PRINCIPES

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Contents for April

Cover Picture

Pseudophoenix Lediniana R. W. Read, growing in the type locality in southwestern Haiti. This is the plant from which the type specimen was made. See also page 77.

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Ramifying and Twisting Stems of Palmyra Palm (Borassus flabellifer)

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Palms are not always single-stemmed. In very many species, the underground or sub-aerial stem produces numerous shoots, and such palms bearing clusters of shoots at the stem base are known as soboliferous or clustering palms. Ridley (55) was of the opinion that the majority of palms are branched in this manner and that palms with one axis are in the minority. Branches are produced as a regular feature in a few genera such as *Hyphaene*, *Nannorrhops*, *Chamaedorea*, *Vonitra* and *Nypa* (65) but otherwise only as freaks in other species. Blatter (6) mentioned that exceptional branching occurs in ten species.

A photograph of a two-headed *Roystonea* was illustrated by Seibert (58). Cremata (13) recorded another instance of branching in the royal palm. I have seen an impressive photograph of a three-branched *Roystonea regia* which Prof. S. G. Saakov of Leningrad took in Cuba. A branched *Coccothrinax argentata* was illustrated by Smiley (60). A specimen of *Livistona chinensis* with two heads had been recorded by Hertrich (37). Recently I photographed a three-crowned *Livistona chinensis* growing at the premises of the Cathedral at Singapore. Hodge (38) reported a two-headed *Sabal Palmetto* and another gracefully branching *Sabal* which has a captivating look against one of the new buildings on the Florida State University campus at Tallahassee. McCurrach (45) published a photograph of a *Sabal Palmetto* from Florida developing four heads some distance up the stem. Burkill (10) reported on branching in *Arenga pinnata*. The *Oncosperma fasciculatum* clumps at the Botanical Garden, Bogor, Indonesia, show aerial branching at various heights. Also there are two *Arecastrum Romanzoffianum* palms at the Agricultural Research Station, Bogor, which show aerial branching. The mode of branching in the above-mentioned two species reminded me of the type we see in *Hyphaene thebaica*.

A number of reports on aerial branching in *Cocos nucifera* have been made over a long period (2, 9, 12, 15, 17, 20, 25, 26, 27, 34, 36, 39, 41, 46, 48, 53, 54, 55, 66, 67). Since the coconut is normally a single-stemmed tree, abnormal suckering is very rare but has been recorded by Patel (52), Davis (19, 28), Aiyadurai et al (1), Chatterjee (11), Michael and Verghese (47).

In the African oil palm (*Elaeis guineensis*), a very few instances of aerial branching have been recorded (22, 51). There is one more branching oil palm not far from Kuala Lumpur, Malaysia. In *Phoenix sylvestris*, a single-stemmed palm, a few instances of aerial branching have been recorded (5, 7, 17, 18, 25, 33, 43). *Phoenix dactylifera* normally produces suckers but Martius (44) illustrates a specimen of *P. dactylifera* with a short side branch midway between the base and the summit. Evans (32) recorded a rare seven-branched *Phoenix Roebelenii*. All the shoots originated from the same point well above ground level. A number of cases of aerial branching as well as suckering have

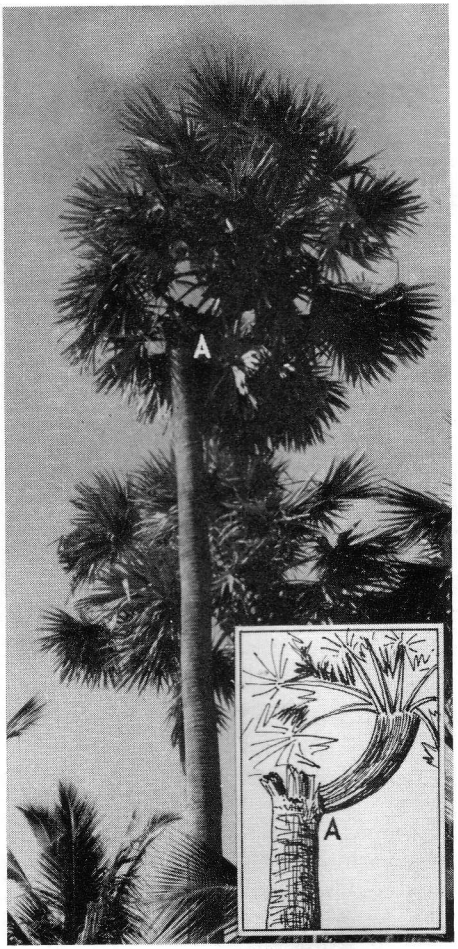
1. The branching *Borassus flabellifer* on the left at present has only one of three shoots.

been recorded in the areca palm (*Areca Catechu*) (2, 24, 25, 36, 42, 49, 50, 59, 64).

In the palmyra palm, *Borassus flabellifer*, a few instances of aerial branching have been recorded (14, 25, 61). A number of branching palmyra palms, mostly from Madras State (India), are described in the following pages. In addition, two instances are recorded where the otherwise sturdy and erect stem showed spiralling and unusual bending.

Ramifying stems

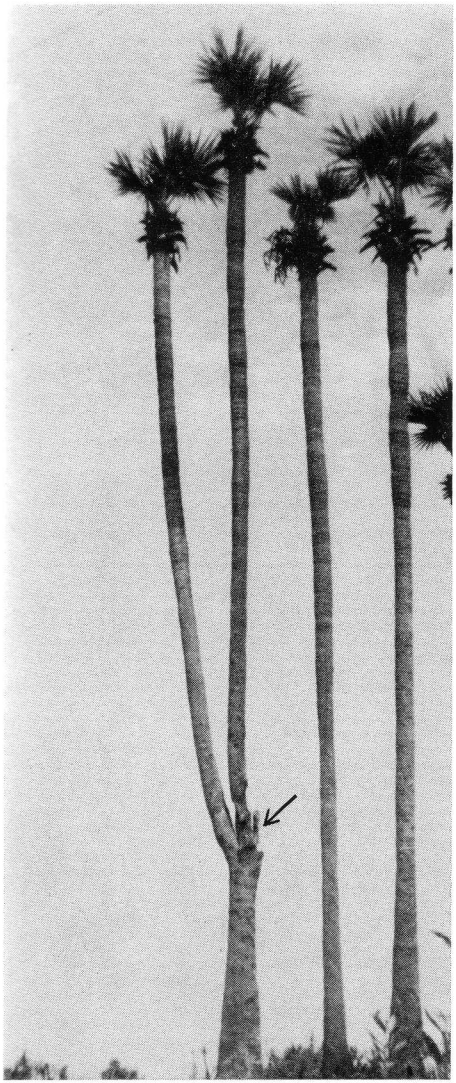
Figure 1 shows a branching palmyra palm (extreme left) with only one of the original three branches. Remnants of the other two shoots which withered many years ago may be seen at the branch junction (arrow). The surviving



2. A female palmyra having only one of its many branches remaining—the insert details the branching junction.

branch shows a very narrow base which obviously was the result of congestion and slower growth of the shoot owing to competition between the three original branches. This palm and many of those illustrated below are still in existence in Madras, Kerala and Andhra States of India.

The surviving shoot in Fig. 1 is the central one but the single shoot still attached to the stem of the palm in Fig. 2 is lateral. The exact number of shoots



3. The palm on the left has only two surviving shoots.

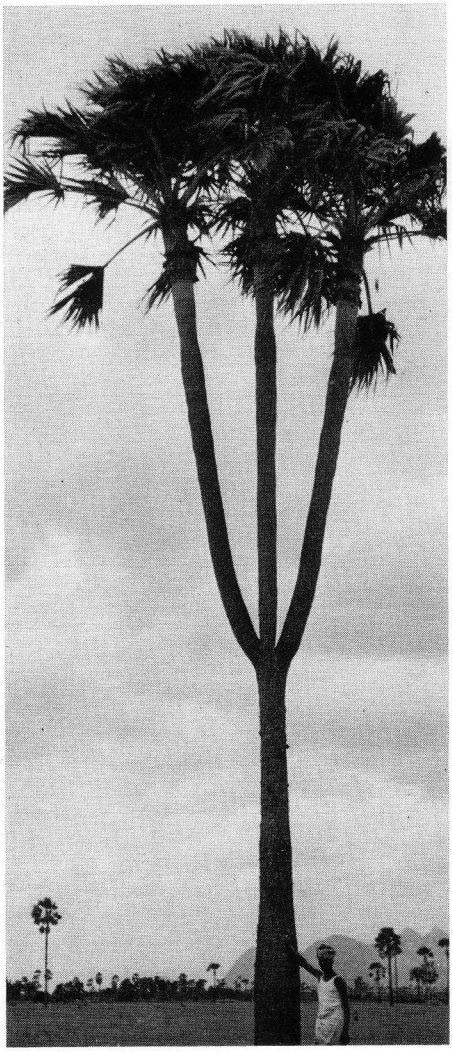
the palm originally had is not known but it may have been seven. Six of them were reported to have been lost in a cyclone. The palm is female and the surviving shoot bears plenty of fruit. Professional climbers without any fear reach the surviving crown to collect tender fruits for the edible jelly-like endosperm.

4. A closer view of the branching junction of a palmyra palm.

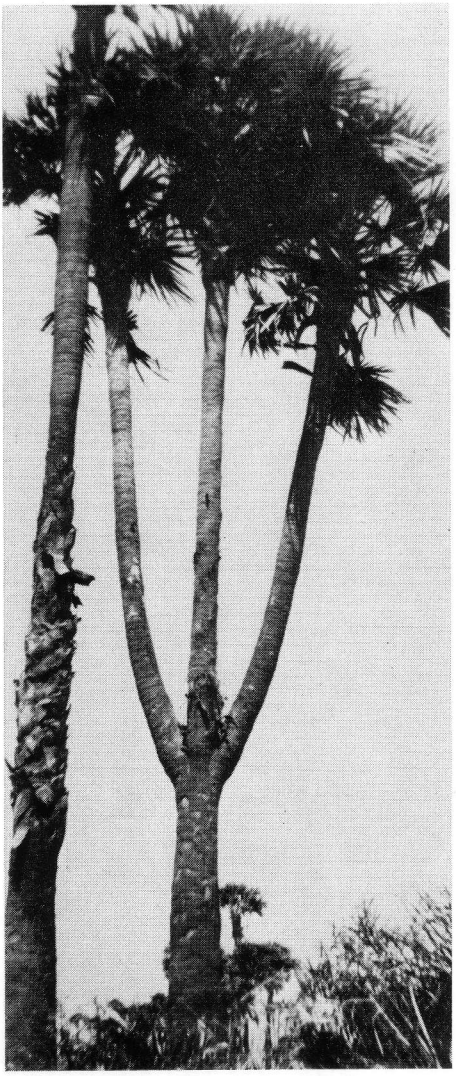
The branching palm in Fig. 3 undoubtedly had at one time more than two shoots as indicated by the scar and the remnants of trunks at the branch junction (arrow).

Figure 4 shows the base of a ramifying palmyra, branching about five feet from the ground. The three shoots are all over 25 feet high. The middle shoot appears to be the continuation of the main stem, and the lateral ones may be offshoots from successively developed axillary buds.

Figure 5 depicts another three-stemmed palmyra from Madras State. All the three shoots are in one plane. Many



5. A palmyra palm having three shoots.



6. A palm with three shoots. Note the tendency to fasciation at the junction.

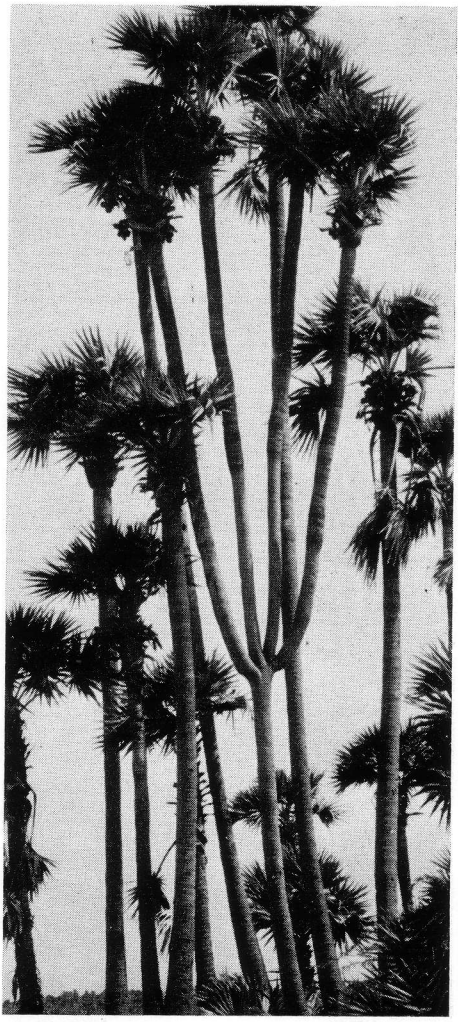
of the other palms illustrated conform to this principle, although in a few, the branches develop in various directions.

Figure 6 is of another three-crowned *Borassus flabellifer*. The middle shoot appears to be the continuation of the original stem as in Figs. 4 and 5. The lateral branches have caught up with the growth of the middle one, but there is no evidence of further branching. The branch junction is slightly fasciated.

In Fig. 7, a branching palm has three shoots surviving although at least three additional shoots had originally developed from the same branch junction. The surviving branches of this female palm are almost of the same height.

In the next four figures (8–11), four palms (all from Madras) are illustrated, each having four distinct shoots. The

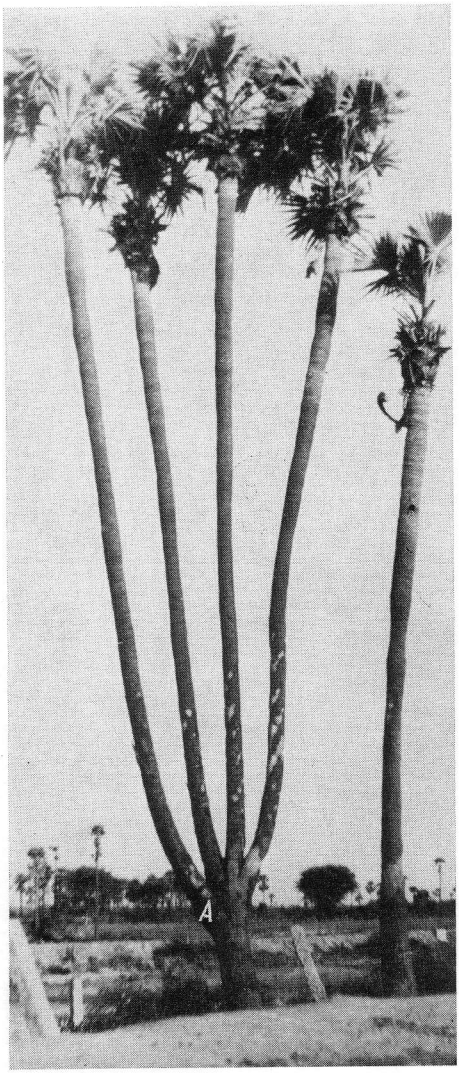
7. A branching palm with three surviving shoots.



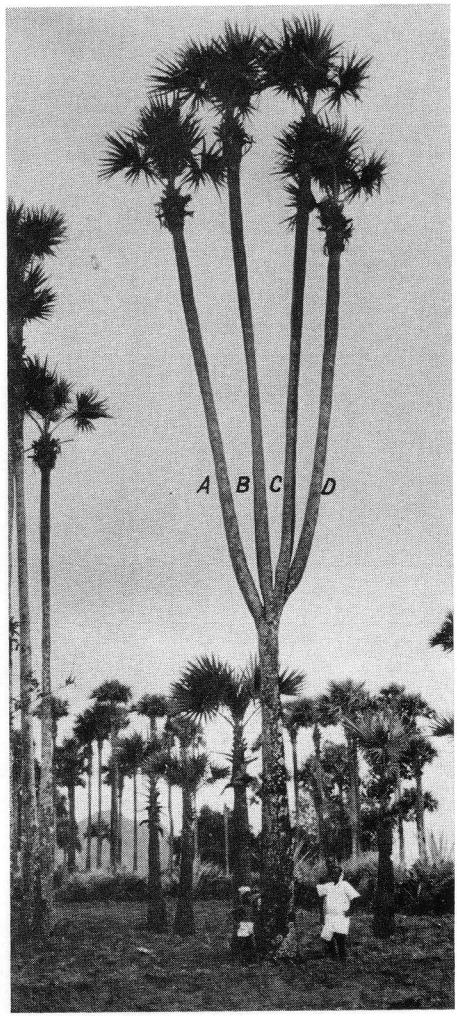
8. A palm having four massive branches.

female palm in Fig. 8 is about 60 years old and about 60 feet high. Branching took place when it was half its present height. It may be noted that all the branches start from almost the same level, and there is no visible mechanical injury anywhere on the stem. The palm was photographed near Madurai. The photographs of palms in Figs. 7, 9, 11, 12, and 16 were kindly supplied by Mr. Alagu Arumugam of Karaikudi, Madras State.

The branching in the palm in Fig. 9 occurred very early and the four shoots developed gigantically, each resembling a normal palm. The attachment of the shoots to the main stem is obviously firm enough to support the enormous weight of the tall branches and to withstand the stress induced by strong winds. The branches do not originate from a common junction and shoot A was pro-



9. Two-stage branching in *Borassus flabelliffer.*

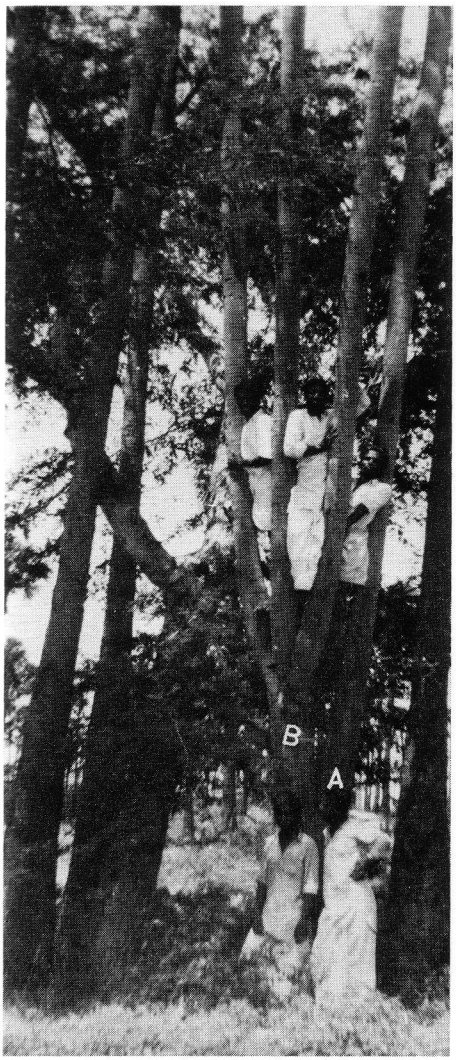


10. Another four-crowned palmyra showing two-stage branching.

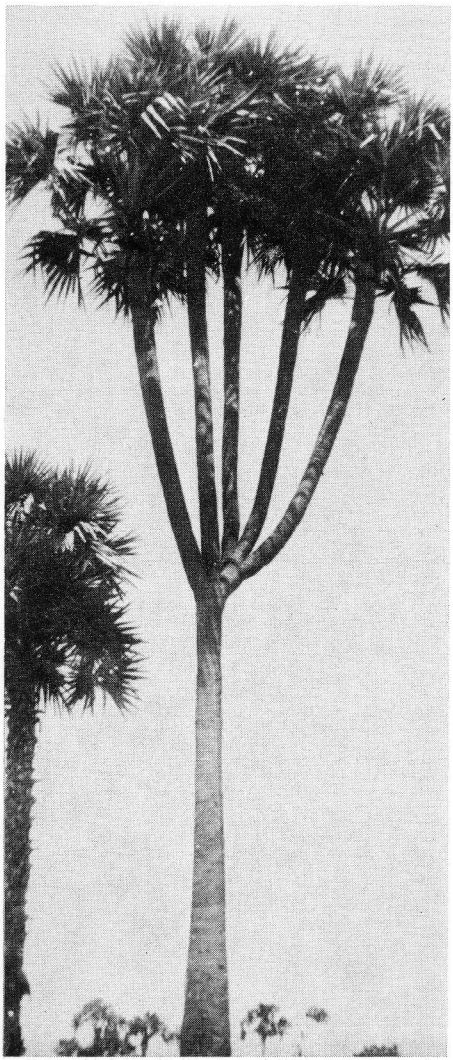
duced at least three years before the remaining three shoots.

In Fig. 10, branching originated about 20 feet from the ground and the branches extend in the same plane. The two inner branches (B and C) are taller than the peripheral ones (A and D). It is clear from the picture that the stem "divided" into two, and one of the branches, after producing a trunk two feet long "divided" again into two. Two of these shoots have a left-handed and the rest a right-handed foliar spiral. The palm is growing at a place about 12 miles from Cape Comorin, the southern end of India.

The palm in Fig. 11 is another clear case of repeated branching. Initial branching began rather early, from the head-level of the youngsters leaning on



11. A further instance of a palm having four tall branches.

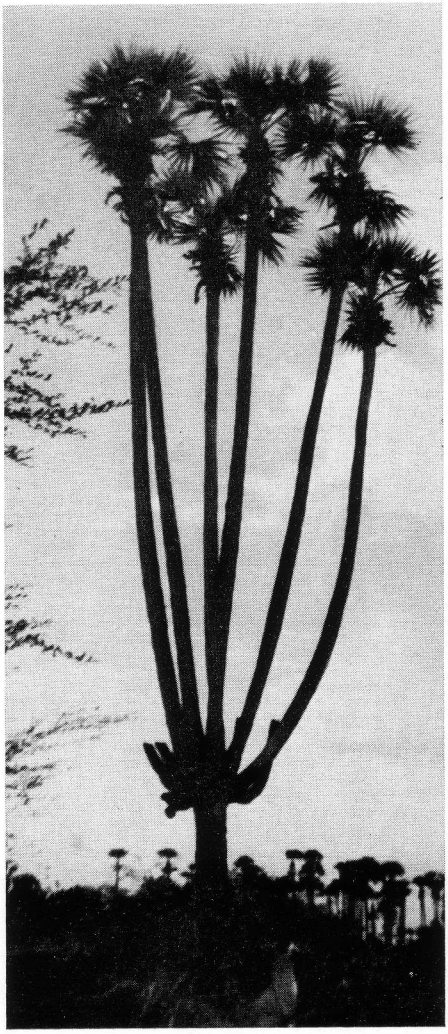


12. A palmyra palm with five branches along a common plane.

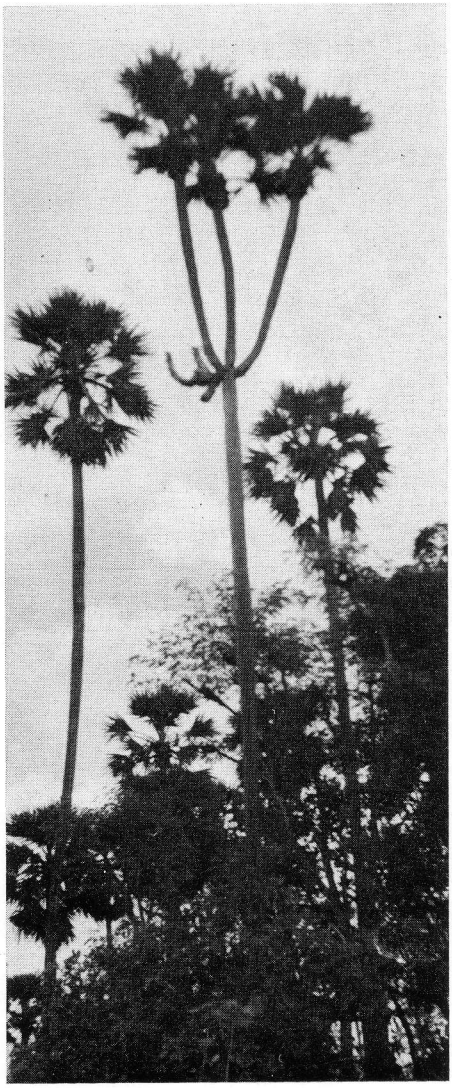
the stem at A. The shoot on the left (B) developed three branches after growing another four feet. Three youngsters are squeezed between the four shoots.

Figure 12 shows a palm having five distinct branches, all in one plane. The branches are almost the same length and seem to have developed from two adjacent levels. I have not seen this palm, and its sex cannot be made out from the picture.

The female palm in Fig. 13 has six tall branches, each with a normal-sized crown. In addition, at least six withered shoots are seen at the common level of branching about 10 feet from the ground. The branches are spread more



13. Branching in this palm started very early. Only six shoots have crowns.

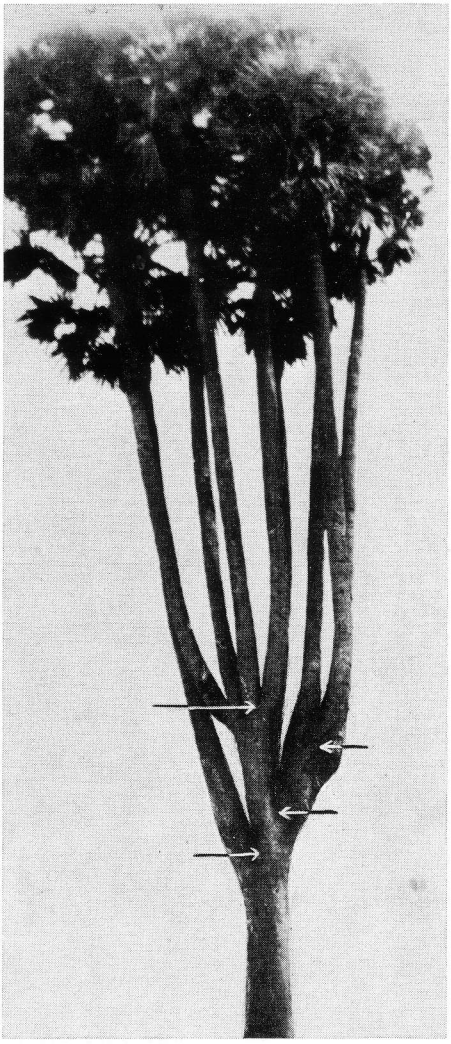


14. The stem of this palm emitted lateral shoots at a height of about 50 feet.

or less in a single plane. Figure 14 shows another palm with seven shoots of which only three have retained living crowns. It is a female palm about 80 year old.

The palm in Fig. 15 has eight branches which developed at different heights and therefore at different intervals. The stem "divided" about 12 feet from the ground. The shoot on the right (A) developed three shoots in one plane after growing for about three feet. The shoot on the extreme right (C), after producing a foot-long trunk, flattened somewhat and transformed into three shoots. Of these, the central one (F), after producing a four-foot trunk, "divided" into two. One branch (H) repeated the phenomenon after producing a trunk about two feet long. Apparently there

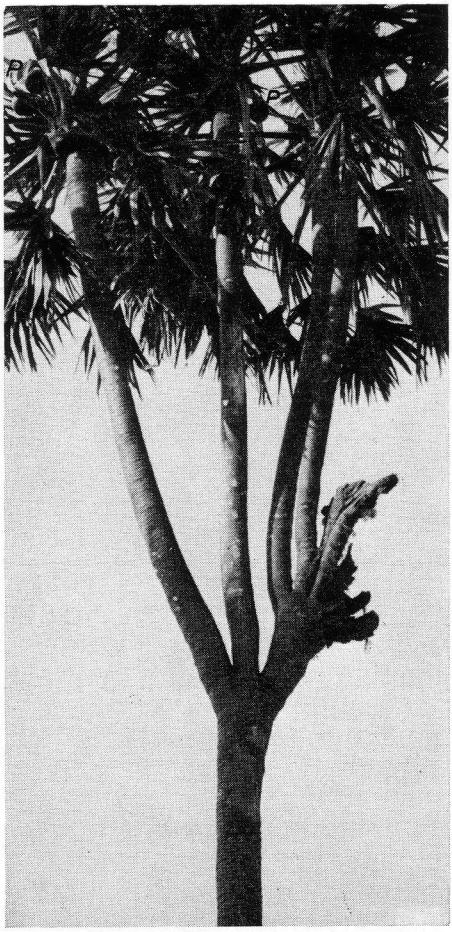
15. An instance of "uniparous" mode of branching in a palmyra palm.



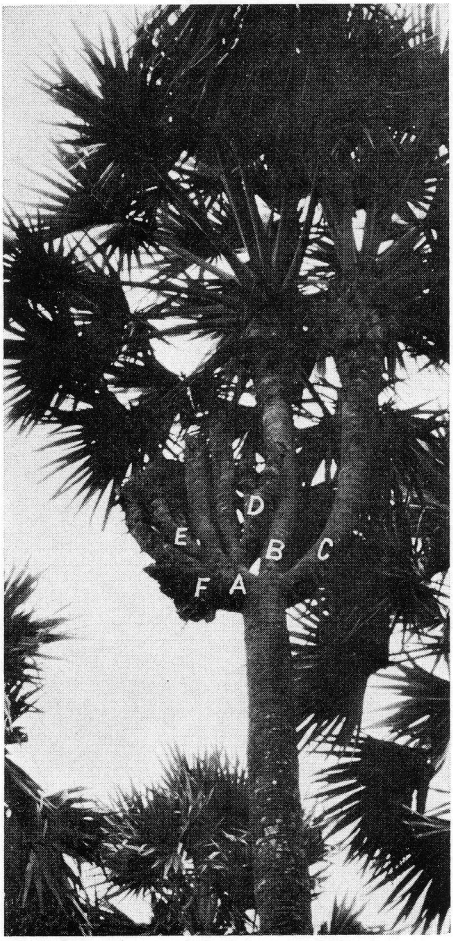
16. A palm bearing nine shoots with crowns intact.

is no mechanical injury to the stem which could be regarded as responsible for the multi-stage branching.

The palms in Figs. 16 and 17 have nine shoots each. Both show clear repeated branching. In Fig. 16, all the nine shoots are intact but they do not lie in one plane. There are at least four branch junctions (indicated by arrows). The palm in Fig. 17 has only four shoots with intact crowns, the remaining five having withered away. The palm is female and the inflorescences of all the branches are successfully tapped for the sugary sap which is either drunk fresh as a cooling beverage or boiled down into jaggery. Sometimes it is fermented and consumed as an intoxicating drink. The spherical bodies in two crowns (P) which resemble fruits are only mud pots for the collection of sap.



17. A female palmyra with nine branches, five of which have lost their crowns.



18. A palm with a fasciating primary branch.

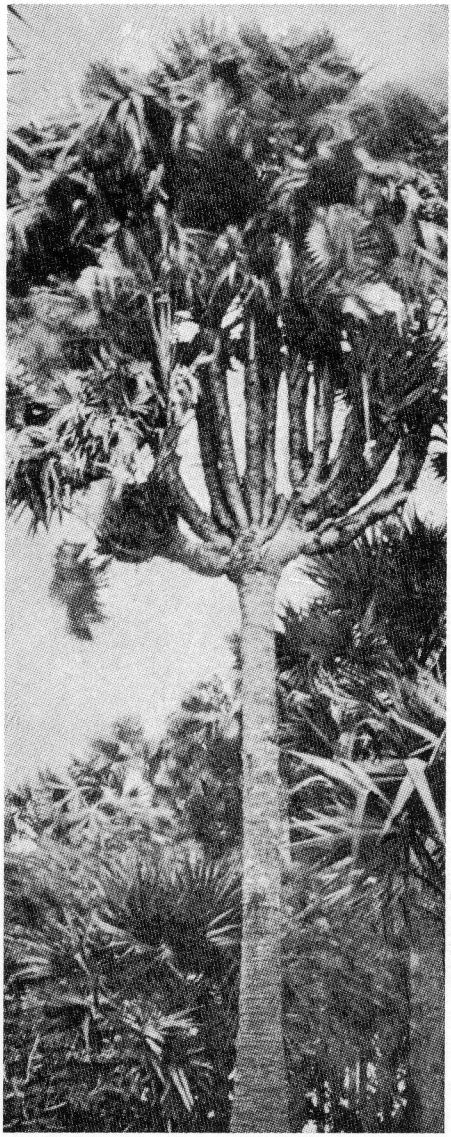
Figure 18 shows another palmyra palm whose stem at a height of about 18 feet developed three shoots; one of them (A) subsequently became fasciated and produced eight shoots. Three of these secondary branches (D, E and F) rebranched. As is clear from the picture, all the shoots grow in one plane. When I photographed this palm in June, 1965, only two shoots had crowns, but five years earlier at least two more shoots had crowns. The palm is surrounded by a group of normal palmyras which make it difficult to photograph the abnormal palm from other angles.

Figure 19 shows another palmyra palm with a fasciated stem. I could not count the actual number of branches the tree produced since those deprived of their crowns were very compact and short. Portions of shoots bearing further orders of branching were also missing at the time of photographing in 1958. The local people call this palm the "hundred-headed palmyra"—a degree of exaggeration is understandable. But this freak tree is regarded with ill-omen as

19. The "hundred-headed" palmyra.

branching is supposed to have been induced by the act of a demon.

The palm in Fig. 20 is perhaps the first branched palmyra I ever saw, some forty years ago. Unfortunately this no longer exists but it used to be an important landmark along the coastal (west) road about 15 miles from Cape Comorin. The branches totalled 28 and all of them grew in one vertical plane. Branching had been at different intervals of time and in different positions. It was reported that the branching was



20. A 28-headed palmyra showing multi-stage repeat-branching.

the result of a lightning strike. It may be difficult to accept this explanation in view of the repeated nature of the branching.

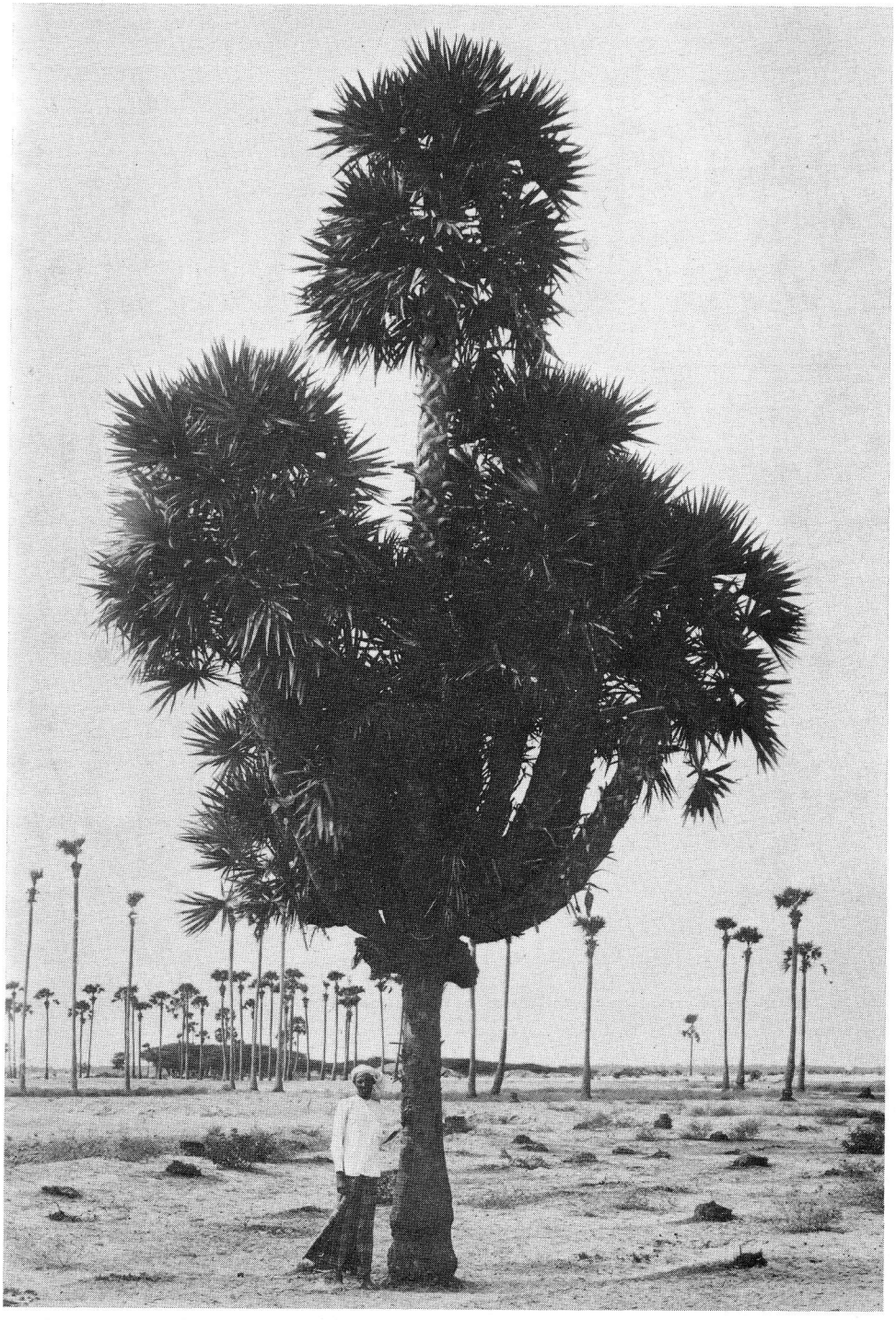
Figures 21–23 represent a slightly different type of branching. All of them have several branches at different levels.

21. A palm with very irregular type of branching.

The branches are arranged irregularly in many planes. Figure 21 is of a palm from Kerala State which has retained only about two-thirds the original number of shoots, the rest having fallen away during a cyclone in 1955. I saw this palm first in 1953 when it looked like a crowded *Pandanus* clump but details of its branching could not be photographed. The branching is rather complicated. At first division, there were three branches, the larger one with many second- and third-order branches having fallen. The scar of this shoot is indicated by the arrow in the picture. The shoot on the left (B) divided into three soon after, of which two have lost their crowns (D & E). The third branch grows as a single stem for a height of about seven feet at the end of which it produced four branches, two retaining crowns. The other two after a while had produced three and four shoots each, but all these third-order branches lost their growing points. The first-order branch on the right (C) produced four shoots (F, G, H, I) but only F still has a crown. Of the remaining three which have lost their crowns, one (I), after growing to a height of about two feet, produced three shoots (J, K, L) of which L, after producing a five-foot stem, branched into three. All these third- and fourth-order shoots lost their crowns. As a whole, the tree now has 19 branches with and without crowns.

Figure 22 has been kindly supplied by the Director, Government Museum, Madras, and shows a *Borassus* with numerous branches. I am unable to give more details than those evident in the picture.

Figure 23 was originally published in a Telegu weekly (*Sachithrawar Pathrika*) of March 17, 1965, and I am indebted to the editor for supplying the picture. It is a unique tree with irregular branching. One main branch (marked X) with its many subsequent branches, is missing. Many branches appear to have developed axillary buds. If this palm is imagined to have been buried in the soil almost as far as the base of the small shoots bearing the crowns, production of the branches (suckers) may be regarded as simulating that in many soboliferous palms as for example, *Chrysalidocarpus lutescens*.



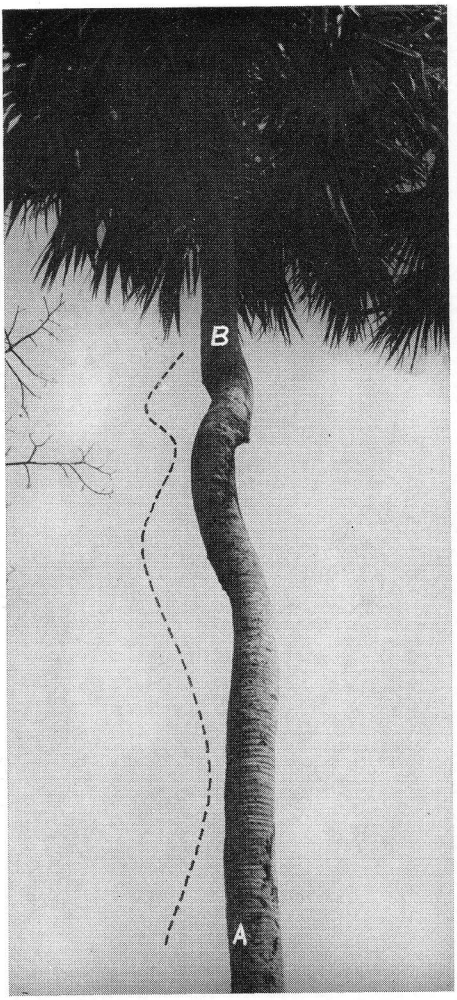
22. A multi-headed palmyra palm. Photo courtesy Government Museum, Madras.

23. A pigmy palmyra with numerous shoots, the white X indicates a withered branch.

Twisting stems

The palmyra palm is one of the sturdiest and most erect, comparable to *Lodoicea maldivica*, so that bends and twists are seldom noticed on them. The two specimens in Figs. 24 and 25 are noteworthy. The palm in Fig. 24 is from the southern end of Kerala and was photographed by my former colleague Mr. U. Sukumaran. The stem has

24. A *Borassus* trunk that has bent twice.



25. A palmyra palm with a twisting stem.

two fairly sharp bends and a broad loop covering about 250°. With the coconut, twisting and bending of the stem is rather common (21). For example, a rare palm at Alagos, Argentina made two acute bends, ultimately looking like the letter N. Another striking case of a twisting coconut is given by Child (12).

Figure 25 is a palm from West Bengal which shows a clear twist of the stem. There is a linear mark of injury starting from A and extending up to B after making two complete revolutions around the stem as indicated in the sketch. The palm in Fig. 25 has a counterclockwise foliar spiral.

Causes for the production of branches

In the soboliferous palms, production of branches (suckers) is a normal characteristic. In a few other species like *Hyphaene*, aerial or sub-aerial branching is also a normal phenomenon (65). But in other palms, branching takes place as a result of certain abnormal causes. According to Morris (48), branching may be the result of the injury or destruction of the terminal bud. This is sometimes the case with *Phoenix sylvestris* where the tender stem is injured for the extraction of a sugary sap. Lightning is another probable cause. A palm mildly struck by lightning may recover and if its single growing point is split into many pieces during the strike, some of these divided stem apices may develop into branches. However, it is difficult to expect a tree to be repeatedly struck by lightning to induce repeated branching. Perhaps the lightning shock creates some systemic imbalance in some palms so as to induce an atavistic characteristic of perennial branching. Diseases affecting the growing point may also induce the production of shoots in palms as reported in the areca palm by Sinclair (59). Quisumbing (54) offered another explanation. In the Philippines, rhinoceros beetles attacking two coconut palms were eliminated by burning the crowns with kerosene. The leaves were scorched and for a time the trees appeared to be dead. After some time the owner was surprised to see new branches developing. It is not clear whether the branching was due to the stimulation of the fire or the beetle attack. Rhinoceros beetle is a

serious pest of the coconut, the palmyra and a few other species of palms and their boring into the growing point may induce multiple branching. Mechanical choking by other plants can also induce branching in palms. Hodge (38) mentions that the two-headed *Roystonea* sp. was the result of constriction by vines originally growing over the palm which practically cut the original single bud into two. This seems unlikely, however. Deliberate splitting of the growing point of a palm to produce branching can be done. Evans (32) is of the opinion that the production of seven branches on a *Phoenix Roebelenii* palm recorded by him was the result of a deliberate act by a skilled plantsman. It appears that there are a dozen such branched palms around the Avocado Palace in Guatemala City. It would be useful if this technique could become widely known. With the coconut, I artifically induced branches while in Kerala (23) and in Calcutta (28). Further success with this method was reported by Michael and Verghese (47). Artificial splitting of the growing point of young *Borassus* sprouts is much easier as is clear from my recent trials.

There is yet another reason for the production of branches in palms. When the terminal bud of a coconut is injured, there seems to be a tendency for adjacent buds, axillary or adventitious, to develop and replace the destroyed terminal bud. According to Quisumbing (54) this is possible because there are inflorescences which fail to develop flowers and fruits but instead produce branches. That an inflorescence can be transformed into a vegetative shoot has been reported in the coconut by many workers (8, 16, 29, 35, 40, 55, 56, 63) in the African oil palm (22, 51), in *Areca catechu* by Davis (30) and in two *Borassus flabellifer* palms by Davis and Basu (31).

It may not be out of place to mention here that the offshoots of branching palms, especially of the date, are sometimes considered to be seedlings germinating in the axils of persistent leaf bases. Stewart (62), referring to the records of branching in palms of northern India, states that they merely result from seed which falls into and germinates within the leaf axils. Brandis (7) rejected this view. However, I have myself photographed at least ten branching *Phoenix sylvestris* palms in northern India. In support of Stewart (62), I wish to mention that I saw hundreds of African oil palms at the United Plantations, Teluk Anson, Malaysia from some of whose leaf axils, several seedlings (up to sixty in one palm) were found to grow. Periodically these seedlings are either pulled down by hand or slashed with a harvesting knife.

Dichotomous branching in palms

There is controversy over the exact mode of branching in certain species of palms like *Hyphaene*. Some workers (6, 57) consider this mode of branching to be dichotomous and not due to precocious development of a lateral bud. The sheath at the point of "forking" has a solid center as well as two lateral channels within which the shoot develops. The two shoots are nearly equal in size and this is regarded as evidence for a true dichotomy. Morris (48), on the other hand, was of the firm opinion that the branches develop from otherwise suppressed axillary buds or by the transformation of flower branches.

Ridley (55) very much doubted the occurrence of dichotomy in palms. According to him, in all cases of bifurcation or apparent bifurcation which it was possible to investigate, one of the branches was a lateral bud, often produced low down on an already tall main

stem and the axillary bud had grown so rapidly that in time it equalled the original one in height and thickness. This is exactly the situation in *Chrysalidocarpus lutescens*. From some branching nodes of this species, I have collected the peculiar sheath with a solid center and two lateral channels. True dichotomy, however, occurs in some cases where the growing point is split by lightning or similar shocks and two shoots develop from the single apical meristem (33). In fasciating stems, the various shoots may have a similar origin.

Summary

Borassus flabellifer is normally a single-stemmed palm. A number of cases are reported where the single stem has produced lateral shoots, each individual having one to thirty or more branches. The exact cause for the production of branches in palms is not known although mechanical injury at the growing point as a result of tapping for toddy (in *Phoenix sylvestris*), or by beetle attack, lightning strike, diseases, fire at the crown, choking of the growing point by other twining plants, etc. have been thought to be some probable causes. While in a few species of palms branching is genetically controlled, it has been possible to induce branching in the coconut, areca and palmyra palms. Most of the branching palms produce fruits as evidenced by some of the female palmyras illustrated above.

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PALM LITERATURE

GLASSMAN, S. F. Preliminary studies in the palm genus *Syagrus* Mart. and its allies. Fieldiana: Botany **31(5)**: 145–165, figs. 44–50. 22 Dec. 1965.

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———. *Syagrus oleracea* (Mart.) Becc. and closely related taxa. Fieldiana: Botany **32(3)**: 13–33, figs. 1–19. 19 Aug. 1968.

The above five studies of the cocoid genus *Syagrus* and its relatives result from revisionary studies being conducted by Dr. Glassman, who is on the faculty of the University of Illinois at Chicago Circle. Dr. Glassman is also a research associate in palms at the Field Museum of Natural History which publishes *Fieldiana*.

A provisional key to the *Syagrus* alliance, both genera and species, is the chief feature of the first paper, while eight new species are described in the second and third articles. The fourth study consists chiefly of taxonomic notes. Of especial interest is Glassman's conclusion that *Arecastrum Romanzoffianum* and *Arikuryroba schizophylla* should be considered species of *Syagrus*, and that each hybridizes with *Syagrus coronata*. In the fifth article, *Syagrus oleracea* is considered with relation to a new species and to a new hybrid.

WESSELS BOER, J. G. The geonomoid palms. Verhandelingen der Koninklijke Nederlandse Akademie van Wetenschappen, Afd. Natuurkunde, series 2, 58(1): 1–202, frontispiece, figs. 1–93, 1 table, distribution maps, plates I–X. N. V. Noord-Hollandsche Uitgevers Maatschappij, Amsterdam, 1968. 22 Florins (about $6.16).

Dr. Wessels Boer has written a botanical monograph of the geonomoid palms which he considers to consist of *Asterogyne* (including *Aristeyera*), *Calyptrogyne* (including *Calyptronoma* and *Pholidostachys*), *Geonoma* (including *Kalbreyera* and *Taenianthera*), and *Welfia*. The book is attractively prepared and well illustrated. It consists of major sections on morphology and anatomy, delimitation of genera, distribution, ecology and uses, references, taxonomy, names of uncertain application, indices of exsiccatae and of names.

The treatment of both genera and species is substantially more conservative than that of Burret, who provided a

(Continued on page 76)

New Palms from the Pacific, II*

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Specimens collected by members of the Royal Society Expedition to the Solomon Islands in 1965 and by several individuals in the Solomons and in New Caledonia represent taxa not previously described or otherwise of interest because of shifts in generic disposition. Those for which material seems adequate are described here.

BURRETIOKENTIA

Burretiokentia hapala H. E. Moore, *sp. nov.*

Ab *Burretiokentia Vieillardii* rachillis dense et longe tomentosis 14–15 mm. in diam., fructibus ovoideis ca. 16 mm. longis infra medium latissimis differt.

Stem solitary, dark green with prominent pale nodes, erect, to 10 m. high, ca. 7.3 cm. in diam. near enlarged base, ca. 5.7 cm. D.B.H., the internodes ca. 12.5 cm. long. Leaves ca. 10, spreading; sheath ca. 1 m. long, olive-green (but inner sheaths pinkish before exposure), densely covered with gray-brown tomentose scales, or brown-puncticulate where scales have been worn or rubbed off, with prominent oblique lines from petiole base toward the line opposite the petiole; petiole very short, ca. 5 cm. long above dry margin of sheath, green, concave above, convex below, where clothed with brown-centered, pale-margined, waxy scales or merely brown-puncticulate from persistent scale bases; rachis ca. 2.4 m. long, lower surface rounded and rather densely brown-puncticulate or with brownish-tomentose scales where protected, upper surface channelled with marginal grooves near base, to deltoid at apex and rather densely pale-tomentose scaly or brown-puncticulate: pinnae about 40 on each side, regularly arranged, narrowly elliptic in general outline, tapered to a strongly reduplicate base and an obliquely acute apex, dull green, irregularly and sparsely brown-puncticulate above, paler and densely brown-membranous-lepidote or brown-puncticulate below, the midnerve prominent and elevated above, clothed below, at least basally, with shining, brown, basifixed or medifixed, lacerate, membranous scales, secondary nerves ca. 5 on each side, prominent below and clothed basally with scales like those of the midnerve, tertiary nerves numerous, lower pinnae ca. 5.5 dm. long, 2 cm. wide, median pinnae ca. 9 dm. long, 5 cm. wide, apical pinnae ca. 3.3 dm. long, 3 cm. wide. Inflorescences 3–4 (in type) among the leaves, about twice as broad as long, densely pale-brown tomentose in all parts except at the base below the insertion of the first bract; bracts 2, green in bud (not obtained); peduncle very short, ca. 5–6 cm. long; rachis ca. 13–16 cm. long to base of terminal flowering portion; branches ca. 13–14, the lowest branches spreading, nearly as long as entire inflorescence, with short peduncular portion, divided into ca. 7 rachillae to ca. 35 cm. long, 14 mm. in diam. (in staminate bud), median branches with 2–3 rachillae, the apical 6–7 rachillae undivided, to ca. 34 cm. long, 14 mm. in diam. (including a central axis 4–5 mm. in diam. clothed with intermixed brown and white hairs to 5 mm. long). Stam-

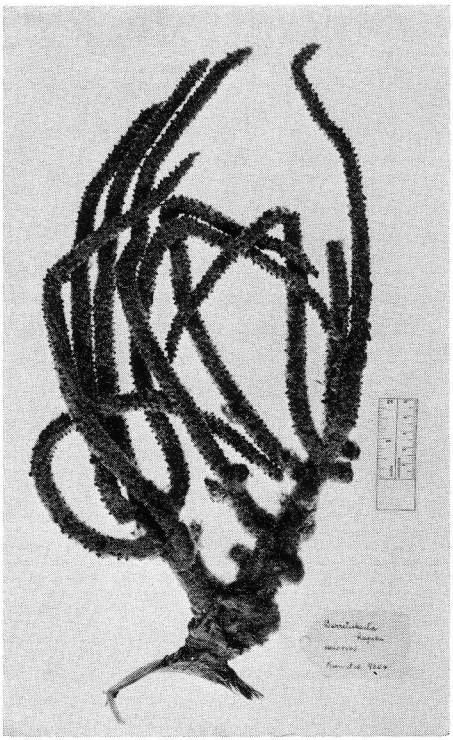
*From work relating to National Science Foundation Grants GB-1354 and GB-7758. For an earlier paper, see *Principes* 10: 85–99. 1966.

inate flowers 5–5.5 mm. long, essentially symmetric; sepals 2.5–3 mm. long, about half as long as petals, broadly imbricate, glabrous except minutely fimbriate margin; petals ca. 3.5 mm. long; stamens 6, filaments sharply inflexed at the apex in bud, anthers ca. 2.5 mm. long with sterile portion in center of each locule laterally; pistillode angled-columnar, truncate, about one-half as long as stamens: pistillate flowers (from a flower remaining on an old inflorescence branch) ca. 6 mm. long; sepals ca. 3 mm. long, broadly imbricate and rounded; petals about 6 mm. long; staminodes apparently 3, dentiform. Fruit (not completely mature, from *Lavoix 25*) ovoid, 16 mm. long, 9 mm. in diam., drying granulose-roughened; stigmatic residue exactly apical; endocarp (from type) 10 mm. long, 8 mm. in diam., the hilar keel about as long as the lateral processes, the surface more or less roughened, the lateral processes flanking a dorsal groove; seed shaped like the endocarp, 8 mm. high, 6.5 mm. in diam.; endosperm homogeneous; embryo basal.

Specimens examined. NEW CALEDONIA: in gallery forest along stream in *Melaleuca* savanna, on road to Parari from Balade, alt. ca. 350 m., 8 April 1964, *H. E. Moore, Jr., R. Barets, L. Chevalier & L. Lavoix 9324* (BH, holotype); same locality, 20 Sept. 1965, *L. Lavoix 25* (BH).

Burretiokentia hapala (from *hapalus* —soft to the touch) was thought at first to be a species of *Basselinia*, despite its robust habit, because of the very densely woolly rachillae in which the staminate buds appear to be sunken. The actual axis is, in fact, rather slender, measuring only 4–5 mm. in diameter, but the long hairs which obscure the axis and all but the tips of the flowers make it appear much thicker. It is the long hairs that suggest the epithet.

Examination of staminate buds and dissection of one fruit recovered from a fallen inflorescence, together with additional immature fruits from *Lavoix 25*, show that the correct genus for this striking palm is the previously monotypic *Burretiokentia*. This second species is readily distinguished from *Burretiokentia Vieillardii* by the woolly (Fig. 1) rather than glabrous (Fig. 2) rachillae; by the fruit (Fig. 3a) which is ovoid and attenuate toward the apex (when not perfectly mature) rather than nearly globose when fresh (Fig. 4o); and by the endocarp and seed with the adaxial keel higher than the lateral ridges (Fig. 3b–d) rather than lower (Fig. 4q, s).



1. Inflorescence of *Burretiokentia hapala*, branches partially trimmed, showing woolly rachillae (*Moore et al. 9324*, BH). Photo by Howard H. Lyon.

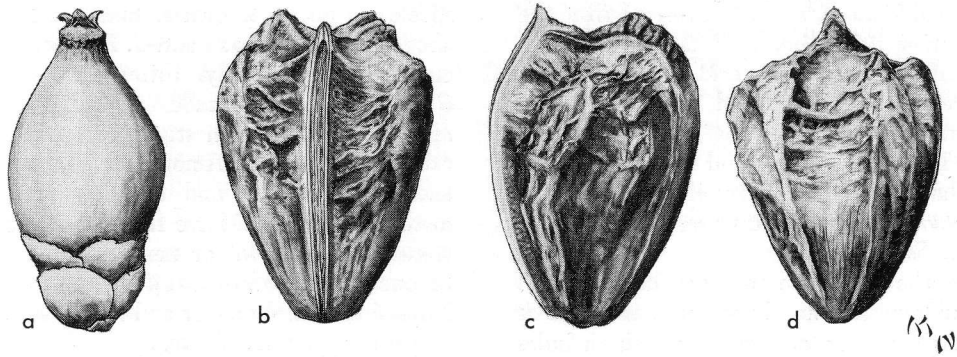
2. *Burretiokentia Vieillardii* with inflorescences in several stages (*Moore et al. 9334*).

CLINOSTIGMA

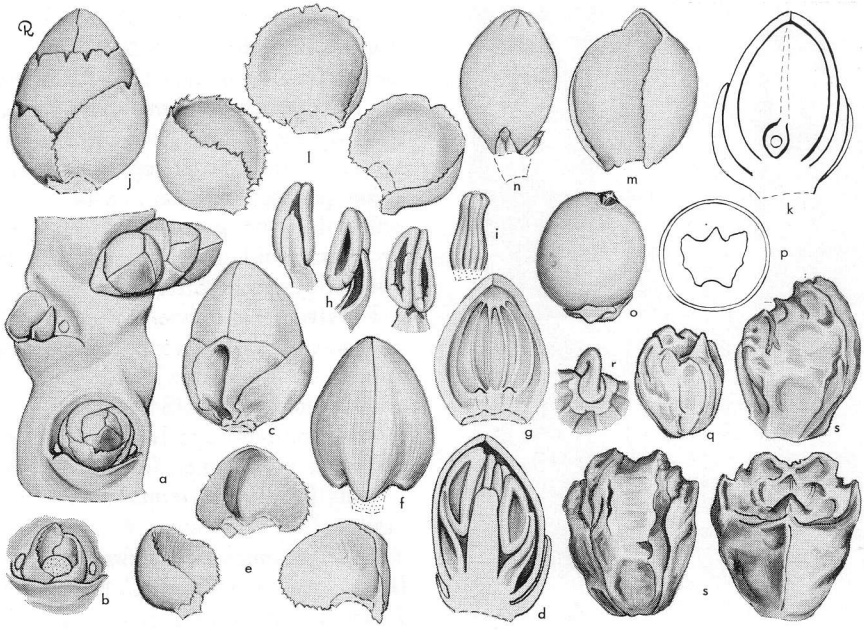
Two undescribed species of *Clinostigma* were among palms collected by members of the Royal Society Expedition to the Solomon Islands in 1965. The genus had not previously been reported from these islands but is readily recognized by its usually scopiform, two- to three-times (rarely simply) branched inflorescence, massive tall trunk, sometimes with stilt roots developed, large leaves having pinnae covered below with minute scales, and above all in the structure of the staminate flower with its acute, usually keeled sepals, asymmetric acute petals, 6 stamens with filaments inflexed at the apex, and a small, ovoid or conic-ovoid, briefly to deeply trifid pistillode much shorter than the stamens.

Fourteen names are recognized in the genus at present as representing species, though the number will probably be reduced when taxa in Samoa and the Fiji Islands can be properly studied. The distribution is unusual for palms: Bonin Islands (*C. Savoryanum*), Caroline Islands (*C. carolinense, C. ponapense*), Samoa (*C. onchorrhynchum, C. Powellianum, C. savaiiense, C. samoënse, C. Vaupelii, C. Warburgii*), Fiji Islands (*C. exorrhiza* and *C. Smithii*, which may not be distinct), the Banks Group of the New Hebrides (*C. Harlandii*), and now the Solomon Islands with *C. Gronophyllum* and *C. haerestigma* described below.

Specific differences, so far as material permits an understanding of them, lie chiefly in the size and shape of fruit, position of the stigmatic residue in fruit, and in the seeds. Fruits of the two species described here are not completely mature, and though the endocarp prob-



3. *Burretiokentia hapala*. **a**, fruit × 2½; **b–d**, endocarp in adaxial (**b**), lateral (**c**), and abaxial (**d**) views × 4. (**a** from *Lavoix 25*; **b–d** from *Moore et al. 9324*, BH).



4. *Burretiokentia Vieillardii.* **a**, portion of rachilla with triads in several stages × 2; **b**, triad with flowers removed × 2; **c**, staminate bud × 4; **d**, staminate bud in vertical section × 4; **e**, staminate sepals × 4; **f**, staminate bud with sepals removed × 4; **g**, staminate petal, interior view × 4; **h**, stamens in three views × 4; **i**, pistillode × 4; **j**, pistillate bud × 4; **k**, pistillate bud in vertical section × 4; **l**, pistillate sepals × 4; **m**, pistillate petal × 4; **n**, pistil and staminodes × 4; **o**, fruit × 1; **p**, fruit in cross-section × 1; **q**, endocarp × 1; **r**, operculum of endocarp × 2; **s**, seed in lateral, adaxial and abaxial views × 2. (From material of *Moore et al. 9334* preserved in liquid.)

ably has attained its mature shape and size, the seeds have not fully formed.

Clinostigma haerestigma is immediately separable from all other species in the genus by its fruit with stigmatic residue basal, scarcely exserted from the persistent perianth. Remaining species have the stigmatic residue lateral or excentrically apical and may be divided into two groups. The fruits are large (12–22 mm. high) and markedly longer than broad in *C. carolinense, C. onchorrhynchum, C. ponapense, C. savaiiense, C. Savoryanum.*

The fruits are smaller (11 mm. high or less) and nearly or quite as broad as high in a second group which includes *C. exorrhiza* (*C. Seemannii, C. Thurstonii, Exorrhiza Wendlandiana*), *C. Harlandii, C. Powellianum, C. samoënse, C. Smithii, C. Vaupelii, C. Warburgii,* and *C. Gronophyllum* described here.

It is difficult to make adequate comparisons between *C. Gronophyllum* and species so poorly known as many of the above. The Fijian taxa and *C. Harlandii,* closest geographically, differ from *C. Gronophyllum* in smaller fruits 3.5–6 mm. in diameter with stigmatic residue excentrically apical. Among the Samoan taxa, *C. samoënse* and the doubtfully distinct *C. Vaupelii* have fruits with the stigmatic residue at or near the center of one side; *C. Warburgii* has smaller fruits 6 mm. in diameter and leaves with spreading pinnae. *Clinostigma Powellianum* has fruit very similar to that of *C. Gronophyllum* and borne on similarly

thickened rachillae but neither flowers nor habit have been described. Species of *Clinostigma* have very limited distribution. It seems unlikely that *C. Powellianum* and *C. Gronophyllum* are identical despite lack of clear differences. I am taking the risk, therefore, of describing *C. Gronophyllum* essentially on the basis of its geography though the nature of the leaves, of the little-branched inflorescence, and of staminate sepals are all unusual for the genus as it is known today.

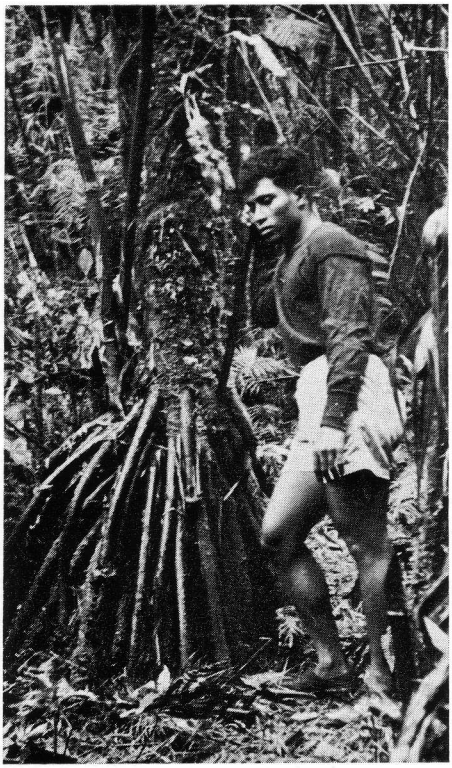
Clinostigma Gronophyllum H. E. Moore, *sp. nov.*

Caulis solitarius ad 21 m. altus radicibus adventitiis ad 1.8 m. longis; folia arcuata pinnis subarcuatis utrinque 37–38 subtus dense brunneo-lepidotis; inflorescentiae rami 13–18 indivisi vel furcati; fructus subglobosus 9 mm. in diam. residuo stigmatum laterali.

Trunk solitary, massive, stately, to 21 m. high, 22.5–27.5 cm. in diam., developing stout stilt roots 1.3–3.8 cm. in diam. up to 1.8 m. from the base, the upper stem waxy-glaucous, weathering smooth, lower stem developing elongate lenticel-like fissures. Leaf-sheath tubular, 0.9–1.5 m. long, green at maturity?, waxy violet or amethyst in young leaves enclosed in outer mature sheaths (i.e. before exposure), the younger inner sheath yellow; petiole 3 dm. long; rachis 2.1–2.7 m. long, slightly arched, with scattered, minute, pale-margined, brown-centered scales on lower surface; pinnae 37–38 on each side, rather stiffly angled upward from the rachis, subarcuate with drooping tips, the central ones ca. 1.17 m. long, 4–4.5 cm. wide, gradually tapered to an acuminate apex, this often frayed and more or less bifid, glabrous with prominent midnerve and 2 secondary nerves on each side above, the midnerve, secondary nerves and numerous tertiary nerves below rather densely lepidote with minute, pale-margined, brown-centered scales and the midnerve with prominent, irregular, brown, membranous, medifixed scales to 7 mm. long, the pinnae near the apex similar but ca. 67 cm. long, 1.5 cm. wide. Inflorescence greenish, 6–7.5 dm. long, with 13–18 undivided branches (fide Corner) or the lowest branches at least furcate in one base collected (BH); bracts 2, green, the outer ca. 7.5 dm. long, soon deciduous, the inner lanceolate, acute, entire, 6–7.5 dm. long, persistent until after flowering, then drying brownish, falling as fruit sets; peduncle ca. 7.5 cm. long, 12 mm. wide at apex, glabrous; rachis not seen complete; branches glabrous, 30–36 cm. long, ca. 3 mm. in diam. near base at anthesis, becoming somewhat thickened in fruit, ridged and angled among the spirally arranged triads which extend nearly to the flexuous minutely spinose-tipped apex, then replaced by paired or solitary staminate flowers only, the triads subtended by prominent, small, acute, nerved bracts, bracteoles subtending the pistillate flower prominent, flat, brown when dry, unequal, one higher than the bract subtending the triad. Staminate flowers cream-white when fresh; sepals narrow, elongate, acute or truncate, 4.5–5.5 mm. long, 1.5–2.5 mm. wide at base when dry, to 6 mm. long when fresh; petals asymmetric, strongly nerved, acute, ca. 5.5 mm. long, 2.5 mm. wide when dry, to 8 mm. long, 5 mm. wide when fresh; stamens 6, exceeding the petals when fresh, smaller and included when dry, filaments broad, fleshy, very briefly inflexed at the apex, anthers deeply bifid basally; pistillode short, conic-ovoid and deeply trifid when fresh: pistillate flowers greenish-white, 3–4 mm. long in bud, the perianth in fruit composed of shining, indistinctly nerved sepals ca. 3 mm. high, and duller, rather strongly nerved petals ca. 4 mm. high; staminodes

5. *Clinostigma Gronophyllum* at 5000 feet elevation on Mt. Popomanasiu, October, 1965, photograph courtesy Professor E. J. H. Corner.

usually 6, dentiform. Fruit (immature) subglobose but produced on one side in a prominent upturned stigmatic residue above the middle, ca. 9 mm. high including perianth, 9 mm. wide including



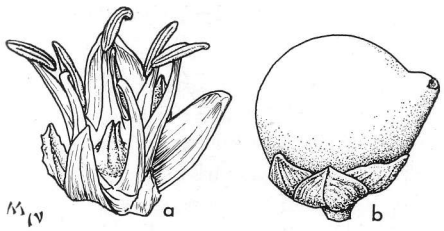
6. Stilt roots of *Clinostigma Gronophyllum*, 5500 feet elevation, Mt. Popomanasiu, October, 1965, photograph courtesy Professor E. J. H. Corner.

stigmatic residue, 7.5 mm. thick, drying granulose; seed not fully formed.

Specimens examined. BRITISH SOLOMON ISLANDS PROTECTORATE. GUADALCANAL: Popomanasiu, 4,700–5,700 ft. alt., Sabatan Mt., 25 October 1965, *E. J. H. Corner R. S. S. 108* (BH, holotype; K, isotype).

Professor Corner has most kindly made available photographs showing habit, as well as preserved portions of rachillae in bud, in staminate flower, and in young fruit to augment herbarium material in preparing a description.

Since Professor Corner was struck by the habital resemblance between this species (Fig. 5) and *Gronophyllum chaunostachys* as illustrated in *Principes*



7. *Clinostigma Gronophyllum.* **a**, staminate flower × 2½; **b**, fruit in lateral view × 2½. (From preserved material of *Corner R.S.S. 108*, BH.)

10: 67, Fig. 5, 1967, and because the leaves are unusual among those species of *Clinostigma* which I have seen personally or in illustrations, I am using the generic name *Gronophyllum* in apposition as an epithet.

The species is noted as common by the collector and clearly seasonal—"all palms now flowering, the flowering more or less over, and setting fruit but no ripe fruit seen." Stilt roots (Fig. 6) are very similar to those of *C. exorrhiza.* Young leaves are noted as being pinnate rather than undivided as in *Gulubia Hombronii.*

Staminate flowers (Fig. 7) appear to be large for the genus. In life, the stamen-filaments are fleshy and stout, all inserted at the same level. The elongate staminate sepals are also noteworthy—in young bud their tips curve over the petals and at maturity, one or more retains the truncate apex. Apparently the inflorescences are not much ramified. Corner notes the branches as undivided but a single base with branches clipped away shows that at least some of the lowermost branches are forked.

Clinostigma haerestigma H. E. Moore, *sp. nov.*

Caulis solitarius ca. 9 m. altus; foliorum pinnae plus minusve pendulae utrinque ca. 45 subtus dense brunneo-lepidotae; flos masculus (2–) 3.5–4 mm. altus; fructus ca. 9 mm. altus residuo stigmatum basali vix ex perianthio exserto.

Solitary, the trunk ca. 9 m. high, 2–2.25 dm. in diam., with a green crownshaft 1.5–1.8 m. high. Leaves 12–14; petiole 7.5–9 dm. long, ca. 3 cm. wide at apex, glabrous and rounded below; rachis 2.7–3.6 m. long, glabrous at maturity below but with occasional shining, red-brown, membranous scales with fimbriate margins on or near the margin; pinnae ca. 45 on each side of the rachis, more or less pendulous, 7.5–9 dm. long, 6.2–7.5 cm. wide at center of leaf, smaller near base and toward apex of the rachis, the upper surface glabrous, lower surface densely beset with minute, shining, pale-margined, brown-centered, membranous, peltate scales along the prominent midnerve and on the single secondary and numerous tertiary nerves on each side, the midnerve with large, red-brown, irregular, medifixed scales to ca. 9 mm. long near the base. Inflorescence 0.9–1.2 m. long with spreading branches; lower bract 0.9–1.05 m. long, cordate-auriculate at the base, glabrous but with a slight glaucescence when dry, upper bract not collected; peduncle short, ca. 10 cm. long, glabrous, somewhat glaucous; rachis glabrous and somewhat glaucous, elongate, with probably more than 20 branches, the lower branches ca. 8 dm. long, again branched near the base into elongate rachillae bearing flowers in triads in the lower two-thirds, with paired staminate flowers above or the staminate flowers solitary near the very slender, minutely spine-tipped apex. Staminate flowers (2–) 3.5–4 mm. long, glabrous; sepals acute, 2–2.5 mm. long, at least the outermost acutely keeled, the margins membranous to hyaline; petals asymmetric, sometimes strongly so, to ca. 3.5 mm. long, prominently nerved when dry; stamens 6, more or less in 2 series, the 3 outer opposite the sepals and shorter than the

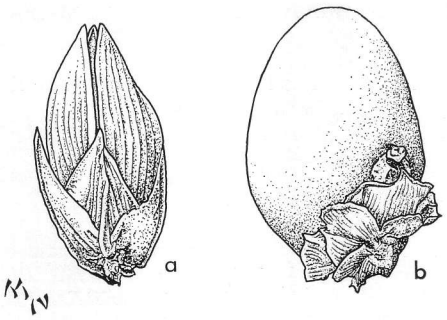
3 inner, the filaments subulate, elongate, inflexed at the apex in bud, the anthers narrowly oblong in outline, deeply bifid at base and apex; pistillode small, ovoid, briefly trifid; pistillate flowers seen only in bud, the perianth in fruit with strongly nerved sepals 2 mm. long and petals 3 mm. long, the bracteoles subtending the pistillate flower and fruit subequal, scarcely or not exceeding the bract and ridges subtending the triads. Fruit (immature) ca. 9 mm. high with stigmatic residue at the base and scarcely exserted from the perianth; exocarp drying granulose.

Specimens examined. BRITISH SOLOMON ISLANDS PROTECTORATE. SAN JORGE: Astrolabe Harbour, frequent in the *Casuarina* forest on ultrabasic soil, 23 Sept. 1965, *E. J. H. Corner R. S. S. 2700* (K, holotype; BH, isotype).

The type collection of this species lacks leaf-sheath and has only an incomplete inflorescence. Both flowers and fruit are present and though the latter is immature, it is probably near its mature size. The staminate flowers with distinctive pistillode, the structure of the inflorescence, and the pinnae clearly identify the genus, and so distinctive is even the young fruit that I do not hesitate to describe the species.

The epithet *haerestigma*, from the Latin *haereo* (to stick or cleave to) and *stigma*, is chosen because the stigmatic residue remains close to the perianth that once surrounded the pistil, growth having been almost completely unilateral (Fig. 8). It is this feature that distinguishes *Clinostigma haerestigma* from other species of the genus. The stigmatic residue in other species is near or above the middle, sometimes excentrically apical, with the exception of *C. carolinense* which is distinguished by its large fruit (15 mm. long) with stigmatic residue 5–7 mm. above the base.

Stilt roots are a prominent feature of some *Clinostigma* species—*C. exorrhiza* of Fiji, for example—but were not noted for *C. haerestigma* by the collector. Other species, moreover, are perhaps more frequent at higher elevations, often on mountain ridges. Thus, it is somewhat exceptional to find one apparently near sea-level and on ultrabasic soil.



8. *Clinostigma haerestigma.* **a**, staminate flower in bud × 7½; **b**, fruit in three-quarter view × 3½. (From dried material of *Corner R.S.S. 2700*, BH.)

DRYMOPHLOEUS

The material described below as *Drymophloeus lepidotus* agrees with the genus *Rehderophoenix* Burret, previously thought endemic to the Solomon Islands, in all details except the pistillode of the staminate flower which is ovoid-attenuate as in many other ptychospermate palms rather than short and trifid as in species earlier assigned to *Rehderophoenix*. The pistillode may vary substantially in flowers of a single inflorescence (in *Brassiophoenix*, for example), and by itself scarcely seems a stable basis for distinguishing a genus. *Rehderophoenix* otherwise agrees well with *Drymophloeus* with which it is here united. Two species of *Coleospadix* earlier noted as belonging here (*Gentes Herbarum* 8: 299. 1953) are also transferred. *Drymophloeus* as so modified extends from Halmahera, Ceram, Amboina, to New Guinea, the Solomons, and possibly to Fiji and Samoa.

Drymophloeus lepidotus H. E. Moore, *sp. nov.*

Caulis solitarius ad 9 m. altus; foliorum pinnae anguste obovatae ad apicem oblique truncatae subtus dense lepidotae; floris masculi stamina 37–45 et pistillodium ovoideo-attenuatum; fructus ruber anguste ovoideus 14 mm. longus 7 mm. in diam.

Trunk solitary, to ca. 9 m. high, 7.5–10 cm. in diam. Leaf-sheaths densely floccose-lepidote where protected, the scales with red-brown centers and white cottony margins, becoming red-brown-puncticulate with persistent scale attachments where exposed; petiole with a rather dense cover of brown-black-centered, pale or dark, lacerate-margined, membranous scales above and below where protected, or merely dark-puncticulate where exposed, rounded abaxially, slightly convex adaxially; rachis with small, dark, membranous, basifixed, entire or lacerate scales, especially above, or only dark-puncticulate when exposed or aged; pinnae narrowly obovate in general outline, apparently regularly arranged along the rachis, very densely covered below on all the nerves with minute, shining, narrowly pale-margined, brown scales and with elongate, dull to shining, brown, twisted, basifixed or medifixed, membranous scales to 10 mm. long on the principal nerves toward the base, glabrous above except for a few large scales on the principal nerves near the base and sparser, minute, dark brown scales on the midnerve, intermediate principal nerve, and margins especially toward the base, median pinnae ca. 53 cm. long on the upper margin, probably ca. 9 cm. wide at the middle (none complete), cuneately tapered to the base, narrowed toward the obliquely lobed and minutely toothed apex, subapical pinnae ca. 25 cm. long, 3.3 cm. wide with nearly truncate apices, apical pinnae ca. 15 cm. long, 3 cm. wide, truncate and toothed at the apex. Inflorescence with 2 peduncular bracts, the lower (prophyll) ancipitous, ca. 29 cm. long, with small, pale-margined, brown, membranous scales outside, glabrous within, the upper inserted ca. 2 cm. above the lower; peduncle slender, ca. 1.8 cm. wide at insertion of lower bract, ca. 11.5 cm. long, glabrous except below the bracts where minutely brown-scaly; rachis glabrous, bearing several divaricate branches to 45 cm. long (an entire inflorescence not seen), these again once- to twice-branched into angled and often flattened rachillae 14–20 cm. long, 2–3 mm. in diam. Flowers borne in loosely spiralled to subdistichous triads in the lower one-half to two-thirds of the rachillae but toward the apex paired or often solitary staminate flowers are borne in subdistichous to distichous fashion: staminate flowers cream-colored, glabrous, ca. 5 mm. long; sepals gibbous at the base, 2.2–2.4 mm. high, 3.0–3.4 mm. wide; petals ca. 4.2 mm. high, 3 mm. wide; stamens ca. 37–45, the filaments short, anthers linear, 2.5–3 mm. long, deeply bifid at base and apex; pistillode ovoid-attenuate, about two-thirds as long as the stamens: pistillate flowers seen only in very young bud; fruiting perianth of sepals ca. 3 mm. high, 3.5–3.8 mm. wide; petals ca. 9 mm. high, 11 mm. wide; staminodes several, distinct or irregularly connate. Fruit red at maturity, yellow when incompletely mature, 2.4–2.5 cm. long, 9–10 mm. in diam., narrowly ovoid, broadest near the base and gradually tapered to a rounded-conic stigmatic residue; exocarp "pebbled" when dry from internal attachment of very short, pale fibers; seed narrowly ovoid, ca. 14 mm. long, 7 mm. in diam., the hilum round, basal, raphe-branches ascending and anastamosing from the base; endosperm homogeneous; embryo basal.

Specimens examined. BRITISH SOLOMON ISLANDS PROTECTORATE.

SAN CRISTOBAL: ultrabasic hill east of Wainoni, 1400–1600 ft. alt., 10 Aug. 1965, *G. Dennis R. S. S. 53* (BH, holotype).

Material of the holotype is incomplete but clearly represents a taxon distinct from the other two species of *Drymophloeus* known from the Solomon Islands. The three species may be distinguished as follows.

1. Pinnae densely lepidote below on all nerves; staminate flowers small, ca. 5 mm. high, with ca. 37–45 stamens and ovoid-attenuate pistillode; fruit ovoid, broadest near the base, tapered to the apex. San Cristobal. ---------- *D. lepidotus*
1. Pinnae not lepidote below except for membranous scales on the midnerve; staminate flowers large, 10–12 mm. long with 190–327 stamens and ovoid or subglobose, trifid pistillode; fruit broadest at or above the middle.
   2. Fruit broadly ellipsoid, 1.9–2.0 cm. long; flowers subdistichously arranged along slender rachillae 3–4 mm. in diam.; staminate flowers with ca. 190 stamens. Santa Ysabel ---------- *D. subdistichus*
   2. Fruit obovoid, 2.4–2.5 cm. long; flowers spirally arranged along thick rachillae 6–8 mm. in diam.; staminate flowers with 290–327 stamens. San Cristobal. ---------- *D. pachycladus*

Drymophloeus litigiosus (Beccari) H. E. Moore, *tr. nov.*

Ptychosperma litigiosum Beccari, Malesia **1**:50. 1877 (*'litigiosa'*).

Coleospadix litigiosa (Beccari) Beccari, Ann. Jard. Bot. Buitenzorg **2**:90. 1885.

Drymophloeus oninensis (Beccari) H. E. Moore, *tr. nov.*

Ptychosperma litigiosum var. *oninense* Beccari, Malesia **1**:52. 1877 (*'oninensis'*).

Coleospadix oninensis (Beccari) Beccari, Ann. Jard. Bot. Buitenzorg **2**: 90. 1885.

Drymophloeus pachycladus (Burret) H. E. Moore, *tr. nov.*

Rehderophoenix pachyclada Burret, Notizbl. Bot. Gart. Berlin **13**:87. 1936.

Drymophloeus subdistichus (H. E. Moore) H. E. Moore, *tr. nov.*

Rehderophoenix subdisticha H. E. Moore, Principes **10**:93. 1966.

PALM LITERATURE

(Continued from page 66)

revision in 1930 and who described many species afterward. This conservatism is all to the good when based on careful observation and has resulted in the recognition of only 75 species of *Geonoma*.

Unfortunately, conservatism at the generic level in *Calyptrogyne* has brought about an odd situation, one in which the description of the staminodial tube as digitately lobed applies only to the subgenus *Pholidostachys* but not to subgenus *Calyptrogyne* nor to subgenus *Calyptronoma*. The reviewer is not convinced that *Calyptrogyne*, *Calyptronoma*, and *Pholidostachys* are not acceptable though related genera. Species descriptions too often fail to agree in detail with specimens which were cited as having been examined, suggesting lack of care in preparation. A more detailed review has recently appeared in *Taxon* 18: 230–232, 1969.

H. E. MOORE, JR.

Some Notes on Pseudophoenix and a Key to the Species

ROBERT W. READ*

The publication of a research paper entitled "A Study of *Pseudophoenix*" and the discovery of two new remote localities for the genus occurred almost simultaneously. A scientific study of *Pseudophoenix*, written in partial fulfillment of requirements for the M. S. degree at Cornell University, appeared in *Gentes Herbarum* [vol. 10: 169–213. 1968] published by the L. H. Bailey Hortorium. It is a comprehensive study of the genus in which four species and two subspecies are fully described, one species for the first time. In addition to the systematic treatment, supporting anatomical and cytological studies are also presented.

The newly described species—*Pseudophoenix Lediniana* R. W. Read—commemorates Dr. R. Bruce Ledin because of his great interest in the horticulture of southern Florida, and his contributions to the study of palms and to The Palm Society. *Pseudophoenix Lediniana* (cover) is endemic to limestone cliffs along the gorge of the Levange River above the road from Grand Goâve to Gerard and Trouin on the southwestern peninsula of Haiti. The species resembles *P. vinifera* somewhat in its large size but can easily be distinguished by the broad inflorescence which arches out from the crown, by its very short flowerstalks, and by the three-lobed calyx. The inflorescence of *P. vinifera*, in contrast, is pendulous alongside the trunk, the flower stalks are rather elongate, and the calyx is cuplike and rounded-triangular. Additional diagnostic characteristics by which one can identify all known species of the genus may be found in the accompanying key.

Shortly before the aforementioned paper appeared, the author visited the islands of the eastern Caribbean while on a collecting and research trip for the Smithsonian Institution. Although *Pseudophoenix* was formerly unknown east of Hispaniola, a large population was discovered on Dominica. Plants resembling *P. Sargentii* (Fig. 1) were found on a dry rocky hillside among semi-deciduous woodland and thorn scrub. The species is apparently restricted to an area of hills above the town of Mero, within sight of the Castaways Hotel, in the lee side of the island. Flowers and fruit were not found, but the hundreds of young plants suggest that fruits are produced in abundance. Until flowers and fruits are examined, the determination of the species must remain tentative. *Pseudophoenix Sargentii* is so far the only species known outside the boundaries of Hispaniola.

Following the discovery of *Pseudophoenix* in Dominica, the author visited Dr. Roy Woodbury at the University of Puerto Rico in Rio Piedras. Dr. Woodbury told of his finding *P. Sargentii* on Mona, a small, low Puerto Rican island about midway between Puerto Rico and Hispaniola. Saona Island, which lies just off the southeast coast of Hispan-

* Dr. Read has just completed a year as a National Research Council Visiting Research Associate at the Smithsonian Institution.

1. *Pseudophoenix* (*P. Sargentii* ?) growing on the dry hills above the Castaways Hotel near Mero, Dominica.

iola, was previously believed to be the easternmost locality for the genus, which is now known to extend even beyond Mona, 500 miles southeast to Dominica. If the species in Dominica proves to be *P. Sargentii*, it would then exhibit a range of distribution of more than 2000 miles across the northern Caribbean.

A Key to Species and Subspecies of Pseudophoenix

1a. Rachillae of the inflorescence mostly straight and extending at right angles, or at least sharp angles, to the axes on which they are borne; inflorescence almost as broad as long; stamen-filaments cuspidate, more than 2 mm. long, united at their bases to form a cupule. ..... *P. Sargentii* H. Wendland ex Sargent

2a. Inflorescence less than one-third as long as the leaves, erect in fruit; primary bract less than three-fourths as long as the peduncle. Florida, Mexico, British Honduras, uncommon in cultivation. ..... *P. Sargentii* subspecies *Sargentii*

2b. Inflorescence more than one-third as long as the leaves, pendulous from an arcuate peduncle in fruit; primary bract more than three-fourths as long as the peduncle. Hispaniola, Mona Island, Cuba, Bahama Island, probably Dominica, and in cultivation. ..... *P. Sargentii* subspecies *saonae* (O. F. Cook) R. W. Read

1b. Rachillae of the inflorescence mostly curved and extending in the same direction as the main axis; inflorescence much longer than broad.

3a. Pseudopedicels (floral stalks) in flower or fruit stout, less than 5 mm. long; ultimate rachillae usually much more than 7 cm. long; stamen-filaments more than 2 mm. long, abruptly dilated and united basally, forming a cupule or ring.

4a. Inflorescence pendulous and nearly paralleling the trunk; calyx rounded-triangular; petals spreading or reflexed against the pseudopedicel; pseudopedicels 3.5–5 mm. long; stamen-filaments in flower or fruit more than 5 mm. long, nearly three-fourths as long as the petals; fruit 1–3-seeded; aborted carpels conspicuous at the base of the fruit; pinnae normally exhibiting dark scales within the basal fold; trunk strongly ventricose. Hispaniola and in cultivation. ..... *P. vinifera* (Martius) Beccari

4b. Inflorescence arcuate (arching, not pendulous); calyx 3-lobed; petals usually clasping the fruit; pseudopedicels less than 4 mm. long; stamen-filaments in flower or fruit less than 4 mm. long, only one-half as long as the petals or less; fruit normally 1-seeded; aborted carpels inconspicuous; pinnae normally lacking scales within the basal fold; trunk columnar, only slightly swollen or irregular. Haiti. ..... *P. Lediniana* R. W. Read

3b. Pseudopedicels in flower or fruit conspicuously long and slender, more than 5 mm. long; ultimate rachillae less than 6 cm. long; stamen-filaments less than 1.5 mm. long, not dilated nor united at the base to form a cupule or ring. Dominican Republic. ..... *P. Ekmanii* Burret

PALM BRIEFS

Palmae: hic et ubique

During recent field studies of fruit-eating birds in Costa Rica and Panama, the well-known importance of palm fruits in the diets of many birds and mammals has come to my attention. It is certainly an importance that merits reaffirmation and further study.

In the tropical lowland forests, there is a regular progression of animals feeding at each palm tree as the fruit ripens. The sequence of visitors can be conveniently divided into those species which feed "early," while the fruit is still attached to the tree, and to those which feed "late," as fallen fruits accumulate on the ground. Among the mammals, the early feeders include the arboreal squirrels and monkeys as well as certain bats (*Artibeus* sp.). Incidentally, the bats often take the smooth black fruits of the wine palm (*Acrocomia*), the seeds of which have been reported to serve as food for cattle and man. The late feeders are represented by such species as the collared peccary and agouti under the nut palms (*Scheelea* sp.), or the bands of coati that are attracted to the fallen fruits of the black palm (*Astrocaryum Standleyanum*). Within the avian world the great majority of the species are strictly early feeders, with only a few types exploiting fruits on the ground. Examples of the latter include certain terrestrial groups such as the tinamous; or the black vulture, which feeds under the introduced African oil palms (*Elaeis guineensis*) when its usual food, carrion, is scarce. In the following comments on royal palms (*Roystonea regia*) each of the birds mentioned is an arboreal, or early, feeder.

Throughout the developed sections of the Canal Zone and adjacent parts of the Republic of Panama, the royal palm is extensively planted. It is especially common in the Pacific coast town of Balboa, which has a public square, "El Prado," planted only with lawn grass and 92 royal palms. At these trees, I have recently watched the feeding of clay-colored robins, palm tanagers, and blue-gray tanagers, each of which is known to be an essentially frugivorous species. In addition, several species which are generally considered insectivorous frequently feed on the palm fruits —my list includes the red-crowned woodpeckers, social flycatchers, and tropical kingbirds. For each species, at least several individuals were present at any one time, indicating that the palms of the square must be a food source for sizeable populations of these birds. In fact, all six are among the most common birds of the town. In other words then, the royal palms provide a natural food supply which is important in the maintenance of local birds. In addition, this species is regularly exploited by wintering migrants, such as the eastern kingbirds on the Pacific shore, as they arrive from North America, and gray kingbirds on the Atlantic coast, arriving from the Caribbean. Interestingly, both of these migrants (flycatchers, family Tyrannidae) are almost exclusively insectivorous at their breeding grounds. At present, we have few clues about the reasons for such frequently noted dietary shifts in migrant birds, although it is clear that the palms are very important, especially as other natural food sources are rapidly being eliminated by man through extensive land clearance.

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