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

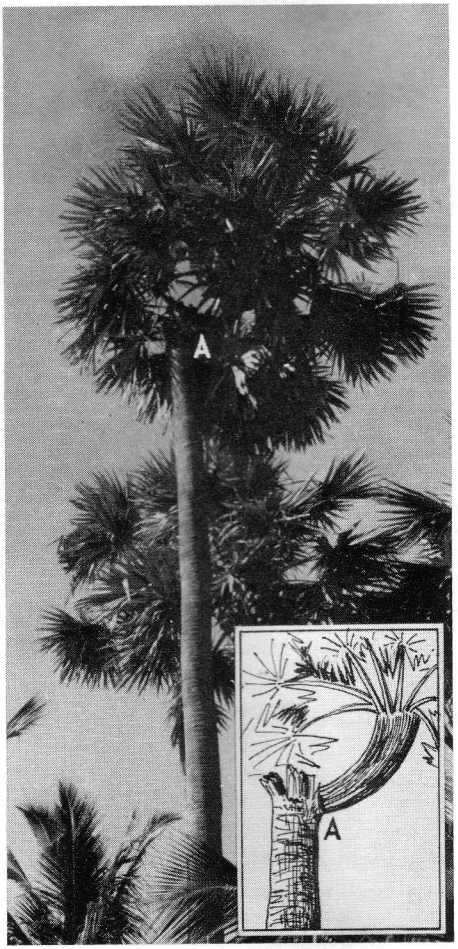
1. The branching *Borassus flabellifer* on the left at present has only one of three shoots.

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

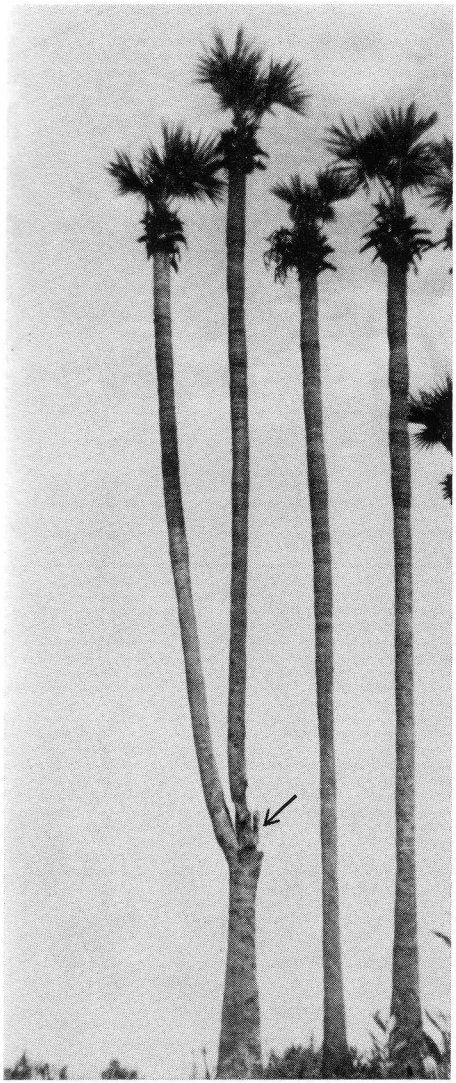
Figure 1 shows a branching palmyra palm (extreme left) with only one of the original three branches. Remnants of the other two shoots which withered many years ago may be seen at the branch junction (arrow). The surviving



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.

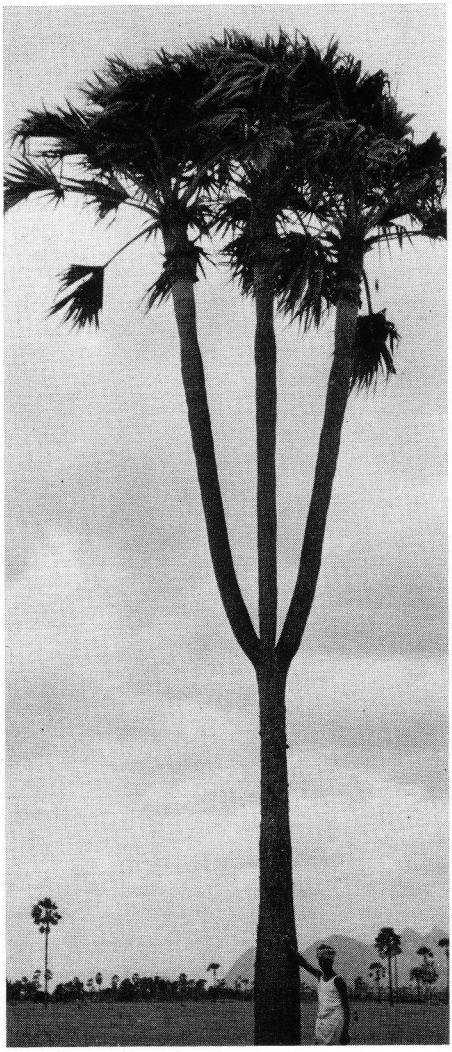
the palm originally had is not known but it may have been seven. Six of them were reported to have been lost in a cyclone. The palm is female and the surviving shoot bears plenty of fruit. Professional climbers without any fear reach the surviving crown to collect tender fruits for the edible jelly-like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

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

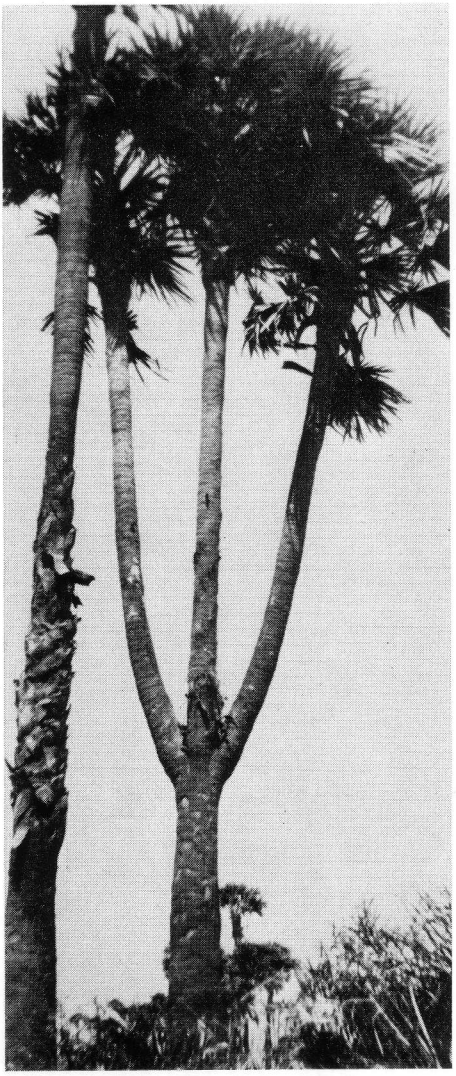
The branching palm in Fig. 3 undoubtedly had at one time more than two shoots as indicated by the scar and the remnants of trunks at the branch junction (arrow).

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.

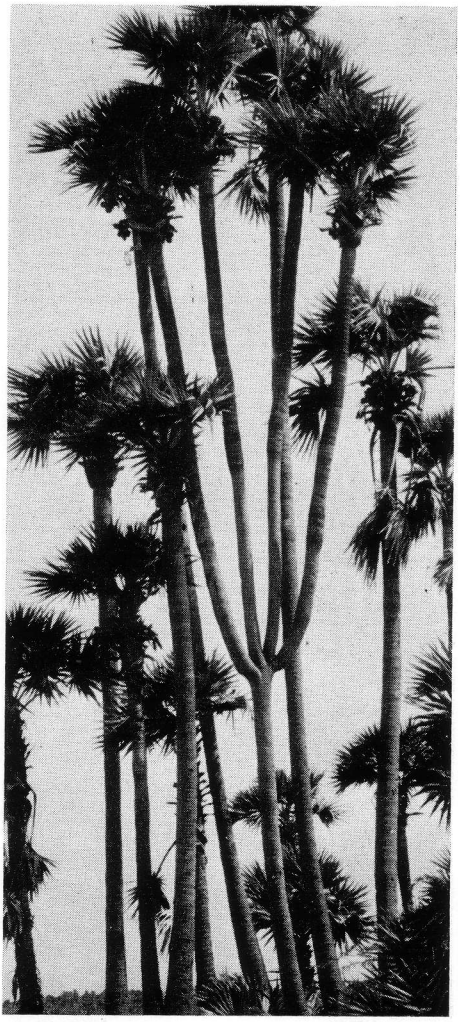
of the other palms illustrated conform to this principle, although in a few, the branches develop in various directions.

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

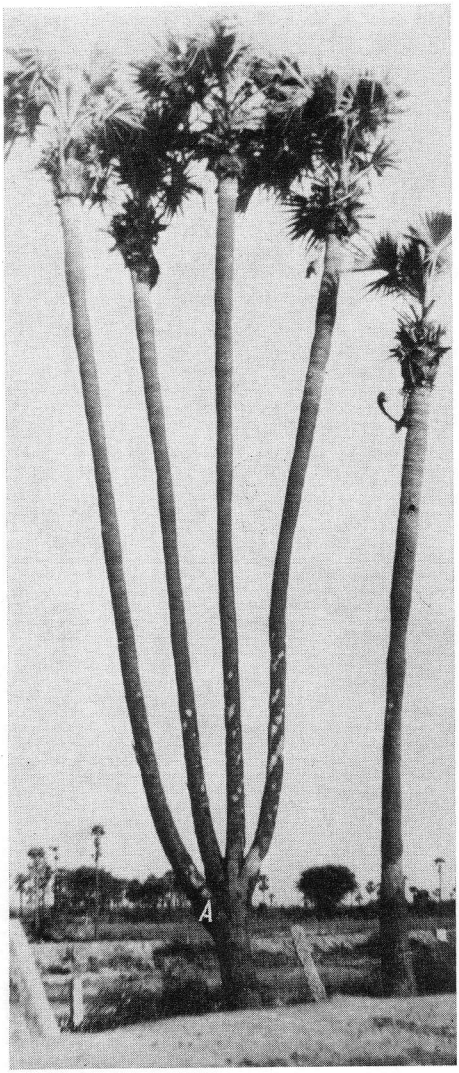
7. A branching palm with three surviving shoots.



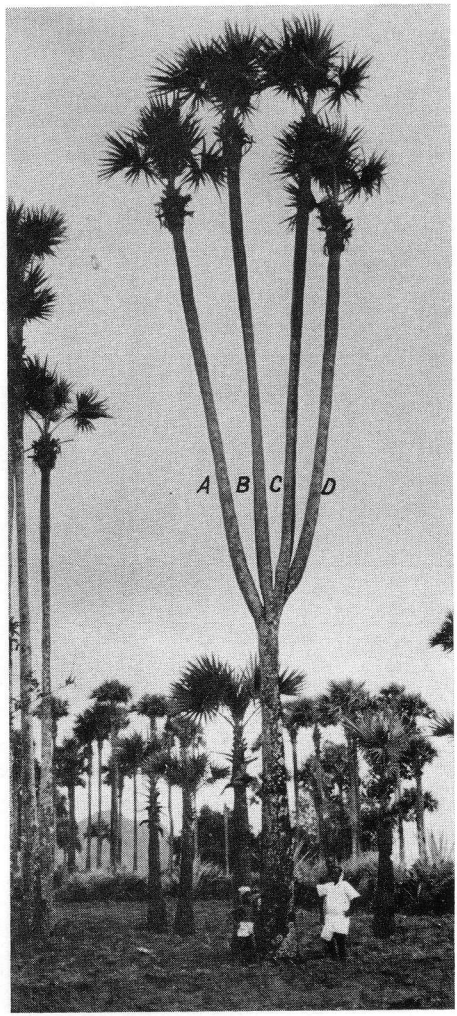
8. A palm having four massive branches.

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.*

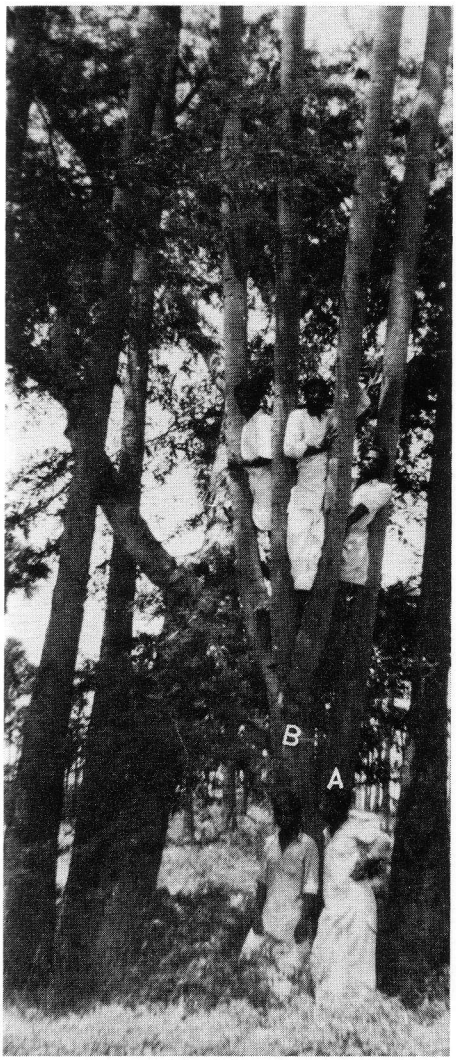


10. Another four-crowned palmyra showing two-stage branching.

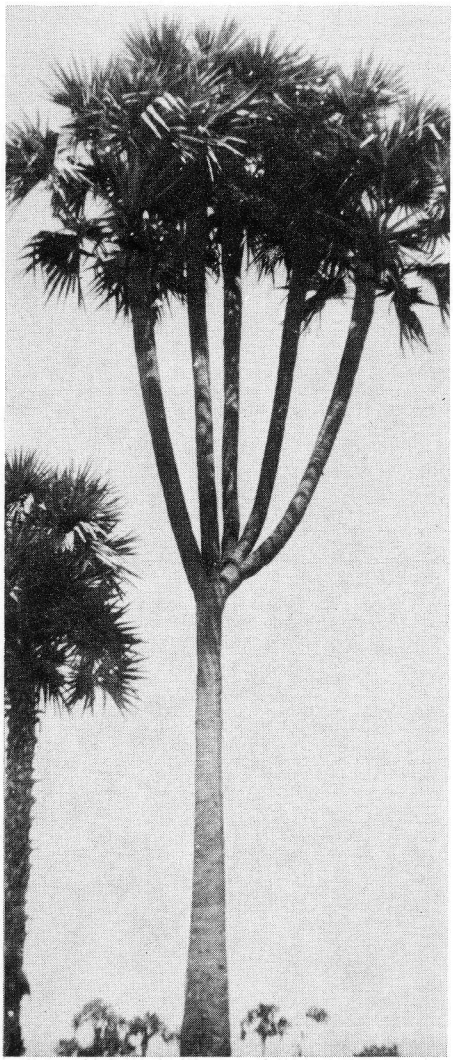
duced at least three years before the remaining three shoots.

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.

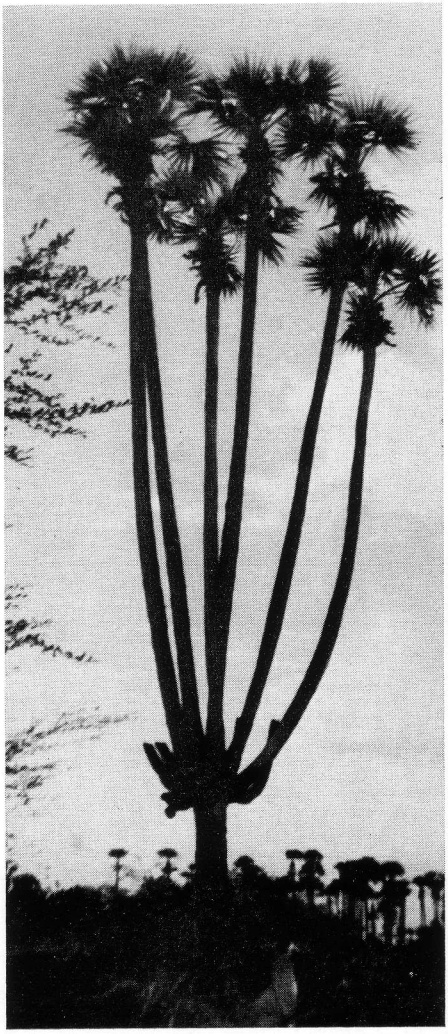


12. A palmyra palm with five branches along a common plane.

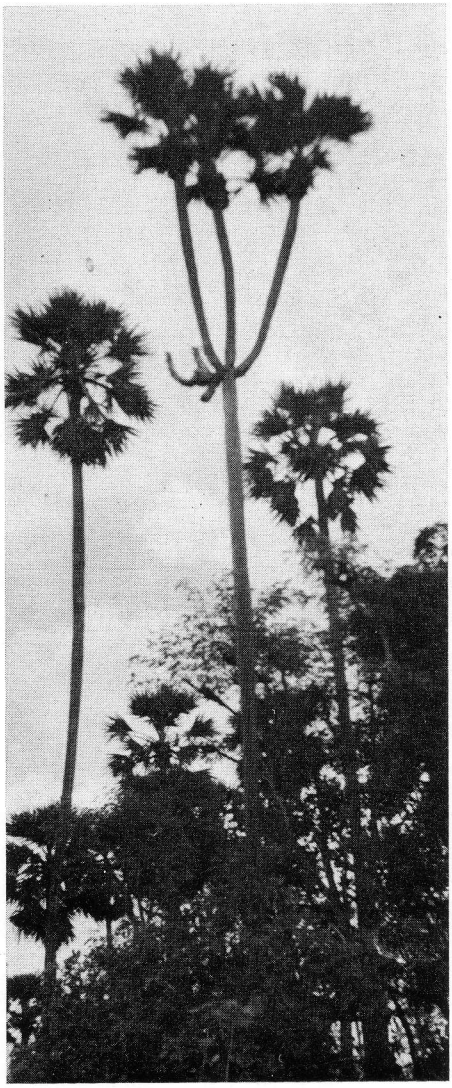
the stem at A. The shoot on the left (B) developed three branches after growing another four feet. Three youngsters are squeezed between the four shoots.

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.

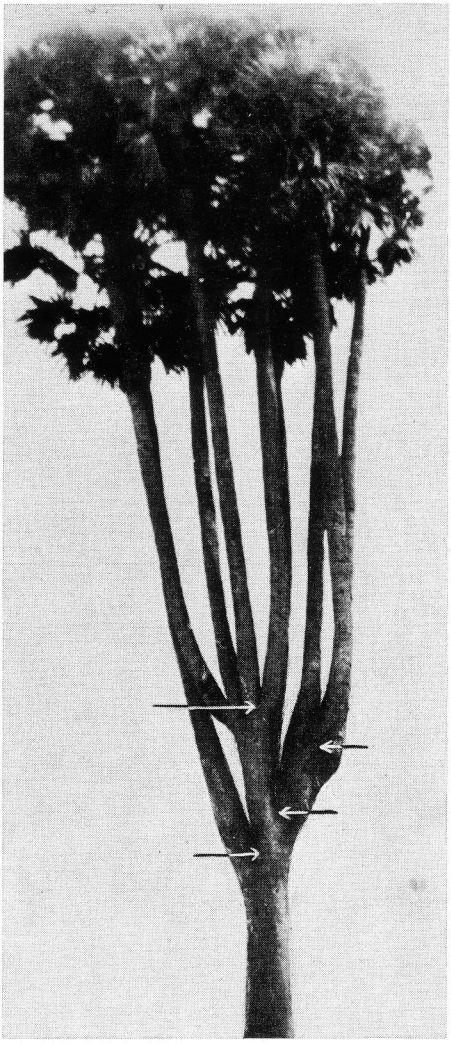


14. The stem of this palm emitted lateral shoots at a height of about 50 feet.

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

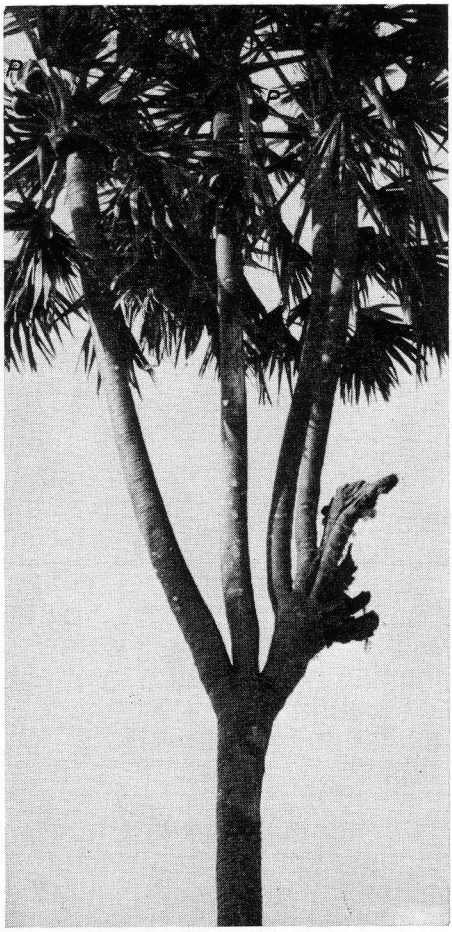
15. An instance of "uniparous" mode of branching in a palmyra palm.



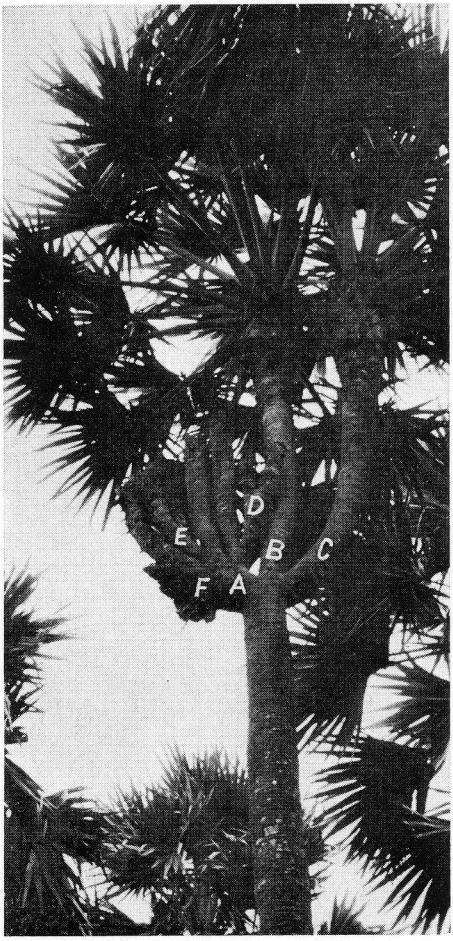
16. A palm bearing nine shoots with crowns intact.

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.

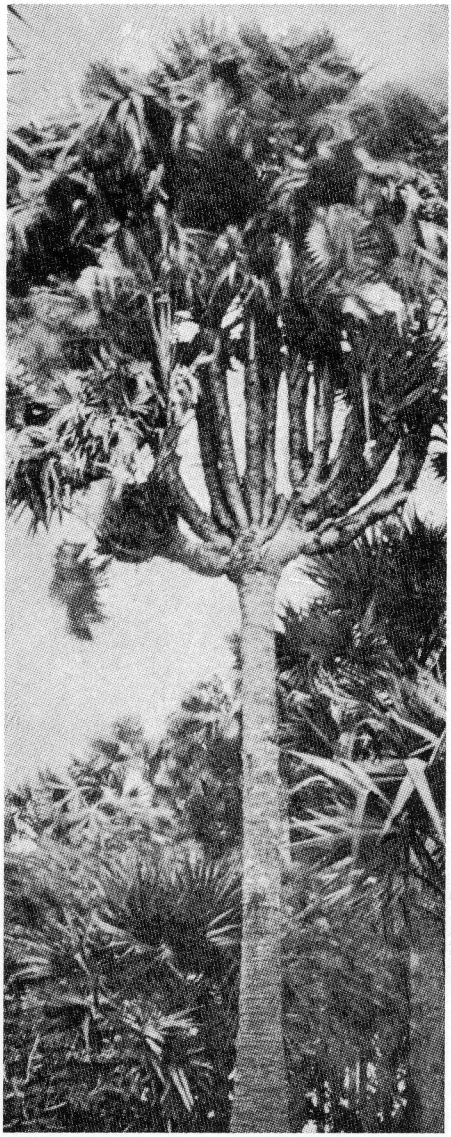
Figure 18 shows another palmyra palm whose stem at a height of about 18 feet developed three shoots; one of them (A) subsequently became fasciated and produced eight shoots. Three of these secondary branches (D, E and F) rebranched. As is clear from the picture, all the shoots grow in one plane. When 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.

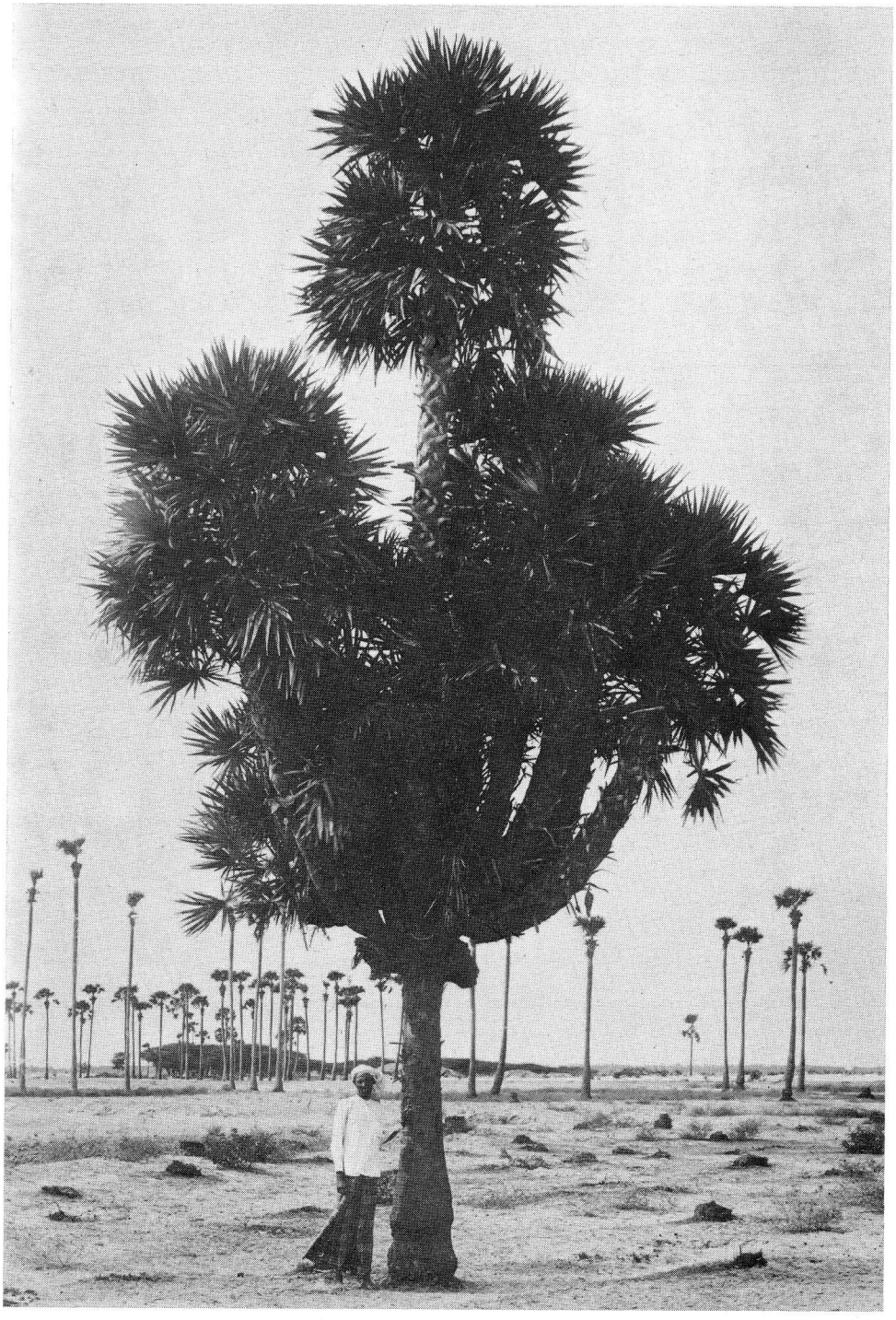
Figures 21–23 represent a slightly different type of branching. All of them have several branches at different levels.

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*.



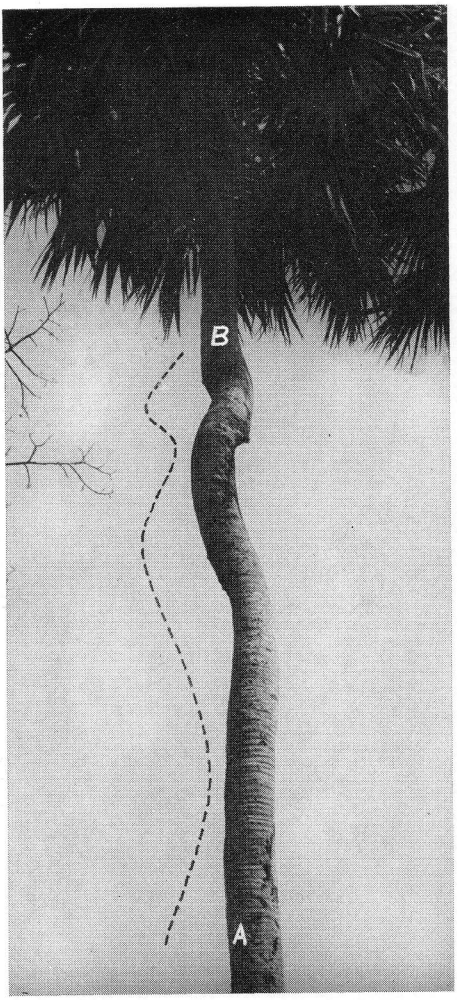
22. A multi-headed palmyra palm. Photo courtesy Government Museum, Madras.

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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———. New species in the palm genus *Syagrus* Mart., II. Fieldiana: Botany **31 (13)**: 283–299, figs. 1–15. 22 Feb. 1968.

———. Studies in the palm genus *Syagrus* Mart. Fieldiana: Botany **31 (17)**: 361–397, figs. 1–20. 23 May 1968.

———. *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

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