

9. *Raphia Hookeri* at the Bogor Botanic Garden, inflorescence left, closeup right. Photographs by J. Douglas.

petuating its traditions, but we need the help of experts from all over the world.

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## Palms of Indonesia

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No botanist is at present able to deal adequately with the palms of the Indonesian Archipelago — a part of the great Malaysian Islands. Although the palm family amounts only to about one-twentieth of the whole flora, it is represented by about 60 genera and at least 800 species. A discussion of all these palms would be out of the scope of this article. Furthermore, it would take more than a life time to master this subject. Therefore, I will deal only with some of the more common Indonesian palms and my experiences with them. But first let us review briefly previous work done with Indonesian palms.

The German-Dutch botanist, Rumphius (?1628-1702), who lived on the Island Ambon in the Moluccas, was the first to study Indonesian palms. His book *Herbarium Amboinense* was issued with text in both Latin and Dutch in six volumes from 1741 to 1755 long after his death. He was very much im-

pressed by the striking form, habits, structure, and life history of palms. He described them and many other plants of the Moluccas and adjacent areas. His book starts with the coconut palm of the Malayan tropics. Other cultivated palms he described were areca nut palm (*Areca Catechu*), the sugar palm (*Arenga pinnata*), the sago palm (*Metroxylon Sagu*), and the rattans. Rumphius' work appeared before Linnaeus' *Species Plantarum* (1753) which started the binomial system of nomenclature and therefore Rumphius' names have no standing in botany. But many Latin names given by Linnaeus and later authors refer back to plants originally described by Rumphius.

An early work dealing with palms of Indonesia according to the Linnaean system was that of C. L. Blume (1796-1862) in the second volume of his *Rumphia* (1839-1843). Blume studied the native flora of West Java. He described for the first time a number of

genera, such as *Oncosperma*, *Orania*, *Cyrtostachys*, *Iguanura*, *Ceratolobus*, *Daemonorops*, and *Korthalsia*. His work was well illustrated. During this same period appeared Von Martius' *Historia Naturalis Palmarum*, the genera and species of palms (1823-1850); the part dealing with Indonesian palms dates from 1849.

The study of palms of Malaysia was continued at the end of the last and the beginning of the present century by Odoardo Beccari (1843-1920), an Italian botanist who traveled in most parts of the Indonesian archipelago, staying a long time in certain areas, and thus, like Rumphius, collecting first hand knowledge of palms growing in their native habitat. His palm studies appeared in the three volumes of *Malaysia* (1877-1890), and in the *Annals of the Botanical Gardens of Calcutta* (Vols. 11-13, 1908-1931). He laid a solid foundation for further monographic studies of Malaysian palms. Beccari was the first botanist who tackled the taxonomy of the genera of climbing palms, the rattans, highly valued for their economic uses but most despised by botanists and other people entering tropical jungles because they are so prickly and have to be handled with gloves or by people with thick skin.

Two leading palm specialists at the present time are Dr. C. X. Furtado at Singapore whose specialty are the palms of Malaya and British Borneo, and Dr. Max Burret of Berlin, who in 1939 made a journey to Indonesia and who recently published in *Willdenowia* (1953 and 1956) a very valuable key and check list of all the palms of the world. From these studies of the above mentioned botanists and more like those of Miquel and Scheffer, in the last century, we become aware of the richness of the palm flora of Indonesia. As parts of Sumatra, New Guinea, Borneo, and some parts of Celebes and the Moluccas, become further explored for palms, it is possible that about 100

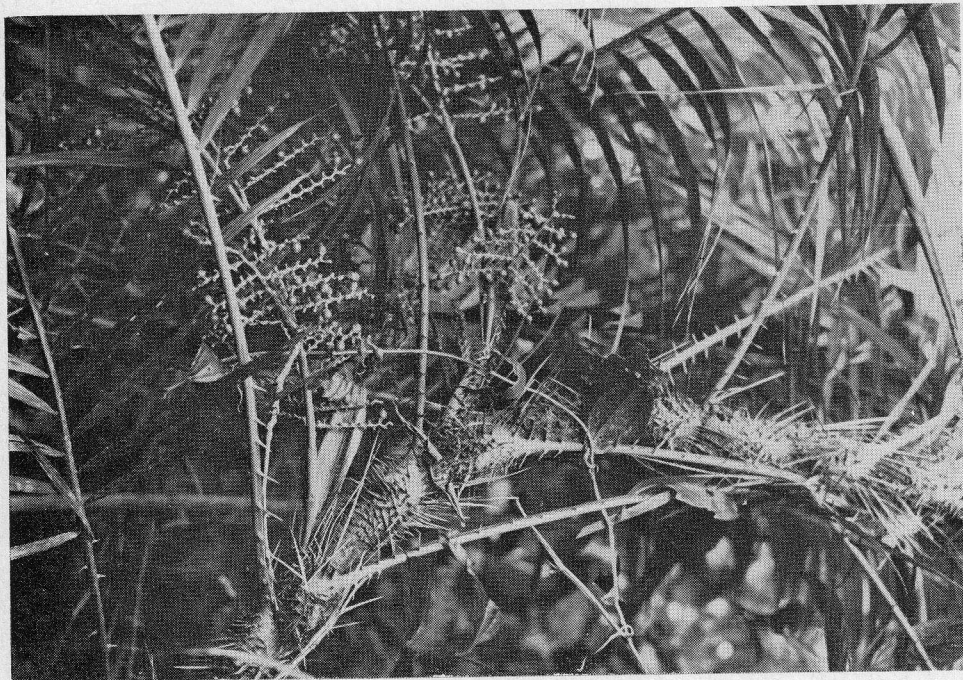
or more new species, especially of rattans and *Pinanga*, may be described.

Before describing the palms of Indonesia, I would like first to mention the different groups of palms and something on their distribution. The large group called *Lepidocaryoideae*, which is characterized by plants possessing scaly fruit and pinnate leaves, comprises about 500 species of rattans in three large genera — *Calamus*, *Daemonorops*, and *Korthalsia* — and some smaller ones. The center of development of this group is in the western part of Malaysian archipelago (Sumatra, Borneo, and to a lesser extent Celebes). The sago palm, *Metroxylon Sagu*, of eastern Indonesia also belongs to this group. A second large group of palms — the *Coryphoideae*—amounts to over 300 species. Leading in the number of species, especially in Borneo and Sumatra, is *Licuala*, fan-leaved dwarf palms of the undergrowth, especially in lowland forests on poor sandy soils. Also in this group are the giant plants of *Corypha*, palms which die after flowering, and the highly ornamental species of *Livistona*. Less known are the species of *Pholidocarpus* with larger fruit than *Livistona*. They are more or less restricted to marsh forests, while *Livistona* and *Corypha* may grow in dryer more open habitats especially along the coasts. The most interesting genus of this group is *Johannesteijsmannia* (*Teysmannia*), occurring in Malaya, Sumatra, and Borneo; it is a short stemmed plant but with giant leaves.

The remaining genera are usually included in the *Arecoideae*. The species are many and difficult to discern. *Areca*, with its species *A. Catechu*, is the very common betel nut palm or Indonesian kampongs (village orchards). But the leading genus in this group is the so called *pinang hutan*, *Pinanga*, represented with about 50 species in Malaya. The species are difficult to tell apart.



10. A fruiting plant of *Nypa fruticans* with old male inflorescences, Bogor Botanic Garden.  
Photograph by W. Meijer.



11. *Daemonorops* sp. in fruit, West Sumatra. Photograph by W. Meijer.

These palms will perhaps sometime become favorite palms in tropical shade gardens. They grow best at the border and in the undergrowth. They do not like open sun. Other members of this group are the decorative *pinang sinawar*, *Actinorrhysis Calapparia*, taller and more aristocratic looking and with more drooping leaves than *Areca*; it is also common in Malaysian kampongs and is probably native in eastern Indonesia; *Oncosperma*, with magnificent drooping inflorescences and spiny stems—one of the most attractive species is *O. tigillaria*, growing along the sandy coast inland of the muddy mangrove forests; another is *O. horridum*, growing inland in the forest of Sumatra and Borneo. Much rarer is *Orania* known from Malaya peninsula, Sumatra, west Java, and eastern Malaysia. Other genera in this group are *Rhopaloblaste*, *Calyptrocalyx*, and *Heterospathe*. Finally, there are the

two subgroups, *Kentieae* and *Ptychospermeae*, which center in east Malaysia with many genera which are totally lacking in the western part.

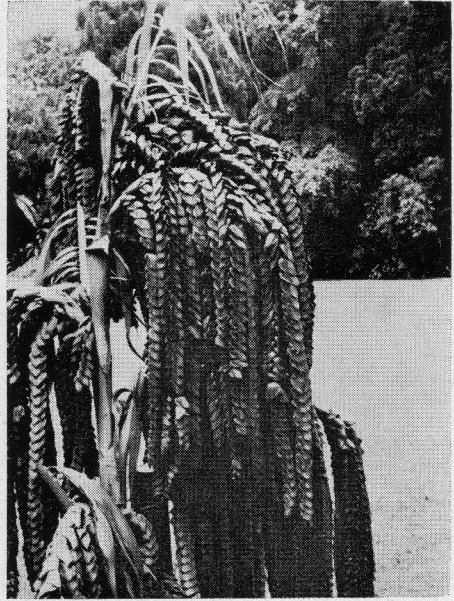
If a palm specialist were dropped somewhere on an island in Indonesia, he would be able to tell you from the palm flora where he is. A rich flora of rattans, of the dwarf fan palm *Licuala*, of *Pinanga*, and some scattered *Oncosperma horridum* and *Eugeissona* along riverbanks and on ridges, of *Pholidocarpus* in marsh forests and *Oncosperma tigillaria* along the coast—would tell him that he might be somewhere in Borneo (Kalimantan). *Pigafetta* and *Calyptrocalyx* combined with still a fairly large amount of rattans would mean the Celebes. A large number of *Kentia* and related genera without the rattan genera *Korthalsia* and *Daemonorops* would indicate that he is in the jungles of New Guinea (Irian). Some

genera would tell him nothing at all, because they occur in the whole Indian Malaysian region—*Corypha*, *Borassus*, *Orania*, and *Nypa*. The latter is a very common coastal palm forming extensive monotonous vegetation on the mudbanks at the estuaries of rivers and along the mangroves.

### Hunting Palms in Western Indonesia

Palms play only a secondary role in the physiognomy of the Malaysian forests. Rattans may be the most abundant of the woody lianas, but other palms occur scattered in the forest; often they are found only in the lowest understory. In some areas that are less favorable habitats for trees, certain palms may be abundant: fresh water swamps are rich in *Pholidocarpus*, coastal pioneer vegetation; former mangrove forests or secondary vegetation may be rich in *Livistona*; sandy ridges behind the mangrove may bear a kind of forest composed of *Oncosperma tigillaria*; steep rock cliffs may be favorite sites for *Livistona* and related genera. I have already referred to the extensive *Nypa* swamps along the coasts, especially where rivers form new mudbanks.

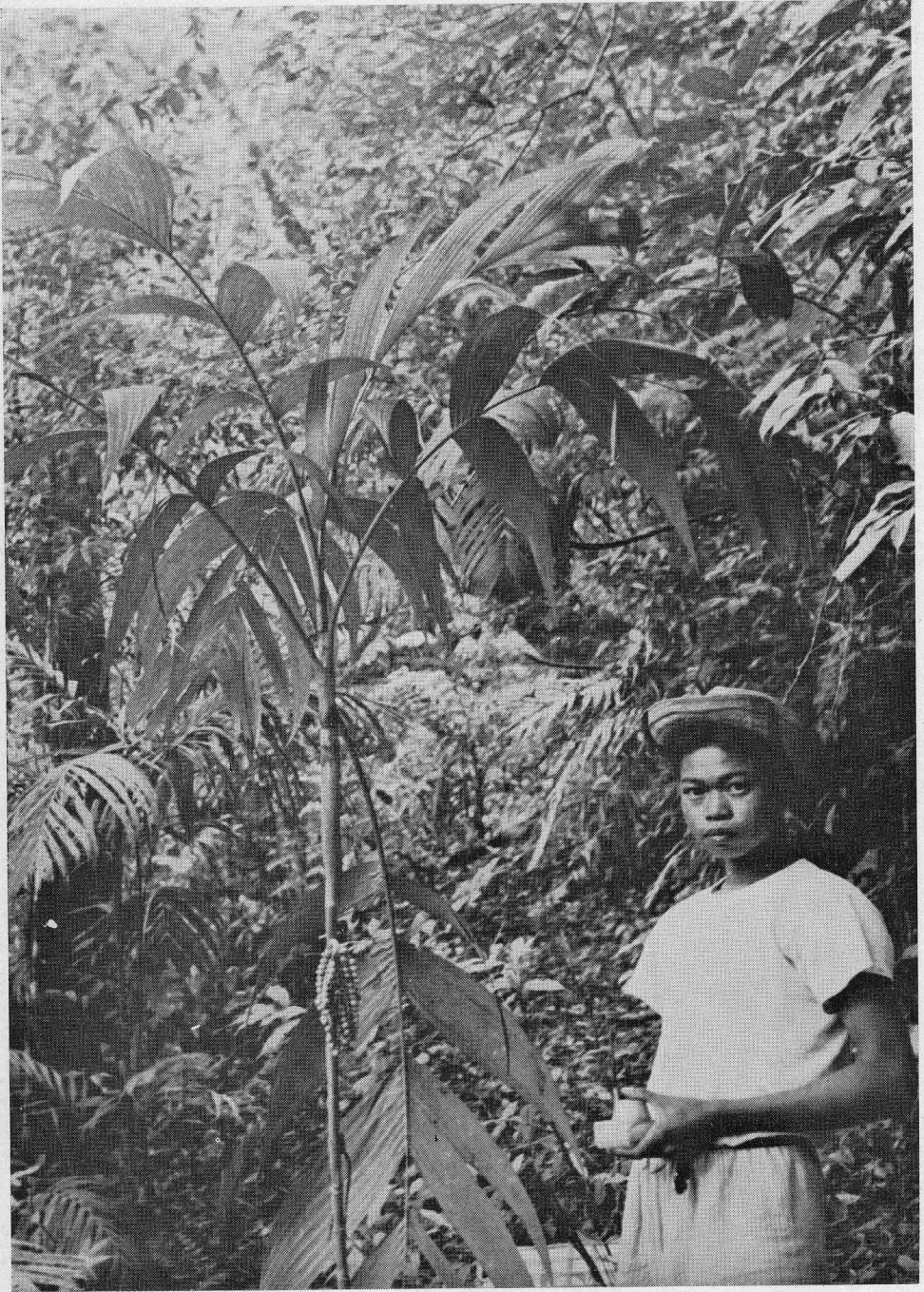
We may obtain a more intimate knowledge of palms if we start to hunt for them in these various localities. On a palm hunting trip in West Sumatra we may start along the coast south of Padang where the road intersects small patches of mangrove and *Nypa* swamps. It is very easy there to study *Nypa fruticans* without walking far on the mudbanks. After some search we may see a flowering *Nypa* with its upright branched inflorescence, long heads of very small male flowers surrounded by bracts and the female flowers in the center. Older inflorescences have withered drooping male branches and young



12. Inflorescence of *Plectocomia elongata*, a climbing rattan cultivated at Bogor. Photograph by J. Douglas.

fruits which grow into large heads, a kind of inflorescence which is unique among palms. The seeds are edible and the inflorescences may be cut off after the sap which contains sugar has been collected in bamboo containers. In small primitive houses along the road we see how the young leaves of *Nypa* are used for manufacture of cigarette paper. Older leaves are gathered and woven into mats which are used for roof thatching called *atap* by Malaysian peoples. If you get rattans from the forests you do not need any nails for binding this together into cheap and good houses.

Along the mangrove our attention is attracted by groups of slender *Oncosperma tigillaria*. The long drooping inflorescences of *nibung* are very decorative. They are spiny palms with strong stems. The inflorescences have double spathes, large enveloping bracts, and the ripe fruits are bluish colored. I saw extensive areas of this palm along the



13. A species of *Pinanga* in forested ravine, Mt. Sago, 3000 feet, West Sumatra. Photograph by W. Meijer.



14. One of the climbing palms, *Plectocomia* sp. in flower, West Sumatra. Photograph by W. Meijer.

coast of the islands Nunukan and Tarakan (East Borneo). At the latter island I once visited the house of a Dutchman which was completely built of *nibung* piles, floors of split *nibung* stems, and thatch of *Nypa*. Proceeding inland on our Sumatran trip we might visit the ravines and forests on the so called Bukit Barisan range, especially the Anei gorge. Here we see scattered groups of the inland *nibung*, *Oncosperma horridum*. The leaves are less drooping but the stems are also spiny. We hunted this palm in Borneo with the Dyak people who rated it highly for the edible cabbage of the young shoots.

Along the river in the Anei gorge grow beautiful groups of a species of *Pinanga*. Inside the forests on the slope of the ravine we may hunt for rattans, thin stemmed ones good for binding purposes, or heavy spiny ones like *Calamus ornatus* used for making sticks and called *rottan semabu* (bamboo-like rattan). The most decorative rattans are the species of *Plectocomia* which have apical inflorescences, the drooping branches of which are densely covered with small brownish bracts. Two other species in West Sumatra are the greenish *Plectocomia elongata* and the yellowish-brown *P. sumatrana*. These rattans are monocarpic — the stems die after flowering. The genus *Korthalsia* has the same feature but *Calamus* and *Daemonorops* have lateral inflorescences. Species of *Calamus* often have spines on the inflorescence branches, those of *Daemonorops* do not. Rattans are widely used for sticks and binding materials and for baskets. Forest people know that some species have edible nuts, and species of *Daemonorops* from Sumatra and Borneo furnish a special kind of lacquer, the so-called "Drake-blood."

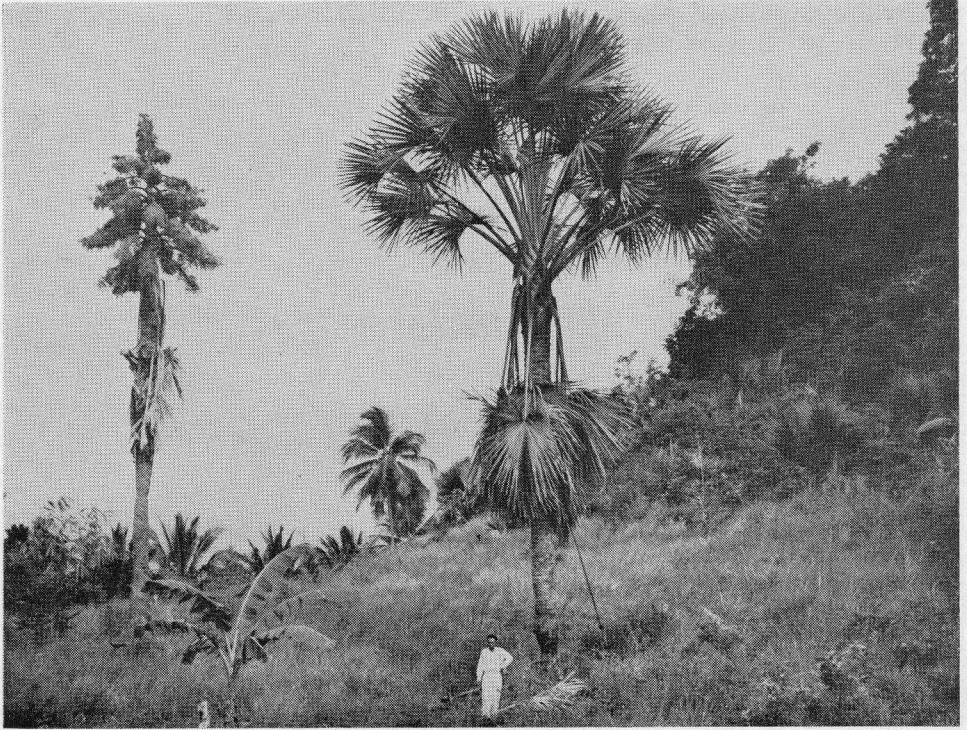
In the forests on these mountain

ridges are species of *Arenga* and the related *Caryota*, the latter with twice compound leaves and wedge-shaped leaflets. Two species, *Arenga pinnata* and *Caryota Rumphiana*, are cultivated in the Minangkabau kampongs. They both produce palm sugar and fibers from the leaf bases, called *idjuk*, are used for thatching the old style houses. It is a pity that so many houses are thatched now with corrugated iron instead of the black *idjuk* which readily becomes overgrown by mosses and ferns. In the Minangkabau kampongs coconut palms are widely planted. If you are thirsty you may ask for young fruits with their refreshing milk. *Cocos nucifera*—*kelappa*—grows in all the fertile cultivated valleys and coastal plains and mountains from sea level to about 2600 feet. Along the coast the coconut grows abundantly and the nuts are collected for the manufacture of the fat-containing copra, which is the dried endosperm.

Near the native houses we will always find some trees of *Areca Catechu*, the betel palm. The so-called nuts are one of the ingredients of betel—a mixture of betel nut, lime, gambir, and leaves of *Piper betle*. The fashion of betel chewing is widespread among the peoples of southern Asia and Indonesia and known from times immemorial. From a medical point of view it is better to chew betel nut than chewing gum because the areca seeds contain tannins which are good for intestinal disorders, and they also contain a vermicide alkaloid arecoline. Some varieties contain more alkaloid than others.

In the undergrowth of the kampongs occur spiny stemless palms, *Salacca edulis* which have delicious tasting but rather acid fruits. This palm is very commonly cultivated especially in east Java and we find the fruit on the markets.





15. *Corypha Gebanga* in North Celebes, at left a flowering plant with dying leaves. Photograph by W. Meijer.

In the kampongs we may observe how palm sugar is made. The sugar palm is a native plant in Indonesia. Its stems often covered with epiphytes such as ferns, mosses, and orchids in the axils of the old leaf bases. Primitive bamboo ladders are used to reach the inflorescences, the male flower cluster being the one usually used to obtain sugar. It is first beaten to stimulate the flow of juice and then it is cut off. Bamboo containers are hung below the cut surface and twice a day a boy collects the juice. The juice is boiled above a fire in a large iron pan. The fluid sugar is made in *Cocos* "cups." There is no better sugar than palm sugar from *Arenga*. Indonesian doctors prescribe it in cases of jaundice.

The fruits of *Arenga* must be handled with care. Their skins contain cry-

stals of calcium oxalate. However, the seeds are edible. They are much liked by civet cats which roam during the night in the kampongs and distribute the palms in grass fields far from the kampong. Palms are probably an older source of sugar than sugar cane which spread with barter from New Guinea to India before the dawn of Indonesian history.

The most famous source of starch and a staple food plant of people in the Moluccas (east Indonesia) is *Metroxylon Sagu*, a swamp palm. It is planted in western Indonesia. Minangkabau people call it *rumbia* and plant it in former coastal swamps. You must look well for flowering stems and to avoid confusing it with *Nypa*. *Metroxylon* dies after flowering. Besides the common non-spiny form occurs a spiny one

which is often considered to be only a variety of the same species.

After we have observed the palms of the native villages, the kampongs, we go back to the forests hunting for palms. On a trip to the high volcanos of Central Sumatra we note how the palm flora diminishes as we climb higher. On Mt. Tandikat and Mt. Sago we observe some special kinds of *Arenga*, and on the latter we find at least four species of *Pinanga* and two of *Caryota*, at a height of about 2600 feet above sea level. Only a few species of rattans are met with at an elevation of 5000 feet. On Mt. Korinchi a species of *Pinanga* grows at 6600 feet.

To see the rich palm flora of central Sumatra we might make an expedition into the dipterocarp-agathis forest in the sandstone region about 1600 feet altitude. It is similar to the forests at the same level and of the same geological formation in Borneo. In the undergrowth of this forest we note a wide variation in the species of *Pinanga*, some rather short stemmed, others larger; inflorescences upright or hanging; fruits yellowish or reddish in color; leaves coarsely or finely dissected. Some of these may be new to science.

Mixed with *Pinanga* are the small fan palms of the genus *Licuala*. The leafstalks are often spiny. The plants are low, almost stemless. The leaves are very useful for thatching material for small shelters. Rattans also occur scattered in such forests. They are most abundant in marshy places. Especially those species of *Calamus* and *Daemonorops* which have dense collars of "horsehair" which are interesting to observe but difficult to handle.

Marshy and peat forests in central Sumatra and east Borneo are the favorite locality of the huge fan palms, species of *Pholidocarpus*. It is not so



16. The crown of *Oncosperma horridum*, Mt. Tandikat, 2000 feet, West Sumatra. Photograph by W. Meijer.

easy to collect these. The leaves are easy to study while the palms are young and short-stemmed, but they are quite out of reach when the palms become older and stretch their crown of leaves and inflorescences above the marsh forests. Axes may be broken on the hard stems. The fruits are as large as lemons. The genus is related to *Livistona*. Several species of the latter are commonly cultivated as ornamental plants in towns in the lowlands of Sumatra and Java. Once I visited a locality where *L. rotundifolia* was growing wild on steep sandstone rocks near Kuliki, north of Pajakumbuh. About 60 palms were growing there on the rocks in a region where ninety percent of the forests had been cut away and the hills had changed into grasslands that burned annually. I managed to collect some fallen leaves, old inflorescences, and some fallen blue-coated fruits, and to make a series of photographs. This documentation was enough to identify the plants, though the fruits were lost afterwards during my sudden departure from west Sumatra.

Almost nothing is known about wild

species of *Livistona* as they occur in Sumatra. From the airplane on the route Padang-Bengkulu-Djakarta you may see big palms growing on the inner side of the mangrove. I am still not sure whether these belong to *Pholidocarpus* or to *Livistona*. On the south coast of west Java, *Livistona rotundifolia* is observed at such habitats.

If we fly over to Java we may see there some other interesting palms of rather impressive growth. One is the so-called gebang palm, a species of *Corypha*. Superficially it resembles *Livistona* but the inflorescence is quite different. *Corypha* species have terminal upright branched inflorescences. Flowering means thus the end of the life of the plant. The taxonomy of *Corypha* is another problem in Malaysian botany. In the Botanical Gardens at Bogor one can see the differences between *Corypha elata* from the Philippines and *C. umbraculifera* from India, but the exact taxonomic position of *C. Gebanga* from Java has not yet been determined. Detailed studies of the flowers and fruits are necessary to settle this point.

The rarest palm in Java is *Orania macrocladus*; it is known from only two localities. The species also occurs in Sumatra and in the Malay Peninsula. Other species of this genus are known from east Indonesia. The plants resemble superficially the coconut palm, but the inflorescences are very different and the leaves are more upright. *Orania* is a member of Arecoideae and more or less related to the American royal palms, *Roystonea*. During our trip in Java we will certainly meet somewhere near Djakarta or in central or eastern Java the famous lontar palm, *Borassus*. Formerly all *Borassus* from Ceylon, India, Siam, Malay Peninsula, Sumatra, Java, and east as far as Timor were considered as belonging to one species—*B.*



17. *Pigajetta filaris* from the Celebes as it grows at the Bogor Botanic Garden. Photograph by W. Meijer.

*flabellifer*. But Beccari called the Indonesian species *B. sundaica*. The matter should be investigated further. *Borassus* prefers regions with a rather long dry season. That is why it is seen more in the dryer central and east Java than in the wet western part. This palm plays an important role in Hindu-Javanese history. The Sanskrit name is *tola*. The leaves are called *ron tal* and were used to write on; rectangular slips were cut

from the leaves, punched in the middle, and threaded into books. It is assumed that the name lontar comes from *ron tal*. On Bali the name seems still to be *tala*. It is possible that formerly leaves of *Corypha* were also used for writing material. Every place where *Borassus* occurs abundantly, it is used as a source of sugar, for its edible fruits, the leaves for roof thatch, and the plants usually end their life on this earth at an age of about 50 to 60 years as building material.

Much more could be told about the palms of Indonesia from my own experience and from the rich literature on this subject. At least ten years of study in the field and another in the herbaria and libraries, besides a lot of skill and perseverance, will be necessary before a rather complete taxonomic survey of this marvellous fascinating family can be given in the great new *Flora Malesiana*, edited by professor van Steenis.

## Palms of Brazil

THOMAS MOSES

*São Luiz, Maranhão, Brazil*

Brazil's greatest lyric poet, Gonçalves Dias, when in exile, wrote of his native land as "The Land where Palm Trees Grow." No title could be more fitting. Brazil has always been recognized as the greatest country in the world for palm trees. In pre-Colonial days, the aborigines called this land *Pindorama*, which means "land of palms."

Surely no area of the earth's surface can be compared to Brazil for palms, for no other country has so many species or so many specimens. The species run to over 500 and the specimens to many billions. From the humid equatorial jungle of the extreme north to the plains and swamps of the extreme south, palms abound in almost uninterrupted sequence and in many areas there are dense palm forests which extend for hundreds of miles.

In my 30 years of incessant travel in Brazil I have had unending pleasure among the palms. Day after day, for weeks and months on end, I have traveled up and down the rivers by launch, canoe and raft, and penetrated the forests on horseback or afoot, admiring, studying, counting and collect-

ing. There's a world of interest in a princely palm, whether it be a solitary palm or one in a grove. First, one admires the beauty — elegant and exotic. Then one thinks of it as a member of a family and looks for characteristics and character. Closer observation will reveal something of evolution, environment and enemies. There is no end to the investigation. To the casual observer, however, a palm is a pleasure to the eye. He sees its feather-like fronds like plumes in a lady's headgear. A lone palm in the midst of exogens is a symbol of survival or an ornament to enhance the surrounding verdure, like lace in a female's mantle. And even in the arid areas, a little group of palms is an oasis in the desert, to cheer the heart and renew the body.

In Brazil, palms are the life of the people. Everything for simple people in primitive surroundings is taken from the palms. To them, the palm is the "Tree of Life." In their folklore they tell of a flood and an old chief, Tamandaré, who alone escaped by climbing a palm, ate the fruit to keep alive, and, when the waters subsided, disgorged the seeds to