aug. 1965,

- P. B. Tomlinson s.n.* (BH); PROV. LIMON: wooded slopes about 5 km. beyond Central of Hacienda Moravia, alt. 1000–1200 m., 13 Apr. 1953, *H. E. Moore 6694* (BH); woodlands south of La Lola on the railroad, alt. ca. 120 m., 15 Apr. 1953, *H. E. Moore 6715* (BH); PROV. PUNTARENAS: Esquinas forest preserve between Palmar Sur and Golfito on United Fruit Co. railroad, 9 Mar. 1953, *H. E. Moore 6537* (BH); Finca Las Cruces, slopes on trail to río Java, alt. ca. 3500 ft., 31 Jan. 1967, *H. E. Moore & M. V. Parthasarathy 9427* (BH); Las Cruces, San Vito de Java, 14 Dec. 1961, *R. W. Read 642* (BH), 18 Dec. 1961, *R. W. Read 659* (BH). PANAMÁ. PROV. VERAGUAS: forested slopes of Cerro Tute, 2500 ft., vicinity of Santa Fé, 25 Mar. 1947, *P. H. Allen 4376* (MO, holotype of *S. panamensis*); CANAL ZONE: Barro Colorado Island, 1931, *S. Aviles 27* (F), 82 (F), 11 June 1931, *L. H. & E. Z. Bailey 141* (BH), July, 1931, *Bailey & Bailey 523* (BH), 10 Aug. 1940, *H. H. Bartlett 16742* (BH), 28 June 1960, *J. E. Ebinger 207* (MO), Aug. 1927, *L. A. Kenoyer 172* (US), 13 Mar. 1958, *H. F. Loomis s.n.* (BH), 6 June 1923, *W. R. Maxon, A. D. Harvey & A. T. Valentine 6826* (US), 6831 (US), 6 Aug. 1934, *O. Shattuck 1143* (F), 18–24 Nov. 1925, *P. C. Standley 41092* (US); Frijoles, 13 July 1923, *O. F. Cook & R. D. Martin 60* (US); northwestern part of Canal Zone (area west of Limon Bay, Gatun Locks and Gatun Lake), near Maru Towers, 10 Nov. 1955, *I. M. Johnston 1644* (BH); forest along the río Indio de Gatun, near sea-level, 17 Feb. 1911, *W. R. Maxon 4847* (US); railroad relocation between Gorgona and Gatun, 10–50 m., 7 Jan. 1911, *H. Pittier 2292* (US); wet forest, hills north of Frijoles, 19 Dec. 1923, *P. C. Standley 27468* (US); PROV. DARIEN: Cerro Pirre, 11 Apr. 1967, *N. Bristan 550* (BH); between upper río Membrillo and Camp 7 on the Construction Road to San Blas, 100–800 m., 26–28 Apr. 1967, *J. A. Duke 10859* (BH); Cerro Pirre, cloud forest and/or mossy forest, 2500–4500 ft., Aug. 9–10, 1967, *J. A. Duke & T. S. Elias El 3712* (MO); PROV. PANAMÁ: beyond Goofy Lake along road to Cerro Jefe, 16 Nov. 1967, *M. D. Correa A. & R. L. Dressler 479* (MO); E. slope Cerro Jefe, 2700 ft., 8 Feb. 1966, *E. L. Tyson 3406* (MO); Cerro Jefe, 2700–3000 ft., 27 Jan. 1966, *E. L. Tyson, J. Dwyer & K. Blum 3240* (MO); PROV. SAN BLAS: between río Diablo and río Acuati, near Nargana, 11 Mar. 1967, *J. A. Duke 14902* (BH). COLOMBIA. DEPT. CHOCÓ: rain forest on hill north of Alto Curiche, ca. 300 m. alt., 19 May 1967, *J. A. Duke 11227* (BH); dense forest near junction of río Condoto and río San Juan, 100–150 m. alt., 20 April 1939, *E. P. Killip 35097* (US); DEPT. CAUCA: Costa del Pacifico, río Micay, brazo Noanamito, orilla derecha, El Chachajo, 2–5 m. alt., 27 Feb. 1943, *J. Cuatrecasas 14248* (COL); DEPT. DEL VALLE: Buenaventura, 3 May 1926, *O. F. Cook 77* (US), 26 May 1926, *O. F. Cook 156* (US); río Calima, La Trojita, 5–50 m. alt., 19 Feb.–10 Mar. 1944, *J. Cuatrecasas 16764* (F; COL); Costa del Pacifico, río Cajambre, 5–80 m. alt., 15 Mai 1944, *J. Cuatrecasas 17653* (COL); Bocana Island in bay off Buenaventura, Apr. 1959, *N. J. De Leon 123* (BH); near Buenaventura, 1960, *N. J. De Leon 243* (BH); dense forest, Cordoba, 50–100 m., 17 Feb. 1939, *E. P. Killip & H. Garcia 33426* (US); slopes and ravines of Agua Dulce, an island in Buenaventura Bay, 12 Feb. 1967, *H. E. Moore, M. V. Parthasarathy & P. Orjuela 9466* (BH). ECUADOR. Junction of the Provinces of Guayas, Cañar, Chimborazo and Bolivar, foothills of the western cordillera near the village of Bucay, 1000–1200 ft. alt., 8–15 June 1945, *W. H. Camp E-3671* (BH); woodlands and fields at entrance to Comune Chilhuilpe, Santo Do-

mingo de los Colorados, alt. ca. 600 m., 21 Feb. 1967, *H. E. Moore & M. V. Parthasarathy* 9486 (BH).

*Synechanthus Warscewiczianus* is a variable species of substantial range sharply differentiated from *S. fibrosus* though occurring with it at least in one

region of Costa Rica near the Hacienda Moravia in Limon Province (see *Moore 6694, 6696*). Species relegated to synonymy have been based on variable characters that, as noted earlier, do not prove reliable in the light of field experience.

## PALM LITERATURE

LEVER, R. J. A. W. Pests of the Coconut Palm. 190 pp., 106 figs., 1 table. FAO Agricultural Studies No. 77. Food and Agriculture Organization of the United Nations, Rome, 1969. Distributed in the United States by Unipub, Inc., P. O. Box 433, New York, N. Y. 10016. Price \$3.50.

An accounting of the most important of very many invertebrate pests of the coconut palm, chiefly insects, and the fewer vertebrate pests occupies two of the four chapters in this paperbound book. Insect pests of copra and practical aspects of pesticidal application are the subjects of two additional chapters. An extensive list of references follows the text and precedes an index.

The book is copiously illustrated with photographs and line drawings printed on glossy paper. Economic aspect, geographic distribution, description, biology, and control are considered for each pest with considerable attention to biological control.

Although the book is centered on the coconut, notes are included when pests are known to attack other palms.

\* \* \*

GLASSMAN, S. F. A conspectus of the palm genus *Butia* Becc. Fieldiana:

Botany 32 (10): 127-172, fig. 1-31. 1970.

———. A synopsis of the palm genus *Syagrus* Mart. *op. cit.* 32(15): 215-240, fig. 1. 1970.

———. A new hybrid in the palm genus *Syagrus* Mart. *op. cit.* 32(16): 241-257, fig. 1-14. 1970.

These three papers are parts of a series that has dealt with the genus *Syagrus* for which Dr. Glassman adopts a circumscription far broader than that accepted of late. Earlier papers were noted in *Principes* 13: 66. 1969.

\* \* \*

TIDWELL, W. E., RUSHFORTH, S. R., REVEAL, J. L. & BEHUNIN, H. *Palmoxylon simperi* and *Palmoxylon pristina*: two pre-Cretaceous angiosperms from Utah. *Science* 168: 835-840. 1970.

TIDWELL, W. E., RUSHFORTH, S. R. & SIMPER, A. D. Pre-Cretaceous flowering plants: further evidence from Utah. *Science* 170: 547-548. 1970.

The authors of these articles suggest that palms, hence flowering plants, were present in Jurassic times.

H. E. MOORE, JR.

# Observations on Pollination in *Bactris*

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Much has been said but little is actually known about the pollination process in most species of wild palms. Schmid (1970b) reviewed the literature on the subject and summarized what was known, but his own study (1970a, b) of pollination in *Asterogyne Martiana* of Costa Rica was the first thorough and reliable contribution to this exciting aspect of palm biology. I went to Costa Rica in the summer of 1970 as a student in the tropical biology course of the Organization for Tropical Studies, hoping to observe the pollination process in some other genera of palms. Suitable material proved to be rather scarce. The tall palms held their inflorescences out of reach and out of sight, and of the smaller palms, few populations contained both male and female flowering individuals. I was fortunate, however, to find two species of the spiny genus *Bactris* (Cocosoideae) in abundant flower and of suitable habit for study. My observations on these palms revealed a pattern of pollination strikingly different from that found in *Asterogyne*.

Two populations of *Bactris* were located in two very different parts of Costa Rica. The first population, occurring at the edge of a large cow pasture on the Finca La Taboga, near Cañas, Province of Guanacaste, proved to be *Bactris guineensis* (L.) H. E. Moore (*Cocos guineensis* L., *Bactris minor* Jacquin). This region has a climate of marked wet and dry seasons. Later in the summer, the Finca was reported to be under several feet of water. The second population was found in a mangrove swamp at the mouth of the Río Rincón on the Osa

Peninsula, Province of Puntarenas. I have identified this population as *Bactris major* Jacquin (*Pyrenoglyphis major* (Jacq.) Karst.). It is close also to *B. balanoidea* Wendl., which is probably a synonym. In their swamp habitat these palms are subject to constantly moist conditions and share the ground with many land crabs.

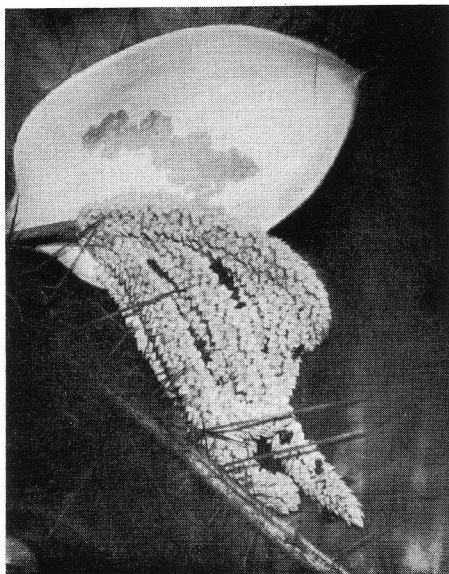
The sequence of flowering events was observed in the *Bactris guineensis* population on July 12 and 13, and in the *B. major* population on August 11 and 12. The behavior of insect visitors was noted and samples of the insects were collected and preserved in alcohol. The descriptions and discussion that follow apply only to *Bactris guineensis* and *B. major* although I will often refer to the subject populations as just *Bactris*. The pollination process is generally the same for the two species.

L. H. Bailey (1943) described both species in detail. In features related to flowering and pollination they are essentially alike. Their general habit is as follows. *Bactris guineensis* is caespitose, with many closely-spaced, narrow canes up to 4 m. (12 ft.) tall, while *B. major* is colonial, forming extensive colonies of well-spaced, narrow canes up to 8 m. (25 ft.) in height. Vegetative parts of both species are covered with long, sharp spines. The inflorescences are each enclosed initially by a single thick, spiny, boat-shaped spathe, which later opens out, exposing a bright, cream-colored interior, much in the manner of a typical aroid spathe. The prophyll sheathes the lower part of the flowerstalk, but is inconspicuous.





1. *Bactris major* growing in a mangrove swamp on the Osa Peninsula.



2. Inflorescence of *Bactris major* just prior to opening of the male flowers. Note *Trigona* bees already on the inflorescence.

The flowers of *Bactris* are unisexual and are arranged in triads of a single female flower flanked by two males, with many additional males interspersed between the triads and occupying the extremities of the rachillae. Flowering is strongly protogynous. That is, on one inflorescence, the female flowers all complete anthesis before any male flowers open and shed their pollen. This situation contrasts sharply with that in *Asterogyne* and in most other monoecious palms, in which male flowers bloom before the females. The strict temporal separation of male and female anthesis on an inflorescence decreases the probability of geitonogamy (pollen transfer between flowers on the same plant), and thereby promotes xenogamy (pollen transfer between genetically different individuals), which is necessary to maintain gene flow in the population. Individual stems usually bear no more than one inflorescence in flower at a time.

This further reduces, but does not eliminate the probability of geitonogamy, since *Bactris* reproduces clonally, and adjacent stems may therefore be genetically identical. Xenogamy ensures gene exchange between clones, and geitonogamy ensures the ability of isolated clones to produce seed. Both processes undoubtedly contribute to the great success of the genus *Bactris*.

The flowering cycle in *Bactris* begins in late afternoon, again sharply contrasting with the situation in *Asterogyne*, in which flowers open early in the morning. The thick, spiny spathe, that tightly encloses the inflorescence prior to flowering, opens rather quickly between 4:30 and 5:30 P.M. The inflorescence then expands and the female flowers all reach anthesis between 6:30 and 7:00 P.M. The calyx and corolla of the female flower are very short and the staminodes much reduced, leaving the apex of the stout and fibrous pistil exposed even in bud.

Table 1. *Data from Bactris guineensis population.*

Time	First day inflorescence	Second day inflorescence
Morning	Spathe tightly closed	Female flowers withered; male flowers unopened, but beetles and flies feeding upon them
4:15 P.M. to 4:30 P.M.		Male flowers open; <i>Trigona</i> bees appear, begin collecting pollen; beetles and flies still feeding
4:30 P.M. to 5:30 P.M.	Spathe opens, inflorescence expands	
5:30 P.M. to 6:00 P.M.		<i>Trigona</i> bees finish collecting pollen and leave; beetles and flies still present in great numbers
6:30 P.M.	Stigmas begin to expand on female flowers; beetles appearing in large numbers to feed on unopened male flowers, many bearing pollen	Male flowers loosen, begin to fall; beetles and flies leave (further activity of flies unknown)
7:00 P.M.	Stigmas fully open, receptive; many beetles present, feeding through the night and presumably contacting the stigmas as they move	

At anthesis, the three stigmatic lobes are reflexed and become slightly sticky. By the next morning, the stigmas are withered and brown.

Between 4:15 and 4:30 P.M. the next afternoon, the male flowers of the same inflorescence all open and the anthers dehisce. The male flowers are somewhat smaller than the females and emit a musky odor. They are conspicuous, with a succulent, cream-colored corolla, short calyx, and six stamens. By 6:30 P.M. the anthers are nearly empty of pollen and the male flowers begin to loosen and fall from the inflorescence. Notice that on any given afternoon the inflorescences in a population are in two distinct phases of flowering. There are new (first-day)

inflorescences, on which the male flowers are unopened and on which the female flowers are approaching anthesis, and there are second-day inflorescences on which the female flowers have undergone anthesis the previous day, and on which the male flowers are now at anthesis. (See Table 1 for a summary of the flowering events.)

Insects usually come to flowers for the purpose of feeding. They may feed on nectar, on pollen, and/or on the tissues of the flower itself. Nectar is apparently not produced by either male or female flowers in *Bactris*. Three lines of negative evidence suggest this: 1) a superficial examination of both kinds of flowers in the field revealed no visible nectar;

2) anatomical studies by Dr. N. W. Uhl (personal communication) showed no evidence of nectaries in the female flowers of two species of *Bactris* (*Bactris* sp., Moore & Parthasarathy 9490, and *B. major* (?), Read 901); 3) no nectar-feeding insects were observed on *Bactris* inflorescences. There were no moths or butterflies, and none of the nectar-feeding flies (including the pollinating syrphids) found by Schmid (1970b) on *Asterogyne*.

Consequently the list of insect visitors to *Bactris* is considerably shorter than that for *Asterogyne*. Altogether, only seven species of insect were collected from *Bactris* flowers at both field sites. Collections were hasty, however, and undoubtedly incomplete, but probably representative of the types present.

The abundant pollen of the male flowers attracts at least three species of *Trigona* bees (Apidae). *Trigona silvestriana* Vachal was collected on *Bactris guineensis*, while *T. corvina* Cockerell and *T. lurida* Smith were collected on *Bactris major*. (Determinations by G. C. Eickwort, Cornell University.) The *Trigona* bees visit only male flowers (on second-day inflorescences) and end their activity before the female flower on the first-day inflorescences reach anthesis. It seems therefore, that they cannot play any role in the pollination of *Bactris*.

The remaining four species of insects collected were found feeding in the tissues of the male flowers. Of these, there were one species of drosophilid fly and three species of small beetles. The beetles include one species of flower beetle (Nitidulidae) and two weevils (Curculionidae). The beetles feed by chewing into the tissues of the unopened male flowers, and may feed on pollen when they reach the interior. They appear on the inflorescences soon after the flowers are exposed by the opening of the spathe. This may be as much as 24 hours before

the male flowers open. The beetles are apparently attracted by the musky odor given off by the fresh inflorescences (by the unopened male flowers?). On the second day, at the time that the male flowers are open and shedding pollen, the beetles begin to leave the inflorescence and move to one of the newly opened inflorescences. The bulk of this movement occurs in early evening, after the bees have finished collecting the pollen and the male flowers are beginning to loosen and fall from the inflorescence. This coincides with the beginning of anthesis of the female flowers on the new inflorescences. (See Table 1.)

The drosophilid flies occur with the beetles on the second-day inflorescences, perhaps feeding on plant juices released by the feeding activity of the beetles. The flies do not occur in my samples taken from first-day inflorescences in the evening; perhaps their food is not available until the next day. Under these circumstances, it seems unlikely that they play any role in pollination of *Bactris*, but more information is needed about their habit and pollen-carrying capacity before anything definite can be said about them.

It appears then, that of all the insect visitors to the flowers of *Bactris*, only the nitidulid and curculionid beetles can play any role in pollination. These insects appear in great numbers on the second-day inflorescences up to the time that the male flowers release their pollen. Subsequently, they appear in great numbers on the new inflorescences at about the time that the female flowers are becoming receptive. Beetles taken from these inflorescences and examined microscopically are found to carry pollen grains of *Bactris*, and only *Bactris*, among the hairs of their bodies. The beetles are small (less than 3 mm. in length), and can carry only a few grains each, but literally hundreds of them make

the trip from an old to a new inflorescence each evening. Only one pollen grain is theoretically needed to fertilize each of the 30 to 50 pistils that will develop into fruit on an inflorescence. Pollen must be transferred inadvertently, as the beetles land on, or walk over the sticky stigmas of the female flowers.

The possibility of pollination by wind should be given some consideration here, since palms have been traditionally regarded as wind-pollinated (see review in Schmid, 1970a). Knuth (1904) suggested specifically that several species of *Bactris*, including *B. major*, are wind-pollinated. However, two factors make wind-pollination in *Bactris* unlikely. First is the fact that wind is usually absent from the wooded natural habitat of the two species studied. Only at the artificially cleared Guanacaste site was there any breeze that might have carried pollen through the air. Second is the fact that the pollen-shedding period of the male flowers on the second-day inflorescences ends before the female flowers on the first-day inflorescences reach anthesis. Male and female flowers would have to attain anthesis simultaneously if wind-pollination were to be effective.

If we accept the hypothesis that *Bactris* is beetle-pollinated in the manner outlined above, then a number of peculiar morphological and phenological features of the plants can be explained. The female flowers, for example, are extremely fibrous (Uhl, personal communication) and are apparently unpalatable to the beetles. They are scarcely touched as the succulent male flowers become riddled by the voracious insects. Since the female flowers also produce no nectar and no pollen, and are not conspicuous in any way, they have no way of attracting insects to themselves. It seems that the male flowers must be the bait to attract the beetles to the inflorescences on which the female flowers are receptive to pol-

len. It follows then that the female flowers must open before the males on a particular inflorescence, so that the unopened males can be present as the attractant. The reversal of the order of flowering from that in most other monoecious palms can thus be directly related to the peculiar means by which *Bactris* attracts its insect pollinators.

The pollination mechanism in *Bactris* is very efficient. The female flowers need not produce any attractant of their own, and can concentrate their energy in their chief function of producing fruit. The male flowers perform a triple duty, of attracting insects to the inflorescences on which female flowers are receptive, then 24 hours later investing the same insects with a load of pollen, and finally, by falling soon from the inflorescences, forcing the insects to leave at just the right time to be attracted to a new inflorescence where they begin the cycle anew. The abundance of heavy infructescences in both *Bactris* populations attests to the success of the system.

I am indebted to the Organization for Tropical Studies and its staff for making this study possible. Thanks also are due to H. E. Moore, Jr., N. W. Uhl, and G. C. Eickwort, all of Cornell University, and C. E. Jones of California State College at Fullerton, for advice and criticism throughout the project, and to Rudolf Schmid, of the University of Michigan for his careful review of the manuscript.

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# On Building a Dream House

M. E. DARIAN D.V.M.

From earliest childhood in Philadelphia, I have enjoyed planting seeds and raising plants. Thus when it came time to select the place where I'd eventually build my dream house, the type of soil, elevation, and proximity to the sea for frost protection were all factors in selecting Vista, a small city in the foothills of northern San Diego County, California. The price of land was also favorable compared to that in Santa Barbara or La Jolla, two other sites considered.

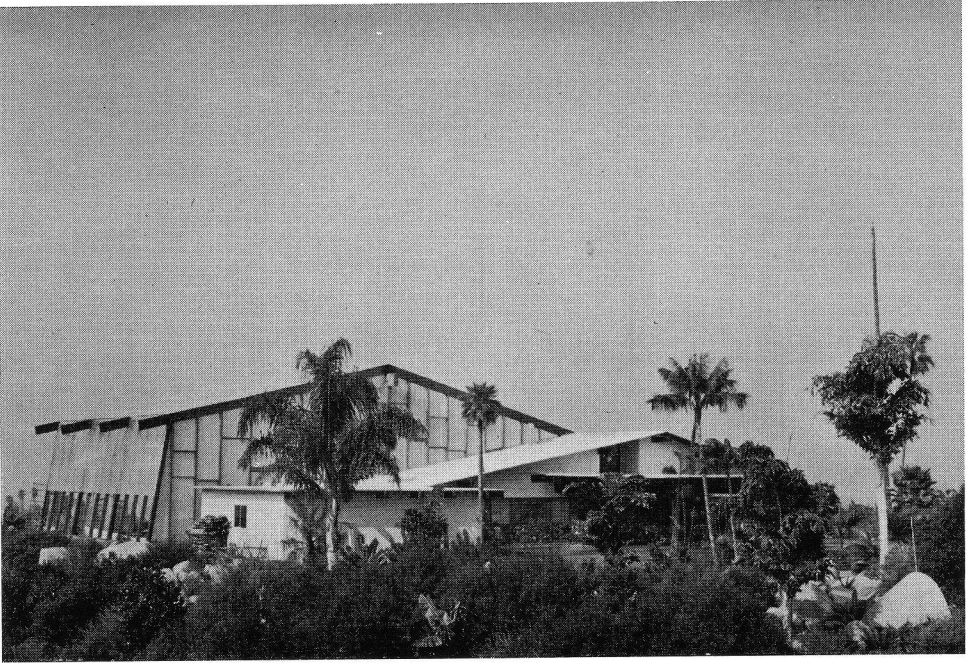
Vista is at 33° N. Latitude, comparable to the location of Charleston, South Carolina on the East Coast. The average rainfall is 12 to 13 inches per year and occurs from December to May, our coldest months. The average yearly temperature is 62° F., about 10° too cold for coconuts. I was fortunate to be able to purchase a 3.02-acre hilltop at 600 feet elevation with fine sandy soil over a solid granite base and near my Veterinary Hospital about seven miles from the Pacific Ocean. The water drainage is excellent and there are many microclimates. The usual winter low is 38° F. which has occurred only three times in three years, but in 1969 the all time low of 32° F. nearly killed *Howeia* because the weather had been unusually mild. Relative humidity ranges from a low of 15 per cent during Santana or desert winds to a high of 65 per cent though 35 to 45 per cent is usual.

The house was constructed to take full advantage of the views which on clear days extend 70 miles to sea and 65 miles inland. Three planter holes in the house provide views of the sky through skylights. The shape of the house is an attempt to reconstruct the eight feet of hill levelled off during grading. Gardens

face the North (cool with shade) and the South (hotter and drier, getting as much solar heat as possible). On the South, a swimming pool should provide extra humidity and the enclosed area around the pool I refer to as the "jungle"—even the pool decking has seven holes for future palm plantings. The "jungle room" is 18 feet high at the ends or eaves and 30 feet high in the center, measuring 48 feet wide and 84 feet long; but the pool, decking, concrete patio areas, plus a large granite outcrop leave little room for the true tropical palms I hope someday to raise there—*Cyrtostachys*, *Lodoicea*, *Pigafetta*.

Another planter hole is in the center of a circular driveway which was solid granite. After blasting twice, 156 cubic yards of rock were removed and the hole was backfilled with 70 yards of topsoil, 50 yards of stable litter, and 25 yards of chicken manure which was mixed by a special backhoe with a 20-foot reach. The hole itself was 30 feet across and up to 10 feet deep, and initially the heat from the mixture was so great that it burned our hands when we removed a 28-foot *Howeia* that was burned to death in two days. Now, however, it is a nice planter hole with beautiful plants of *Howeia* and as ground cover strawberries, tomatoes, and watermelon.

The two protected planter areas are designed as part of the house to avoid the "added on" look and they required special design to withstand winds of 90 miles per hour with a safety factor up to 135 miles for a short period. The entire expanse of roof over the house and "jungle" presents a great lift of nearly 10,000 square feet which was properly handled by the engineer.





3. Right side of entry hall destined ultimately to house a *Cyrtostachys*. Alocasias, xanthosomas, *Anthurium*, and bromeliads in front of and on wall. Photo Ken Foster.

When it came to planting palms, I was most motivated by Dent Smith's articles on the necessary preparation of holes and with rock present—many outcrops

of solid blue granite penetrate the surface—I decided after first digging a few holes to hire a backhoe at \$15.00 per hour. The operator was able to dig six

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1. Front of home built by Dr. Darian; the "jungle room" to the left and rear is covered with clear fiberglass to within seven and a half feet of the ground where replaced by plate glass. Photo Ken Foster.

2. Head-on view of house and "jungle room" (left) with howeias, cycads, *Hedyscepe* at corner of center planter. Photo Ken Foster.



4. Atrium with *Howeia Forsteriana*, Hawaiian tree-ferns, Japanese maple, and *Chrysalidocarpus Cabadae*. Photo Ken Foster.

to eight holes per hour so we dug 30 holes one morning and in one day 48 to 50 holes averaging six feet wide, broad, and deep, though some were only four feet deep and others were eight feet wide and deep. These holes were backfilled with half stable litter (one-half horse manure and one-half pine shavings) and half native soil which in most instances was a fine black humus—true topsoil!

After the first year, I decided that everything must have a pipe to it and be on a sprinkler system, but different plantings required different rates of watering so seven different valves were installed with over 7,000 feet of plastic pipe. Now the citrus are watered once or twice a month, certain palms once a week, others once a day, and in the heat of the summer, when the warmest night tempera-





5. Three planters have skylights above them like this one 14 feet above the *Pinanga*. Photo Ken Foster.

ture stays above 60° F., I water certain palms up to four times a day or equivalent to 500 inches of water a year. This watering procedure has resulted in some phenomenal growth—for example, a *Caryota urens* (a mountain type obtained from David Barry) was set out in 1965 when 20 inches high with two leaves and a stem an inch thick at the base and by late 1968 had reached a height of 22 feet and was 18 inches thick at the base. It grew an astonishing eight feet of trunk

in the last year. Most losses are due to my over-eager removal of leaf-bases prematurely, and at one time to gophers though cats now control these most satisfactorily.

One section on the shadiest side of the hill has, in addition to water bubblers to each hole, four overhead sprinklers allowing me to produce “rain” at will. This section is referred to as the tree-fern section—it experiences white hoar-frost five to ten times each winter. Here grow



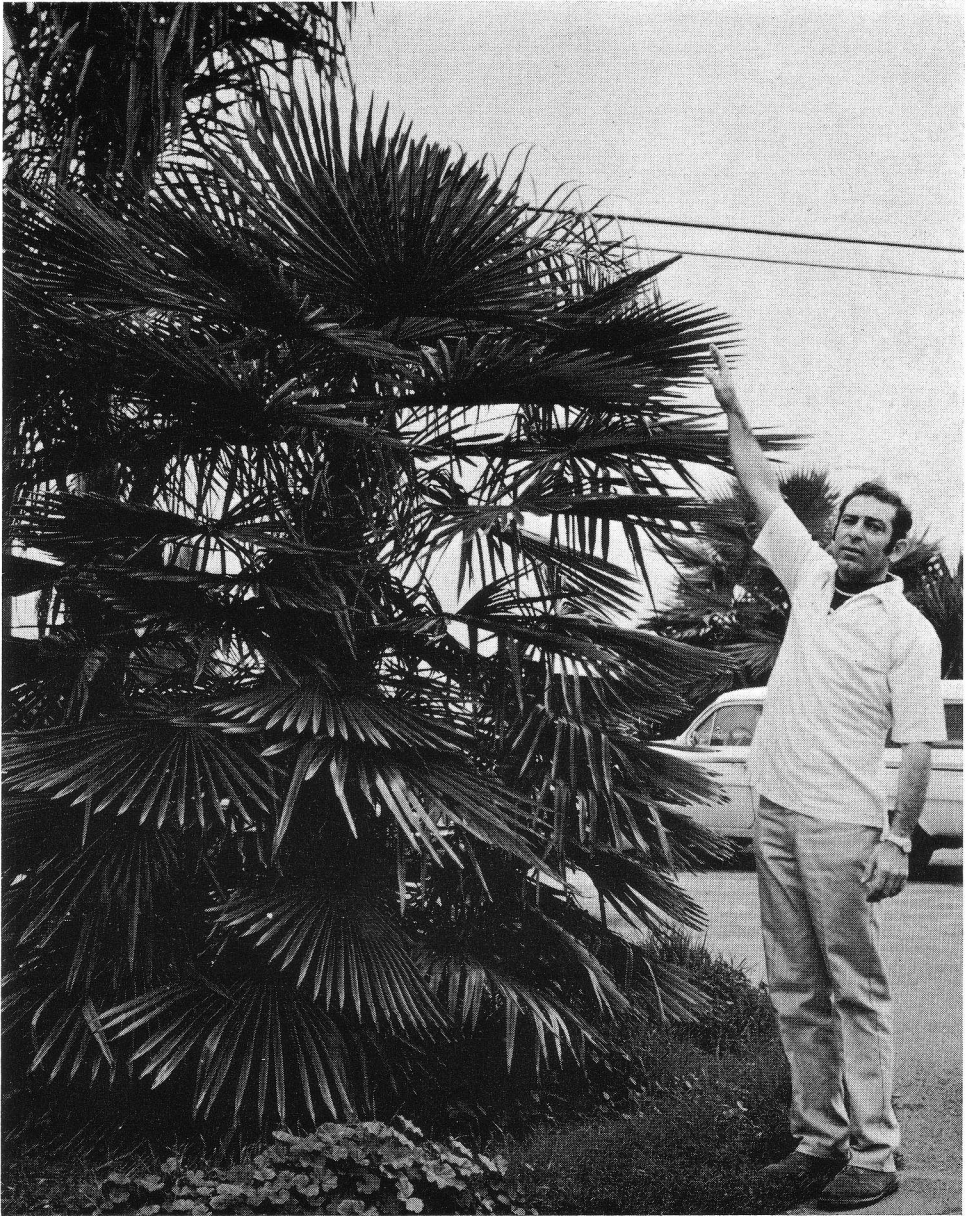
6. Rock outcrop eight feet high and 12 feet across at side of pool in "jungle room." Photo Ken Foster.

tree-ferns, *Eucalyptus*, redwoods, and *Rhopalostylis* palms.

Although palms are by far the predominant type of plant on the property, in addition to the above, *Spathodea campanulata* (African tulip tree), mangos, *Macadamia*, citrus, and deciduous fruit trees from apples to walnuts are also grown successfully. During the summer, it is usually hot, sunny, and dry, but earlier it is foggy and then the

*Rhopalostylis*, *Parajubaea*, and *Ceroxylon* grow best. On the contrary, royal palms don't start growing until July when they look their worst, looking better in December when *Ceroxylon* and the tree-ferns look their worst.

Most of the plantings were set out in 1965 and 1966 but every year new and some very rare palms for this part of the world are set out against good advice and often with subsequent failure. But it's the exceptions that count, and even



7. A *Trachycarpus Martianus* set out by the parking lot of my hospital from a one-gallon can four years earlier reaches almost nine feet in height and carries over 50 leaves. Photo Ken Foster.

if only half my expectations come true, I should have over 100 genera growing inside and outside in the ground on this hill. Unfortunately, compared to more

tropical areas, the rate of growth for more tropical plants is ridiculously slow. Almost all the work and planting were done by myself with the help of my close

personal friend Con M. Slack though advice and inspiration were provided by Jim Specht, Dent Smith, Bill Seaborn, and PRINCIPES.

Plants of great value were obtained from David Barry, the Fairchild Tropical Garden, The Palm Society, but most were obtained by writing letters. For every ten letters written I might receive one reply, and from every ten replies one new addition, but it was from such sources that *Lodoicea*, *Neodypsis Lastel-*

*liana*, *Parajubaea Torallyi*, and *Pigafetta filaris* seed were obtained. In addition, the contacts made are as interesting and rewarding as the palms so I continue to work for my palm showcase. What success I've had has been due to excellent drainage, judicious watering in cool weather, heavy frequent watering in summer, and protecting newly set-out plants against the burning sun. I hope someday to have further reports on the success of the venture.

## PALM BRIEFS

### The Case for Sprouted Palm Seeds

Peter B. Dow, a seedsman of Gisborne, New Zealand, offers palm seeds and also several species of sprouted palm seeds. I bought some sprouted seeds of his native palm, *Rhopalostylis sapida*, several years ago. They arrived in fine condition, having been placed with a little damp peat in a plastic bag enclosed in a light carton. They were ready to be planted in three inch pots. There was no apparent set-back to the sprouts. I would guess that only part of the endosperm in the seeds had been consumed at the time. The spread from the tip of the unopened leaf to the tips of the well developed roots was about two and a half inches.

The advantage of sprouted seeds to the buyer is obvious. They side-step the uncertainty of germination and the time involved. The practice of supplying sprouted seeds should become common. This would be especially important with small seeds that lose viability quickly and with seeds of palms that live in the very wet tropics, such as *Oncosperma*. Such seeds have holes from which the cotyledon may emerge that are comparatively large and with only a thin skin

over them to protect the embryo from dessication.

The main requirements for the supplier of sprouted seeds would be to protect seed beds from rats, birds, and full sun. After germination and before the endosperm in the seeds is completely consumed, the sprouts should be removed from the seed bed, washed free of soil, and placed in plastic bags with slightly damp peat or sphagnum moss. Most kinds of plastic bags, or baggies, are air-tight when sealed. A series of small holes should be made in the bags to avoid suffocation of the sprouted seeds during the time of shipment.

Sprouting seeds before shipment is not practicable with the kinds that produce cotyledonary stalks which carry the seed plumule and radicle a considerable distance from the seed before beginning the formation of the ascending leaf plumule and the descending roots. These stalks are stiff, brittle, and impossible to confine with the seeds for shipping. Examples of such palms are *Hyphaene* and *Borassus*.

About ten years ago I took a tourist launch trip to Kandahar Island in the

(Continued on page 39)



# Phoenix canariensis and Phoenix cycadifolia

HAROLD E. MOORE, JR.

*L. H. Bailey Hortorium, Cornell University, Ithaca, New York*

A century ago, species of *Phoenix* were evidently favored as indoor palms. Wilhelm Neubert, for example, wrote of them (1873) as easily cultivated, quick-growing, and hard to kill. In addition to *P. dactylifera*, he mentioned several others, among them some known by horticultural names but not described botanically, including *Phoenix canariensis* and *P. tenuis*, the last illustrated by a juvenile plant.

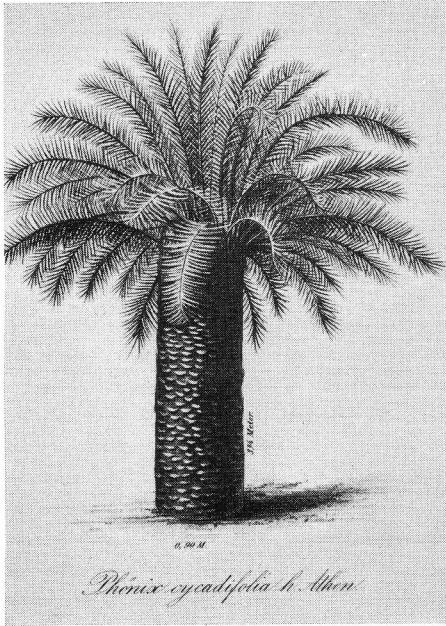
This was an early use of the name *Phoenix canariensis*, though no description accompanied it; the juvenile plant of *P. tenuis* cannot be identified. In fact, Neubert considered *P. canariensis* and *P. tenuis* to be very close to each other or identical. According to *Index Londinensis*, *Phoenix tenuis* was illustrated as early as 1863 in a Verschaffelt catalogue which I have not seen but doubtless was shown as a juvenile plant unaccompanied by an adequate description and thus not identifiable. By 1871–72, Verschaffelt was offering material listed as *P. canariensis*, *P. cycadifolia*, and *P. tenuis* in Catalogue no. 16. So far as I am aware, none of these names was validly published by botanical standards. Then in a period of a decade, three names were published in acceptable form and it remains to fix their applicability to the plants we know commonly as *Phoenix canariensis*.

First was the publication of *Phoenix cycadifolia* Hort. Athen by Eduard Regel in 1879. Second was the publication of *Phoenix canariensis* by Chabaud in 1882. Third was the elevation of

*Phoenix dactylifera* var. *Jubae* to specific rank as *Phoenix Jubae* by D. H. Christ in 1885. The first two were described from horticultural materials, the third from plants native in the Canary Islands. But the third name need concern us only if the earlier names are not validly published or are equivocal in some fashion.

The name *Phoenix cycadifolia* had been used in horticulture for some years before 1879 but it was apparently only then that any kind of description appeared, and the description was meager in the extreme, being only a statement by Regel that a plant growing at Athens and illustrated in plate 974 (reproduced here as Fig. 1) was perhaps to be interpreted as one of the many forms of *Phoenix dactylifera*; that it ran to "*Phoenix dactylifera canariensis*" (an invalid trinomial) but that the leaves were much shorter and the whole appearance of the palm was more that of an *Encephalartos* (Cycadaceae) than a date palm.

Beccari referred *Phoenix cycadifolia* to the synonymy of *Phoenix dactylifera* in his study of *Phoenix* (1890). When I prepared the entry for *Phoenix* in "An annotated checklist of cultivated palms" (1963) just before leaving for extended field work, I relied heavily on Beccari's work, for the genus has yet to be studied more intensively. However, the plant figured by Regel appeared more like *P. canariensis* than *P. dactylifera* because of its solitary trunk of large diameter and broad leaf-scars so I included the



1. The plate illustrating *Phoenix cycadifolia*, a species or hybrid or uncertain identity. Reproduced from *Gartenflora* 28: pl. 974. 1879.

name as a synonym of *P. canariensis* not realizing that it had priority by three years and should, if identical, be taken up in place of *P. canariensis*. The awkwardness of this situation has since become apparent to me, hence I have made a special effort to review all the evidence and, thanks to the kindness of Dr. Eleonora Francini Corti, Director of the Istituto Botanico, Firenze, Italy, have been favored with a reproduction of pertinent pages in the rare journal in which *Phoenix canariensis* was described.

There can be no doubt but that *Phoenix canariensis* was properly described and illustrated. The plants that served as the basis for Chabaud's description had been grown from seed sent to Hyeres, France, from Orotava in the Canary Islands. The description was elaborate, including details of inflorescence, flowers, and fruit, the latter and a seed illustrated. Though Chabaud indicated in the

horticultural text that he thought *Phoenix canariensis* was more likely a variety of *P. sylvestris*, he definitely accepted it at the specific level. He moreover noted that hybrids had already been produced naturally and artificially and that there were *canariensis*-like forms in horticulture and with horticultural names such as *P. tenuis*, *P. canariensis macrocarpa*, *P. canariensis erecta*, *P. canariensis tenuis*, and *P. cycadifolia*. Following Chabaud's article, Naudin used the name *P. canariensis* in 1885, and a colored plate with details of fruit was published by André in 1888. A detailed description was given by Beccari in 1890 as part of his monographic study of *Phoenix* and Chabaud provides a good account with historical notes in his book on palms (1915).

*Phoenix canariensis* is a firmly founded, long established name for a species of prime horticultural importance. If it were clear that *Phoenix cycadifolia* Hort. Athen ex E. Regel were identical with *P. canariensis* it would be necessary to take it up, and at one time I was nearly convinced myself. The possibility that it may represent a plant of hybrid origin, the fact that the description is inadequate botanically, and the stylized nature of the plate which raises questions as to identity all lead me to preserve the *status quo* by listing *Phoenix cycadifolia* in the synonymy of *P. canariensis* with a query. Anyone who can convince himself that the name has unequivocal status is free to take up the name but I am unwilling to do so. Thus the entries for *Phoenix canariensis* and *P. cycadifolia* in *Principes* 7: 156-157 should be corrected to read:

**P. canariensis** Hortorum ex Chabaud, La Provence Agricole et Horticole Illustrée 19: 293, fig. 66-68. 1882. Canary Islands.

? *P. cycadifolia* Hort. Athen. ex E. Regel, *Gartenflora* 28: 131, *pl.* 974, 1879, *nomen subnudum*.

*P. dactylifera* var. *Jubae*, Webb & Berthelot, *Hist. Nat. Canar.* 3(2), *Phyt. Canar.* 3: 289. 1847.

*P. Jubae* (Webb & Berthelot) D. H. Christ, *Bot. Jahrb.* 6: 469. 1885; 9: 170. 1888.

*P. cycadifolia*: ? *P. canariensis*

There are some additional names that may belong with *P. canariensis* but so far as I have been able to ascertain these are all *nomina nuda* (naked names) lacking descriptions hence not validly published and when figured by juvenile plants not identifiable. They are *P. tenuis* Hort. Verschaffelt, *Catalogue* 1863: 13 *cum ic.*, 1863 and ex Neubert, *Deutsches Magazin für Garten und Blumenkunde* 26: 203, *fig.* 204, 1873; *P. Vigieri* Hort. ex Naudin, *Revue Horticole* 57: 541, 1885; *P. dactylifera* var.

*canariensis* Hort. ex E. Regel, *Gartenflora* 28: 131, 1879 and ex Drude, *Gartenzeitung* (Berlin) 1: 182, *fig.* 42, 1882.

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## ADDENDUM

### Bactris Pollinators

Since completing the manuscript for the article appearing on pages 20-24 (Observations on Pollination in *Bactris*), I have received the following identifications for insects collected on *Bactris* flowers:

Curculionidae: *Phyllotrox megalops* Champion and ?*Grasidius longimanus* Champion (both determined by Anne T. Howden, Entomology Research Institute, Canada Department of Agriculture).

Nitidulidae: *Mystrops heterocera* Sharp and *Mystrops* sp. (both deter-

mined by W. A. Connell, Department of Entomology and Applied Ecology, University of Delaware).

The above insects are believed responsible for pollination in two species of *Bactris*, as discussed in the article. Specimens are now deposited at the collection of the Department of Entomology and Limnology, Cornell University. Once again thanks are due to George Eickwort for sending the specimens out for identification, and to the authorities cited above for their cooperation.

FRED ESSIG

## NEWS OF THE SOCIETY

### Members

At the Biennial Meeting held last August 1st at Melbourne, Florida, the secretary reported that the Society had the largest number of members in its history: 520. Since that date the Society has received 39 new members, an average of almost two per week. While this is most encouraging, 46 members did not renew their membership in 1970. Some of them are members of long standing, and we are hoping that they still will send in their dues and be reinstated.

The Society's costs are rising, so we must make every effort to compensate for the loss of 46 members as well as increasing the membership to ever higher levels. Please continue to invite your palm-loving friends and acquaintances to join.

### Fiscal Year

Until now, the Society's fiscal year has been from May 1 to April 30. This has caused some confusion, and extra effort for our bookkeeper and accountant, as separate reports had to be prepared for the Bureau of Internal Revenue and for the Society. Our new officers have decided to make our fiscal year correspond to the calendar year, thus simplifying the bookkeeping. Our President will make arrangements to adjust the dues for those who have already paid up to May 1, 1971. All new memberships are being dated as of January 1, 1971.

### Seed Bank

The Seed Bank has been very active during the past year. Many thousands of seeds have been received and distributed to those members who have requested them. Among them there have been quite a few species new to us, com-

ing from Australia, the Solomon Islands, Thailand, etc. These have been sent to the members who have asked for "any rare seeds." There are 37 names on the "rare seed" list. Any member who wishes to grow these rarities may ask for them, on condition that prompt reimbursement is made.

Due to rising costs, it has been necessary to raise the reimbursements from 50¢ to \$1.00. Most of the members who have expressed an opinion think that even at this price, the seeds are a bargain.

Besides the Fairchild Tropical Garden, which is our chief source of seeds, we wish to extend our heartiest gratitude to the following members who have so generously contributed seeds: Alix Landscape Decor, Mr. D. L. Anderson, Dr. W. T. Bailey, Jr., Mr. William Bates, Mr. James Benzie, Mr. W. L. Bidlingmayer, Mr. Fred Boutin, Mrs. June Bremerman, Mrs. T. C. Buhler, Mr. Donn Carlsmith, Mr. D. I. Carroll, Mrs. Gertrude Cole, Mr. H. F. Cooper, Mr. John Criswick, Dr. I. C. Daly, Dr. M. E. Darian, Mr. G. F. C. Dennis, Mrs. Lillian Ehsanullah, Mr. J. A. Goodloe, The Honolulu Botanical Garden, The Instituto Agronomico of Campinas, Brasil, Mr. and Mrs. A. R. Jennings, Mrs. W. J. Krome, Mr. and Mrs. A. C. Langlois, Mr. Guy Lionnet, Mr. R. N. Lyall, Mr. W. D. Manley, Mrs. A. C. Margraff, Mr. M. F. Miller, Mr. R. M. Montgomery, Dr. H. E. Moore, Jr. and the Bailey Hortorium, Mr. Walter Murray, Mr. D. A. Pritchard, Mr. Dent Smith, Capt. Ura Snidvongs, Mr. J. P. Specht, Cmdr. W. Sumawong, Mr. J. E. Turner, The U. S. Plant Introduction Station, Miami, Fla., Mr. R. G. Wilson, Mr. J. J. Wright, Mr. M. Yamakawa, and Dr. U. A. Young. If I have inadvertently left anyone out, please accept my gratitude and humblest apologies.



I also wish to thank Mrs. Ruth Shatz and Mr. Robert Norris, who have accompanied me on early morning collecting trips and helped clean seeds.

### Two Corrections

Will those who received seeds of *Nephrosperma* and/or *Phoenicophorium*

from the Seychelles, please transpose these names, as the labels were transposed and the seeds were sent under the opposite name. Please excuse! Also, Dr. I. C. Daly writes that the seeds he sent labeled *Livistona Drudei* were later identified as *L. decipiens*, so please correct.

LUCITA H. WAIT

## CLASSIFIED SECTION

Will sell to the highest bidder:

I. Complete set of L. H. Bailey's and H. E. Moore's palm papers in *Gentes Herbarum* (Cornell University). 31 papers.

II. Complete set of *Principes*, including the 5 mimeographed Bulletins that preceded *Principes*.

III. *Cultivated Palms*, 1 bound, 1 unbound. 1961 special issue American Horticultural Magazine.

IV. *Index of American Palms* (bound). B. E. Dahlgren, Field Museum of Nat. Hist., bot. series. 1936.

V. *The Major Kinds of Palms* (unbound). Alex D. Hawkes. Bot. Papers Fairchild Tropical Garden. 1950, 86 pp.

VI. *A new palm from Cocos Island collected on the Presidential Cruise of 1938*. O. F. Cook. Smithsonian Misc. Coll. vol. 98, pp. 1-26, 26 plates, 1939.

VII. Papers by Hermano Leon:

Contribución al estudio de las palmas de Cuba. Revista de la Sociedad Geografica de Cuba, año 4, no. 2, 1931, 28 pp.

*Following published in Memorias de la Sociedad de Hist. Nat.:*

Contribución al estudio de las palmas de Cuba—Genero *Copernicia* II. 1936, 24 pp. & 4 plates

Contribución al estudio de las palmas de Cuba—Genero *Coccothrinax*. 1939, 50 pp. & 13 plates

Contribution à l'étude des palmiers de Cuba—Nouveautés dans les palmiers royaux de Cuba oriental. 1943, 14 pp. & 2 plates.

VIII. Papers in Journal of New York Bot. Garden. John K. Small.

The buccaneer palm. 1922, 12 pp.

The saw-cabbage palm. 1922, 11 pp.

The blue-stem—*Sabal minor*. 1922, 9 pp.

The silver palm—*Coccothrinax argentea*. 1924, 7 pp.

The scrub-palmetto—*Sabal Etonia*. 1925, 7 pp.

The James palmetto—*Sabal Jamesiana*. 1927, 5 pp.

The royal palm—*Roystonea regia*. 1928, 9 pp.

IX. *Papers in Science*. O. F. Cook

A second household palm, *Omanthe costaricana*. 1939, 4 pp.

Juvenile characters of royal palms. 1935, 2 pp.

Royal palms in upper Florida. 1936, 4 pp.

An endemic palm on Cocos Island near Panama mistaken for the coconut palm. 1940, 4 pp.

Hurricane palms in Florida, including a new genus, *Simpsonia*. 1937, 4 pp.

X. *Papers in Notizblatt des Bot. Gard. u. Mus. Berlin-Dahlem.* (In German). M. Burret.

Die palmengattungen *Oenocarpus* Mart. und *Jessenia* Karst. 1928, 51 pp.

Die palmengattungen *Orbignya*, *Attalea*, *Scheelea* und *Maximiliana*. 1929, 51 pp.

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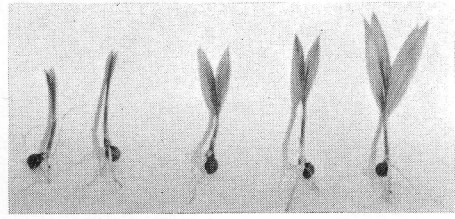
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## The Case for Sprouted Palm Seeds

(Continued from page 32)

Zambezi River several miles above Victoria Falls. There were two kinds of palms lining the river banks—clumps of *Phoenix reclinata* and tall *Borassus*. I had been told that elephants were exceedingly fond of the large seeds of *Borassus* and would come over to the island for them. I was not told how they got there, but it was evident that they had, as the only *Borassus* seeds to be found were those that had been trampled on. They had been pressed level with the soft, moist earth and the elephants could not pick them up. I dug up about a dozen with the blade of a pocket knife and took them back to my hotel room and placed them in a plastic bag. The next morning I saw that each seed had begun to extrude its large cotyledonary stalk. The extension was rapid and within two days it was certain that the seeds could not be shipped because of the increasing length of the stalks. Apparently, the stimulation of the seeds by aeration after their excavation from the wet, dense soil had induced immediate germination. Incidentally, the



1. Seedlings of *Geonoma Schottiana* sprouted and ready for shipment. Photo by David Barry, Jr.

importance of aeration as a factor in the germination of palm seeds is a story that awaits the telling.

Before the airplane, I sent and received palm seeds that were enclosed in tins with slightly damp peat or coir. These shipments usually took weeks. Occasionally I would be pleasantly surprised to receive seeds that had sprouted en route. The heat from the engine rooms of the steamers had probably stimulated the sproutings. Under the conditions of today I would much prefer not to be surprised but to expect to receive seeds that had been nicely sprouted by an enterprising supplier.

DAVID BARRY, JR.  
Los Angeles

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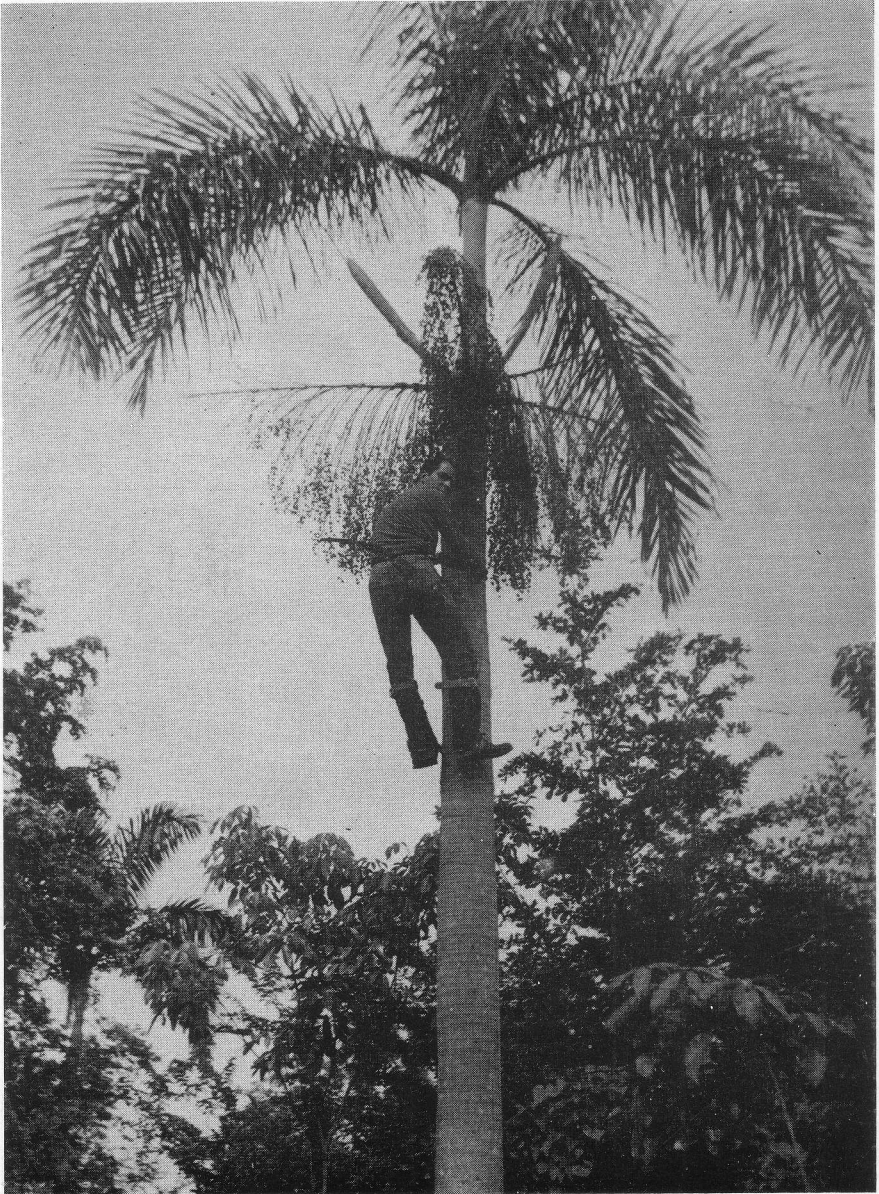
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I certify that the statements made by me above are correct and complete. Signed, Mrs. Lucita H. Wait, Executive Secretary.

## Photo Gallery . . .



Dr. R. W. Read climbs *Roystonea princeps* near Negril, Jamaica.