PRINCIPES

Journal of The Palm Society

April, July 1968
Vol. 12, Nos. 2, 3

THE PALM SOCIETY

A non-profit corporation primarily engaged in the study of the palm family in all its aspects throughout the world. Membership is open to all persons interested in the family. Dues are $10.00 per annum payable in May. Requests for information about membership or for general information about the Society should be addressed to the Secretary.

PRESIDENT: Otto Martens, 308 Elfwood Drive, Monrovia, California 91016.

VICE PRESIDENT: John Popenoe, 10901 Old Cutler Road, Miami, Florida 33156.

SECRETARY: Mrs. Lucita Wait, 7229 S.W. 54th Avenue, Miami, Florida 33143.

TREASURER: Wallace E. Manis, 13601 Old Cutler Road, Miami, Florida 33158.

DIRECTORS: 1966–68, David Barry, Jr., California; Nat J. De Leon, Florida; Mrs. Alvin R. Jennings, Florida; Walter J. Murray, Florida; John Popenoe, Florida; Nixon Smiley, Florida; Dent Smith, Florida. 1966–70, Walter H. Hodge, Maryland; Eugene D. Kitzke, Wisconsin; Harold F. Loomis, Florida; Wallace E. Manis, Florida; Harold E. Moore, Jr., New York; Mrs. L. H. Wait, Florida; Mme. Ganna Walska, California.

PRINCIPES

JOURNAL OF THE PALM SOCIETY

An illustrated quarterly devoted to information about palms published in January, April, July and October, and sent free to members of The Palm Society.

EDITOR: HAROLD E. MOORE, JR.

ASSISTANT EDITOR: WARREN J. DOLBY

EDITORIAL BOARD

David Barry, Jr., Walter H. Hodge, Eugene D. Kitzke, Harold F. Loomis, Nixon Smiley, Dent Smith, P. Barry Tomlinson.

Manuscript for PRINCIPES, including legends for figures and photographs, must be typed double-spaced on one side of 8½ × 11 bond paper and addressed to the Editor at Bailey Hortorium, Mann Library, Cornell University, Ithaca, New York, for receipt not later than 45 days before date of publication. Authors of one page or more of print will receive six copies of the issue in which their article appears. Additional copies or reprints can be furnished only at cost and by advance arrangement.

Contents for April–July

Cultivated Palms of Venezuela
August Braun 39

Regular Features

Palm Briefs 104

News of the Society 105

Cover Picture

A branched specimen of *Hyphaene ventricosa* on the Rusizi plain, Burundi, Central Africa. See also page 104.

Mailed at Miami, Florida
October, 1968

Cultivated Palms of Venezuela

AUGUST BRAUN
Botanical Garden, Central University of Venezuela, Caracas

About 120 palm species lend a distinct accent to the public parks, spreading lawns, boulevards, and gardens of Venezuela. These palms represent the characteristic flora of tropical America. Equally, they symbolize as living monuments the history and culture of the country. During the period of the conquistadores, the royal palm, *Roystonea venezuelana*, occupied the center of courtyards and gardens; this palm was a symbol of special authority, and to this day has kept its place as the most beautiful of all palms.

Later on, with the construction of public parks and gardens, some more native species were added, such as *Aiphanes*, *Sabal mauritiaeformis*, *Scheelea macrocarpa*, and the now pantropical *Cocos nucifera*. Many decorative palms which adorn gardens nowadays have been imported by travellers and immigrants. These palms adapted themselves very well and also have been propagated successfully. This situation explains the relatively high number of foreign species compared with a rather restricted number of native species. Up to a few years ago, scarcely ten species of the Venezuelan palm flora were found here in cultivation. To import seedlings and young palms from other countries was much more convenient than to search for them in the wilds of Venezuela, then so difficult of access. Only with the opening of the country through a widespread network of roads and a well-functioning airplane service did collecting trips into the interior of the land become possible and material of the rich palm flora of Venezuela become accessible. This paper is a result of my participation in this undertaking. Collecting trips from the northern coast of Venezuela down to the borders of Brazil, from the Andes of the west to the swampy forests of the Amacuro Delta in the northeast, have not only furnished new palm material for the horticulture of the country, but also a new wealth of knowledge for the successful cultivation of these palms. In addition to the task of collecting, I have attempted to build up a fairly extensive photographic archive of this palm flora. Photography offers an ideal means to show something of the richness and essence of this palm flora which a mere collecting of material could never do. These photographs attempt to capture the nature of this palm flora for a better comprehension for the reader and better characterization for the taxonomist; they are also of value to the horticulturist.

The purpose of this paper is, therefore, to give a survey of the palms presently in cultivation in Venezuela, following them from their natural habitats in the primeval wilderness to the palm gardens; further, to demonstrate their usefulness, and also to list those genera and species which were collected from the wild for horticultural purposes, identified, and then cultivated.

Since in certain cases a specific epithet could not be established, the number of named species has remained relatively small. Nonetheless, I have to state that in a relatively short period of time, the number of palms collected and successfully cultivated in this country has risen to 45 species and that new material is being added constantly.

This paper came into being through

1. Map of Venezuela showing the states.

the generous help of some active palm friends. At this place I want to express special gratitude to Dr. H. E. Moore of the Bailey Hortorium, Cornell University, Ithaca, New York for his corrections and valuable suggestions. Special gratitude is also due to Mrs. Lucita H. Wait, Secretary of The Palm Society in Miami, who took upon herself much work in the publication of this paper. I am also indebted to Doctora Roth who translated this work from the German into English. My gratitude is also extended to Dr. J. Steyermark of the Botanical Institute, Caracas; his recent collections for the National Herbarium furnished me with important data. But also I want to express my gratitude to all other persons who in some way assisted me and who cannot be named here.

This first illustrated treatment of the palm flora of Venezuela I offer as a gift to the friends of tropical vegetation. I also hope that this work will win new friends for these unrivalled representatives of the plant kingdom, the palms.

THE PALM REGIONS OF VENEZUELA AND THEIR CLIMATES

Among American countries, Venezuela is one of the richest in palms. About 180 species occur in the various vegetation zones of the country and one may say that palms can be found in all 23 states of Venezuela. From the north to the south of Venezuela, the following palm regions may be emphasized: 1) the coastline; 2) the half-arid region; 3)

2. The Venezuelan coastal range with its cloud forests at a height of 1900 m. (6232 ft.).

the coastal mountains and the lower parts of the Andes; 4) the *llanos*; 5) the Guayana.

Enormous stands of coconut palms are a characteristic feature of the Venezuela coast, with a total length of 2813 kilometers (1758 miles). These are partly planted by man and partly they

originate by consequent self-dissemination. The humid and hot region near the ocean is the ideal climate for the coconut palm.

The coastline is followed by an arid region with its flora of cacti. This belt is in turn succeeded by the half-arid region which is particularly dry during the so-called rainless months from January to May. The humid and hot climate here is similar to that of the coastline, but without the salt ocean winds. A few *Syagrus* species may be found here, such as in the vicinity of Puerto Cabello (State of Carabobo) and near Puerto La Cruz (State of Anzoátegui). There, where denser shrub and tree vegetation occurs, species of *Bactris* may also appear. These areas are uninviting, especially during the dry season. In the rainy season, they are usually inaccessible because of the great number of climbing and creeping plants which there penetrate the rest of the vegetation.

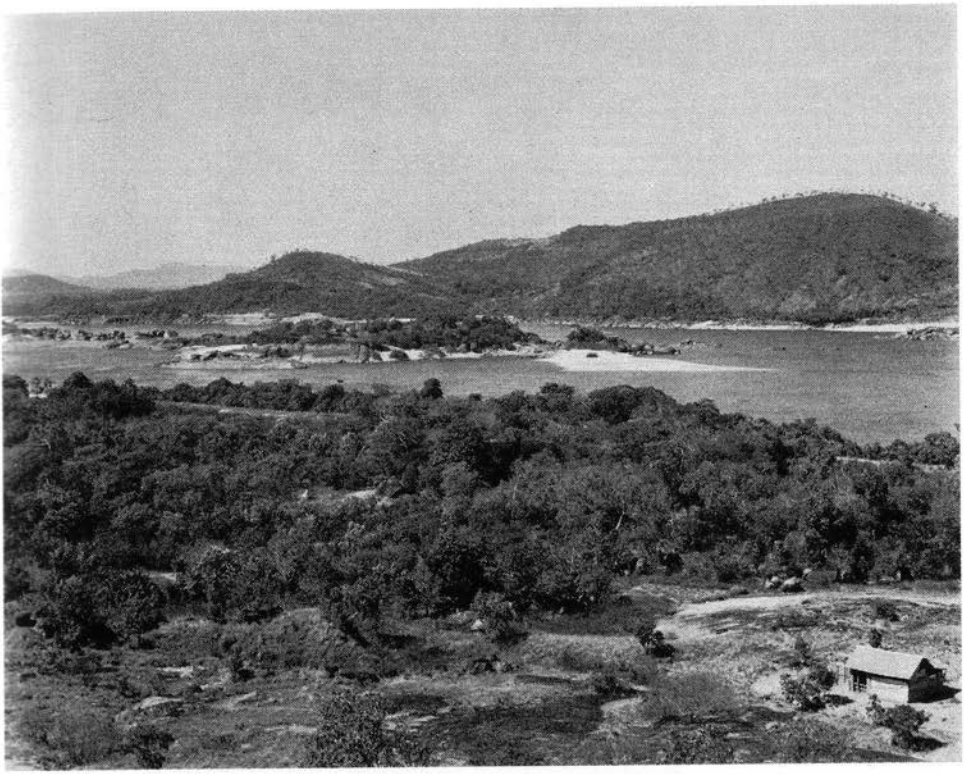
Entirely different and far more interesting are the palm regions of the coastal mountains and of the Andes. Here tropical cloud forests predominate with such typical genera as *Catoblastus, Chamaedorea, Ceroxylon, Geonoma, Aristeyera, Euterpe, Socratea,* and others. Most of these genera grow as understory palms or in forest clearings. The cloud forest is a kind of rain forest. Its daily precipitation often comes down only as mist, as the name indicates. In contrast to the rain forest, the cloud forest undergoes an arid period, although only for some weeks or months, usually in the first quarter of the year, but there is no absolute regularity. During the rest of the year, the relative humidity in the forest remains fairly constant between 90 and 100 per cent. The temperatures stand in relationship to altitudes. A more detailed description of the climate of the cloud forest zone will be given in another part of this paper, such as in the account of the natural habitat of *Geonoma pinnatifrons*.

Llanos is the name of the Venezuelan lowland. It constitutes a region of enormous extent, with a total length of 1100 kilometers (685 miles) from the Orinoco basin to Táchira, and a breadth of 500 kilometers (312 miles) from Carabobo to the river Meta. The vegetation of the *llanos* consists of savannas and gallery forests. The savanna is characterized by grassland, interrupted by shrub, tree, or forest formations.

A typical palm of the wide open *llanos* is, for instance, *Copernicia tectorum* in the states of Guárico and Anzoátegui. The genus *Acrocomia*, with two species in Venezuela, is furthermore a very typical element of the *llanos*. These palms are among the best known in this area and even penetrate into the Orinoco region. Special mention must also be made of the beautiful *Sabal mauritiaeformis* in the states of Zulia, Varacuy, and Carabobo.

In the open to dense forest formations of the *llanos* occur many species of such genera as *Bactris, Desmoncus, Aiphanes, Mauritia, Scheelea,* and others. These same genera also are found south of the Orinoco, often even the same species as in the north.

The region south of the Orinoco includes the Venezuelan Guayana with the Amazon Territory and the Amacuro Delta. In these areas, the largest stands of palms in all Venezuela thrive. Here genera are found which do not or only scarcely occur in other states, such as *Leopoldinia, Lepidocaryum, Socratea,* and so on. With the exception of the species which grow well in the montane forests, most palm species prefer the humid lowlands, either the vast open savannas or the primeval or gallery forests. The climatic conditions



3. The region of Maypures in the Amazon Territory of Venezuela. The upper Orinoco with its extensive palm regions begins here.

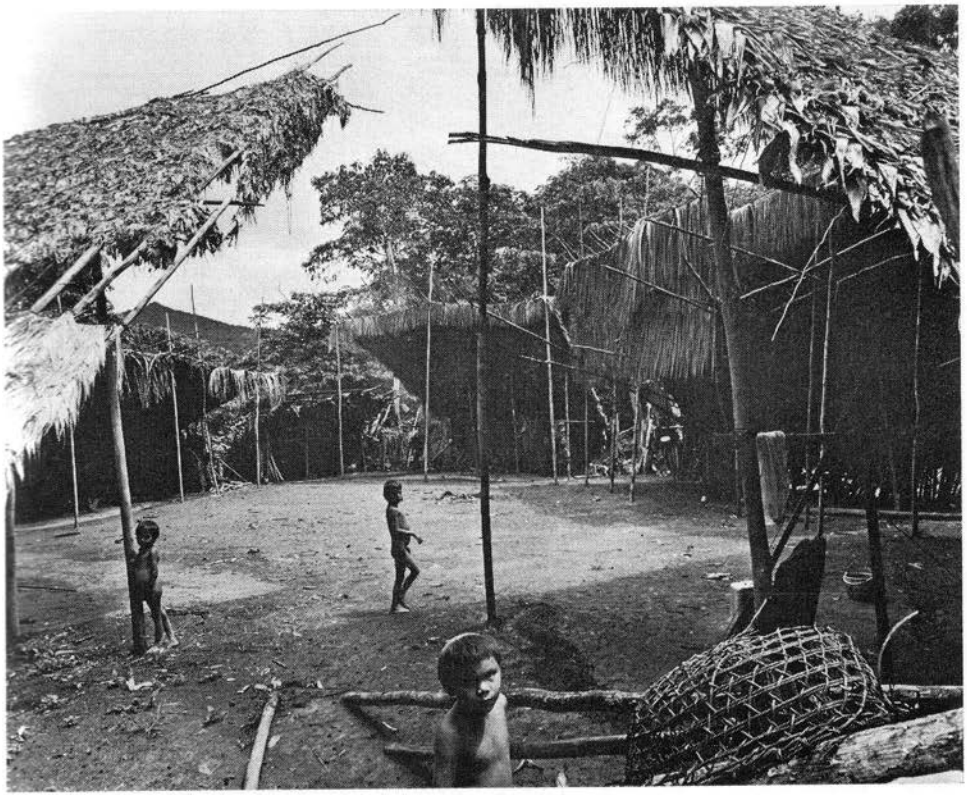
here vary considerably, as does the precipitation—between 1 and 4 meters (40–160 inches) per year. Here one can differentiate regular longer dry periods, and seasons in which it rains throughout the year with the exception of a few weeks. The torrential tropical rains of Guayana are notorious—10 centimeters (4 inches) of rain can fall within a few hours. The vast savannas are often flooded for months. The huge gallery forests on the upper Orinoco are likewise inundated from June on. The water level rises several meters over the river banks. Here is the most extensive palm flora of the country. *Astrocaryum* may cover entire forest tracts so densely that they become impenetrable. The genus *Euterpe* sometimes predominates over hundreds of kilometers. This is certainly the most abundant genus in these regions. In the northern part of Amazon Territory there are savannas which are interrupted by the enormous granite massifs of the Maypures region. Here are the natural habitats of *Syagrus orinocensis*, an extremely hardy and tough palm which grows abundantly on the steepest granite slopes, withstanding there many months of excessive dryness and high daytime temperatures. During the day, the air glimmers over these granite massifs and the temperature reaches the maximum in which a plant can barely survive. Dwarf shrubs, where they still exist, are stripped of foliage during this dry season, yet the palm remains green.

4. This *churuata* of the Piaroa Indians of the upper Orinoco is built almost exclusively from leaves of a *Geonoma* species.

In the deep lowlands there are grass plains turned into swamp during and after the months of the rainy season. Here the *Mauritia* palms give the otherwise desolate landscape a highly tropical character, indeed they are considered as the symbol of the Guayana region.

Where the humid jungle climate stimulates a dense and luxuriant vegetation, most frequent of all palms are species of the genus *Desmoncus*. As climbing palms they even reach the uppermost story of the giant trees and thus they make certain their distribution. In the Amacuro Delta, between the innumerable watercourses, *Manicaria saccifera* predominates. This palm is considered a symbol of the humid delta area.

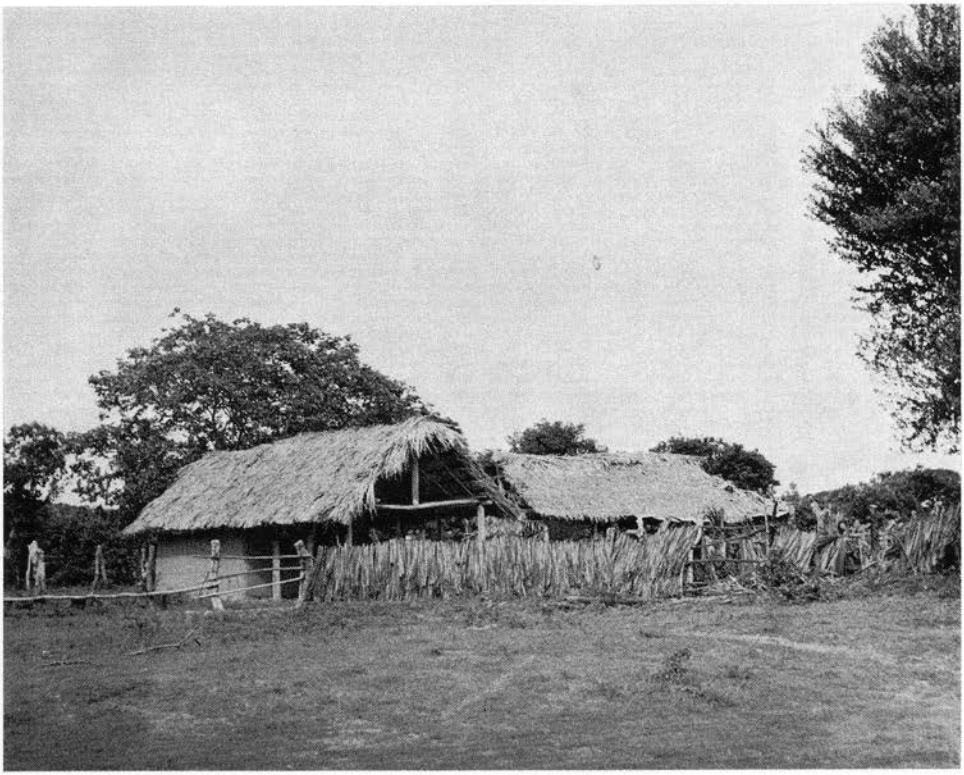
One of the most splendid fan palms of the Guayana region is *Sabal mauritiaeformis* growing in half-open forests. Its giant fans, appearing almost sky-blue, are unrivalled among all palms. In the upper Orinoco region, *Maximiliana Martiana* has not only conquered the flat savanna but also crowns rolling hills for hundreds of kilometers. Similarly, *Scheelea Humboldtiana* borders with majestic splendor the river edges of the great Orinoco River in the total delta area. In the blackwater region,



5. A Waika settlement in the upper Orinoco region; the span-roofs are thatched with *Geonoma* and *Jessenia* leaves.

Lepidocaryum species are found, beautiful palms bearing a resemblance to *Mauritia*. In the dense primeval jungle forests one may meet populations of *Leopoldinia Piassaba*, a fairly odd-looking palm; its trunk is hidden by plump, dark-colored masses of pendulous fibers. Where the jungle has turned into swamp in the upper Orinoco, large stands of *Socratea exorrhiza* are found. Their stilt roots, looking like giant polyps, are a key character of tropical vegetation. Further upriver, where the Orinoco is still a small stream, a rare palm of most unusual appearance is found, the so-called *barrigona* (big-bellied) or *Iriartea ventricosa*. Usually hidden in the evergreen virgin forest, occasionally a specimen 20–25 meters (66–82 feet) high overtops the forest roof with its leafy crown. The bolt upright trunks are swollen above the middle, thus giving rise to the name big-bellied.

It should be mentioned here that the genus *Geonoma* is the only terrestrial flora over large forest areas. These palms are often so numerous that they supply the Indians of these regions with all the building material for their settlements. Because of their particular elegance and beauty, the genera *Jessenia* and *Oenocarpus* should have been mentioned at the very beginning. This summary on palm habitats and climates will be supplemented with further data in another part of this paper.



6. A settlement roofed with palm thatch in Bolívar State.

ON THE USEFULNESS OF PALMS IN VENEZUELA

In the tropics, the palms are among the most important economic plants. They provide primitive tribes with everything necessary for their existence: wood for building their homes, leaves for roofing, fruit for consumption, fibers for ropes, nets, basketware, hammocks, and other articles. Those palm products which are found useful in the interior of the country are mentioned here, listed in order of their importance: 1) leaves; 2) stems; 3) fruits; 4) fibers; 5) roots.

An Indian village in the tropics is always built where a rich palm flora prevails, for here man depends on the palms. From the deepest primeval forest to close to the edge of modern cities, palms have offered lumber and roofing material for the construction of human dwellings up to the present time.

The traditional hut made of palm leaves is still in use today, especially among forest-dwelling Indian tribes. The durability of roofing made of palm leaves depends largely on the quality of the leaves used; for not all palms furnish equally good material. Yet, in practice, it is always so that only those leaves are taken and used which are available in the largest quantities. Thus, for instance, the leaves of *Geonoma* species are by no means very durable, but they are used by most of the Indian tribes in Venezuela because they are present in abundance. About 13,000

7. Part of this Indian plait work is made of palm products.

leaves are needed for a single span-roof of a Waika Indian hut; since each settlement has three to five such huts, the number of leaves needed is very high.

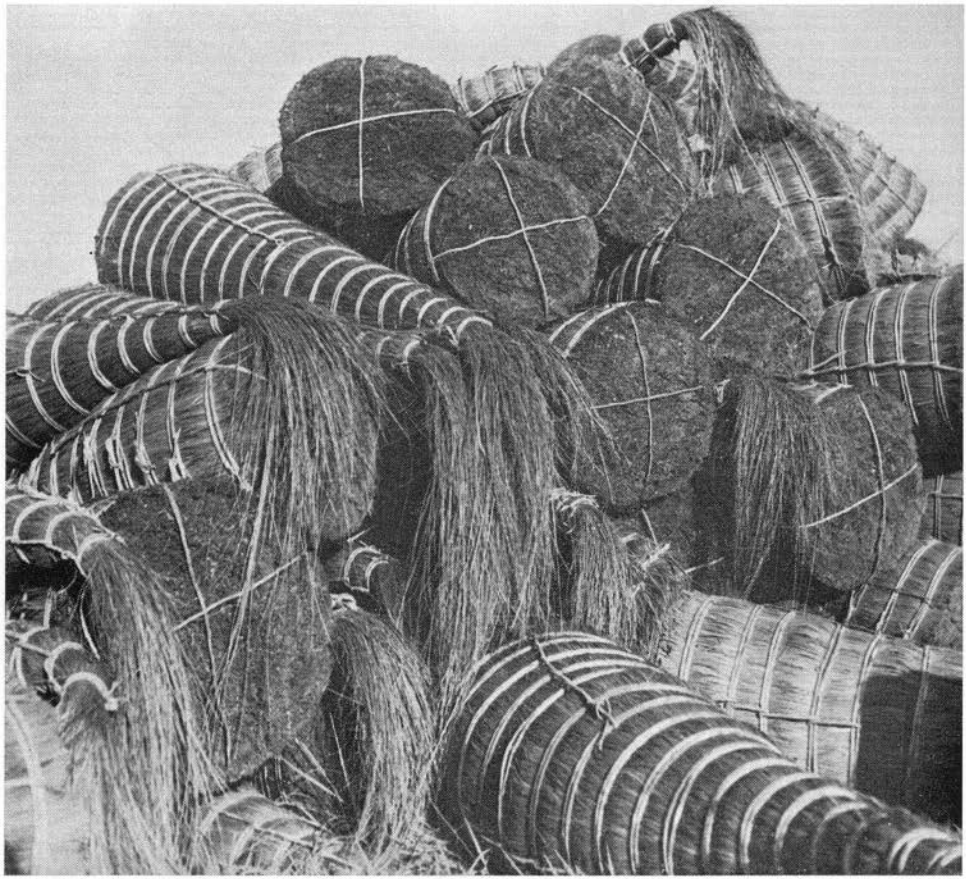
The Motilone Indians in the state of Zulia use as dwellings the so-called *bohio*, a building more than 40 meters (136 feet) long which is almost exclusively thatched with *Geonoma* leaves. Here about 100,000 leaves are needed for a good job. Now and then the Indians also use other leaves, especially for the entrance to their huts. The most durable leaves for roofing are furnished by *Leopoldinia Piassaba* of the upper Orinoco. The little Orinoco village of San Fernando de Atabapo owes all its roofs to this palm species, and often even the rest of the hut construction too. The leaves of *Scheelea* species are of similar good quality. Such palm-thatched roofs usually last ten to fifteen years. In the Amacuro Delta, where *Manicaria saccifera* occurs abundantly, its leaves are used for roofing. This palm has the largest and widest pinnate leaf of all palms in tropical America.

Of the fan palms, the leaves of *Copernicia tectorum*, *Sabal mauritiaeformis*, and species of the genus *Mauritia* are used for thatching. Seen from the inside of the house, such roofs are real works of art.

The narrow canoe or the basket-boat of the Indian is likewise roofed with palm leaves. The admirably beautiful Indian baskets and mats are mostly plaited of palm fibers. There are many different shapes, sizes, and weaving designs—enough to fill several museums with them. Moreover, hammocks, cradles, quivers, packbaskets and many other objects are made of palm fibers. Cassava, the vital manihot flour of the Indians without which they could not exist, is extracted with rods of palm fibers and packed in palm leaves. All Indian porters make use of temporary packbaskets quickly woven on the spur of the moment, using leaves of *Scheelea* and *Maximiliana*.

At least as useful as the leaves is the wood of the palm trunk. Utilization of the wood varies according to palm region and species found there. Of greatest value are, of course, those palms whose wood can be used as timber for construction such as *Copernicia tectorum* and *Socratea exorrhiza*. Their wood is at least as tough as ironwood and therefore much appreciated. The wood of *Euterpe* species which grows in very large stands in the upper Orinoco region is sometimes used for building huts and larger dwelling houses. For instance, to construct a mission house in the upper Orinoco region, about one thousand such stems were felled, cut lengthwise, and the boards used for floors and walls. I state this here to emphasize the usefulness of this palm species especially. The wood of *Bactris* is less known here, but it is used here and there by carpenters for making furniture.

The straight and slender stems of *Iriartella setigera* furnish the Amazon Indians with blowpipes for hunting. The



8. *Leopoldinia Piassaba*, native to the upper Orinoco region, furnishes this raw material for the brush and broom industry.

Waika Indians of the upper Orinoco make their hunting bows from the tough wood of *Bactris Gasipaes*. Mature old stems of *Mauritia flexuosa* are cut down by the Guarao Indians to procure the starchy pith. Roasted, it yields the daily bread for these Indians. Wine is obtained from numerous palm species. In Venezuela, many *Mauritia* palms are used for this purpose. After the trees are felled, holes are cut into the trunk. The gathering juice is at first sweet, and ferments later. The decaying trunks of several palm species provide a niche for the very fat larva of a beetle species eaten by the Indians as a great delicacy.

Among Venezuela's rich flora there is no plant family that yields so many edible fruits as the family of palms. The most carefree season for the Indian tribes of Venezuela is the time when the palm fruits are ripe. Full-fledged harvest feasts are then celebrated, and overeating is often followed by indigestion. The Waika Indians of the upper Orinoco celebrate the most important tribal festivals at the time of fruiting of *Bactris Gasipaes;* feasting on these palm fruits is the central point of the festival. Fresh fruits for consumption are collected

from the following palms: *Aiphanes*, *Jessenia*, *Mauritia*, and species of *Bactris*. Refreshing beverages are made from several kinds of palm fruits, for example from the fleshy outer coat of *Mauritia*. The fresh fruits of *Jessenia Bataua*, soaked in water for some days, yield an excellent and nourishing drink. The fruits of *Jessenia polycarpa* are squashed, soaked in water, and the juice used as a substitute for milk. The thick outer coat of these fruits is edible, has a sweet taste, and is very nutritious.

The most delicious beverage, however, is yielded by the coconut palm. The "coconut milk" in the cavity of the nut is rich in vitamins A, B, and C. But the most important produce of this palm is the copra from which the coconut oil is obtained. As a cooking oil, it is known all over the world today. The production of copra fat in Venezuela amounts to approximately 17,000 tons a year. The coconut palm is, therefore, the most important industrial palm of the country. Other important palms yielding cooking oil are species of the genera *Scheelea* and *Astrocaryum*. The fruit of these palms is gathered by the natives. The pulp of the fruit of *Jessenia Bataua* likewise yields a very fine cooking oil. The Indians extract this oil by boiling the fruits in water. Finally, it is reported that the fresh and liquid endosperm of unripe *Manicaria saccifera* fruits supposedly has a high curative value for cough and asthmatic suffering. The Indians use the roasted and grated fruit pulp of *Mauritia flexuosa* as flour in the preparation of some of their meals. Vinegar is obtained from the fruits of some species of *Bactris*. Creative carvings made from the husk of the coconut are quite well known; many kinds of ornamental chains of beads appealing to the feminine world are made of palm seeds.

Again it is the coconut palm with its thick fibrous cover around the nut which furnishes valuable raw material for the mat, carpet, and rope industry. The rough fibrous cover of the stems of *Leopoldinia Piassaba* of the upper Orinoco region yields very useful raw material for the brush and rope industry. The Guarao Indians of the Amacuro Delta sometimes use as loincloths the sacklike inflorescence bracts of *Manicaria saccifera*, which consists of a more or less dense layer of fibers.

A laxative is made from the root of the coconut palm. The Indians probably use the roots of *Mauritia* for the same purpose. Amazon Indians grate their cassava with the spinous stilt roots of *Socratea exorrhiza*. Many primitive Indians wear parts of palm roots around their neck and arm. It is possible that they ascribe magic powers to them.

THE CULTIVATION OF PALMS IN THE TROPICS

Some essential information on the cultivation of palms will be mentioned here briefly. All the following data result from many years of practical experience in the Botanical Garden of the Central University of Venezuela. This chapter includes sections on collection and sowing of seeds, germination data for Venezuelan palm species, care of seedlings, transplanting of palms into garden and park, diseases and pests of palms.

Collecting Palm Seeds and Their Treatment Until Sowing

Collecting palm seeds, in a technical sense, does not mean simply to take everything that is available but to select skillfully seeds from mature infructescences. Only under extreme circumstances should fruit not quite ripe or already stale be gathered. Whether the seeds have a hard shell or a fleshy cover, the collected material must be treated to

9. Sowing beds with seedlings of different species. Easily recognizable in the two containers in the foreground is the coarse soil referred to in the section on sowing which keeps the seeds moist, warm, and aerated.

remain viable unless it is to be sown within a reasonable period of time. An old sin committed by gardeners even today is simply to dry the seeds and to store them in paper bags until they are needed. As a rule, such seed does not germinate at all or at least very unsatisfactorily and over long periods of time. A better way is to stratify the seeds; it is also a much more economical, simple, and neat method.

Depending on the quantity of seeds, they are put into pots, tin cans, or other containers, a layer of sand alternating with a layer of seed. The important point in this process is a certain degree of dehydration of the seed. The sand should be moist, neither too fine- nor too coarse-grained. The seed should thus be stored in a place safe from the influences of weather, and with a sufficient supply of air. During storage the hu-

10. Seedlings of *Bactris* placed on moist moss and intended for shipment.

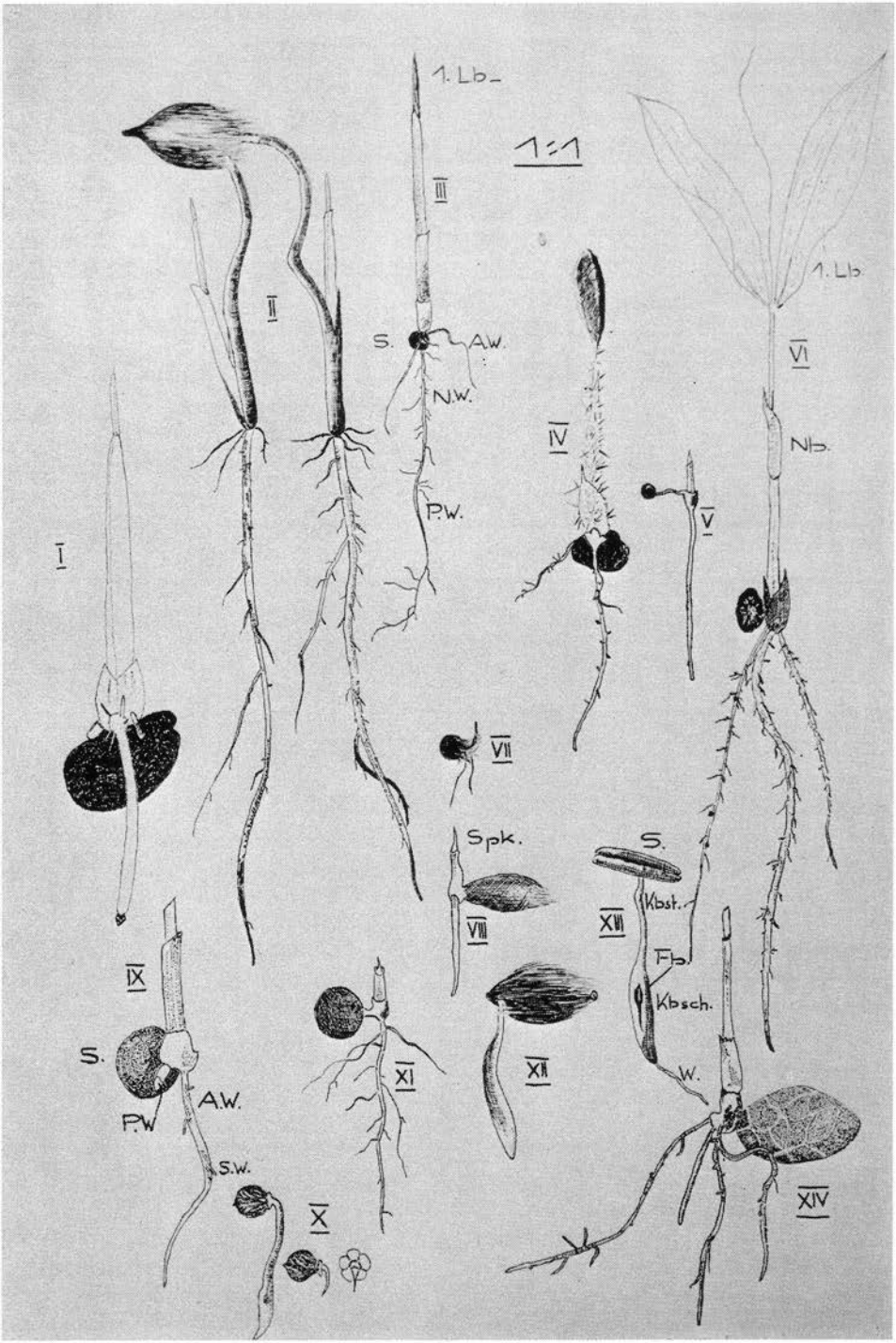
midity needs to be checked, and damage from rats and mice prevented. In place of sand, some other material for conservation can be used, such as peat-moss mixed with coarse sand. This might prove a better method for more delicate and valuable species. Seed conserved in this manner retains its viability and will start to germinate independently, some types sooner, others later, varying from species to species. It is therefore important to label the stored seed with name and date. This way, the time point of germination can be more or less guessed and the seed taken out of storage. Seed shipped by mail should be treated in the same manner in order to prevent early-germinating seed from desiccation.

In the wild, the collector often can only pick up seeds and seedlings from the ground at the foot of the mother plants. Such material should be taken up very carefully, wrapped in moist moss and packed in plastic bags. Damp sand or humus will also do, if moss is not available. Such packages also need a sufficient air supply, must be protected from pressure and bruises, and likewise must be checked against drying out. Further, it is advisable not to remove the fleshy coats of the collected seed such as *Bactris, Aiphanes, Desmoncus, Jessenia, Mauritia,* before it is shipped. It is better to leave such seeds in their covering until the time of sowing or storing.

Seed from diseased stock, infected with fungi, or particularly damaged by pests should be disinfected before storage.

Sowing

Seedbeds should be placed in different locations, depending on the origin of the palm seeds, whether collected in cool montane forests or in hot lowlands. For seed from higher elevations to be propagated here in the tropics, a place with lower temperature should be chosen. It is sufficient if the seedlings are exposed to the morning sun until about 9:00 A.M. and shaded for the rest of the day. Palm seed coming from hot lowlands must be treated quite differently: it is sown in hotbeds exposed to the sun all day long. A glass cover is recommended, at least for seeds difficult to germinate. The space necessary depends on the quantity of seed. The commercial grower will sow in large cold- or hot-frames; for the amateur a flower pot might be sufficient. In any type of container, drainage is very important. The soil used is a matter of preference, but the beds should not be shallow and the soil should be loose and friable. Instead of the standard soil mixtures, other media may be substituted and are used in more progressive establishments. In Caracas we utilize a mixture of fine woodshavings and rotted horse manure. The seeds germinate very readily in this loose material and find sufficient moisture and nutrients until they are transplanted. Removal of the seedlings from this substrate is very simple and does


1. Lb.
1:1
III
II
S.
A.W.
N.W.
P.W.
IV
V
1. Lb
VI
Nb.
I
VII
Spk.
VIII
S.
Kbst.
XIII
Fb
Kbsch.
W.
IX
S.
A.W.
P.W
S.W.
XI
X
XII
XIV

not damage the roots. A disinfection treatment of seed before sowing is strongly recommended, particularly if the seed has been purchased.

Seeds are sown together according to size. Small seeds are planted shallow, with a glass frame rather close to the soil level. Large seeds, such as *Scheelea*, *Attalea*, *Cocos*, etc. should be placed in a deeper hot frame. Fleshy seed coats, as those of *Bactris Gasipaes*, are best removed before sowing to avoid the danger of mildew. If such seeds are allowed to ferment for a few days, the flesh can easily be removed and the seed sown.

Seeds with a thick fibrous cover, like *Cocos nucifera*, species of *Scheelea*, and many others, are treated differently: here it is of advantage to the seed and seedling not to remove the fibrous cover. Whether sown in pots, open beds, or frames, the seed is best covered with the same loose medium as used in the rest of the pot or bed. Other material can be employed, such as a mixture of peat and coarse-grained sand for delicate and valuable species. For the seed of montane palms, a covering of sphagnum moss has brought about good germination results. Ample watering is important before the frames are covered with glass or wire mesh. Labels with the names and sowing dates are also necessary.

Seeds that are difficult to germinate and all those from the hot regions should be kept in full sun, so that in the hottest hours of the day the temperature may rise to 40° C. (104° F.). Only during midday heat should the glass frames be raised slightly or receive some partial shading.

In some cases it is advisable to sow the seeds into deep cans. This applies to species which quickly develop deep roots and therefore are difficult to transplant. Sometimes it may be suitable to plant the seeds directly in their permanent location, such as the native *Syagrus orinocensis* or *Cocos nucifera*. The hole dug should be the size sufficient for a young palm, and the soil again porous and deep. Of course, such sowing must obviously be protected from trespassers and therefore it is more suitable for private gardens.

Germination Data for Venezuelan Palm Species

No plant family shows so many peculiarities with regard to germination as the palms. Germination depends largely on fresh and well-treated seed material. But satisfactory results also depend on the proper care of the sown seed. Kept too dry even for a short time, seed may lose its viability or germination may be delayed for many months. Seed or seedlings kept too wet rot easily; for example, if with improper drainage or lacking drainage.

←

11. Seeds of various palm genera in different stages of germination: all are natives of Venezuela except *Caryota*, *Howeia*, and *Phoenix*. I, the semi-lateral seedling of *Mauritia flexuosa;* II, two seedlings have grown out of a seed of *Scheelea macrolepis;* III, *Roystonea venezuelana;* IV, strongly armed seedling of *Bactris* sp. with first leaf; V, seedling of *Sabal* sp. about 6 weeks after sowing; VI, seedling of *Desmoncus orthacanthos* with first leaf; VII, seedling of *Euterpe* about 2 weeks after sowing; VIII, *Howeia Belmoreana;* IX, *Dictyocaryum fuscum* 5 weeks after sowing; X, *Caryota mitis*, two seedlings at 1 month (r.) and 1½ months (l.) after sowing; XI, *Ceroxylon Klopstockia*—note the strong roots which have been developed within the same period of time as those of the seedlings of other genera; XII, seedling of *Syagrus* sp. about 7 weeks after sowing; XIII, *Phoenix dactylifera;* XIV, seedling of *Catoblastus praemorsus* about 13 months after sowing. Abbreviations: Aw—adventitious root; Fb—first leaf-blade; Kbsch—cotyledonary leaf; Kbst—cotyledonary stalk; Lb—leaf-blade; Nb—ligule; Nw—lateral roots; Pw—primary root; S—seed; Spk—plumule; Sw—lateral root; W—root.

TABLE 1. *Germination results for diverse genera and species as obtained in the Botanical Garden at Caracas*

Name	*Germination time in days*
Acrocomia aculeata	180–300
Aiphanes aculeata	65
Aristeyera spicata	90
Astrocaryum sp.	130–347
Bactris Gasipaes	65– 70
Bactris major	150
Catoblastus praemorsus	270–330
Ceroxylon Klopstockia	300–490
Chamaedorea pinnatifrons	115–125
Desmoncus orthacanthos	40– 80
Dictyocaryum fuscum	112–160
Euterpe sp.	14
Geonoma pinnatifrons	80– 90
Iriartea sp.	90
Jessenia sp.	25
Jessenia Bataua	40
Jessenia polycarpa	20– 30
Manicaria saccifera	115–130
Mauritia flexuosa	65
Mauritia flexuosa (stale seeds)	210–270
Mauritia subinermis	75
Maximiliana elegans	160
Oenocarpus caracasanus	38– 50
Roystonea venezuelana	60–165
Sabal mauritiaeformis	55– 60
Scheelea macrocarpa	60–120
Socratea exorrhiza	45– 70
Syagrus orinocensis	30– 40
Syagrus sp.	90–110

A most peculiar phenomenon and one typical for the palm family is the delayed germination of the seed at certain intervals. Early-germinating seeds, usually few in numbers, are followed at intervals by more groups of germinating seeds. Frequently, but depending on the species, the second batch represents the majority of seedlings. Delayed germination continues, but in reduced numbers. Often the last seedlings appear when the first seedlings have developed into strong young plants. There is an obvious benefit to the plant in delayed germination, especially in the natural habitat. Losses caused by climatic influences or herbivorous animals thus may be replaced by late-germinating seeds.

Tables 1–4 show germination results for a number of native Venezuelan palm genera and species.

Treatment of Seedlings Until Potting

After germination, the seedlings are kept in light shade and the glass frames are opened more frequently in order to harden the seedlings. As indicated by the germination results above, the seedlings appear at irregular intervals, and

12. Seedlings of different species of palms in a bed.

thus transplanting takes place accordingly.

Frequently the first seedlings have already been transplanted twice by the time the last seed germinates. Our regular procedure is to transplant larger seedlings from the seedbed into pots, tin cans, or plastic sacks. Plantlets with

TABLE 2. *Germination results for Astrocaryum sp. (from Alto Paragua, State of Bolívar)*

After 160 days	3 seeds germinated
After 185 days	3 seeds germinated
After 220 days	2 seeds germinated
After 253 days	3 seeds germinated
After 347 days	1 seed germinated

13. Seedlings of *Chamaedorea* transplanted into tins.

long fleshy roots must be lifted out carefully as they are extremely susceptible to root damage. The size of the container depends on the rate of growth of the individual species and the size of the seedlings in general. Containers neither too large nor too small should be chosen; if they are too small, the plants will suffer from lack of moisture and nutrients, if they are too large, it

TABLE 3. *Germination results with stale seeds of Desmoncus orthacanthos*

After 300 days	20% germinated
After 540–660 days	70% germinated
After 730 days	2% germinated

TABLE 4. *Germination results for Roystonea venezuelana*

After 60 days	15% germinated
After 120 days	45% germinated
After 150 days	29% germinated
After 165 days	11% germinated

may happen that slowly growing species develop too slowly, the soil turns acid, and the plants die off. Therefore different containers should be used for delicate species, for fast growing plants, and for deep-rooting species such as *Copernicia, Maximiliana, Scheelea.*

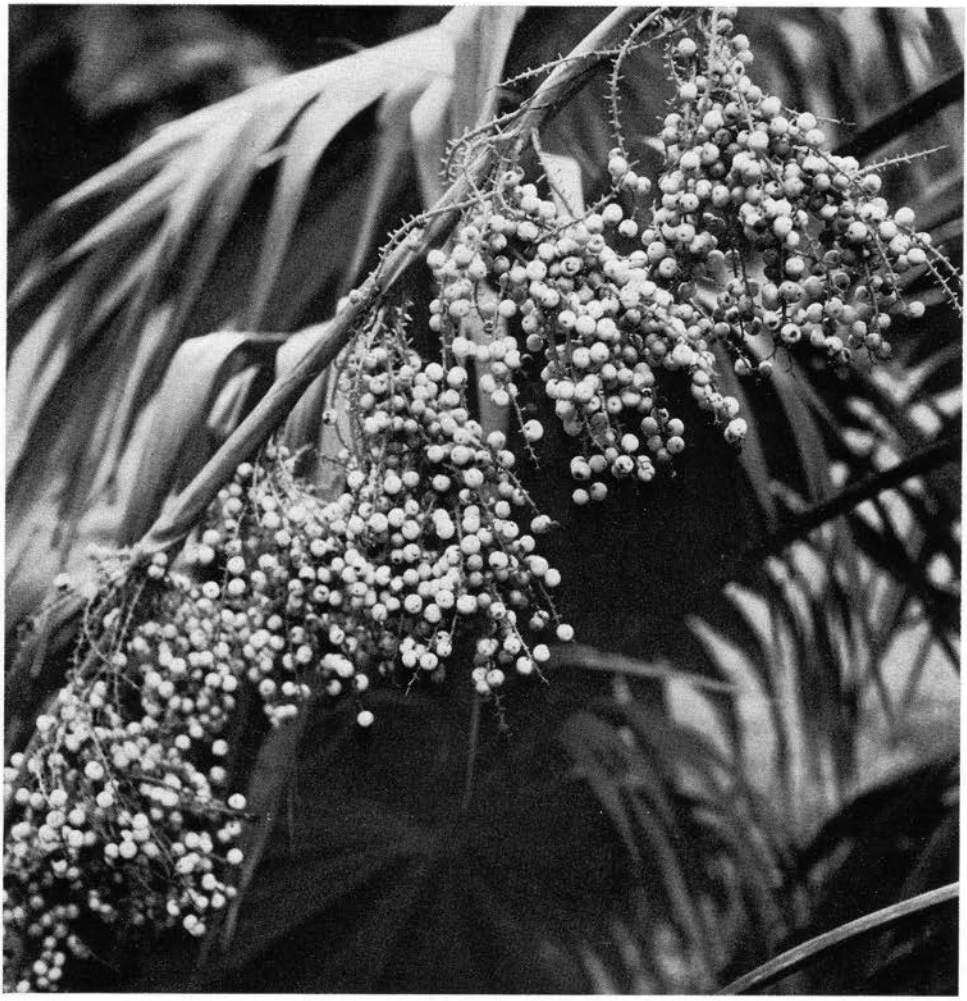
The soil used here depends on the rate of growth of the individual species. Above all else, it should be loose, rich in nutrients, and have good drainage qualities, perhaps by mixing in coarse-grained river sand. Delicate *Chamaedorea* spp. are given a mixture of leaf mold, old cattle manure, with sand added. More robust species profit from a mixture of two parts loam, one part old cattle manure, some sand, horn chips and bone meal. After potting, the seedling should be well watered. A commercial grower will put the pots into special frames. The plants are allowed to grow fast at first, later they will be hardened again. Here in the tropics, the more robust plants can be put directly into semi-shade, bypassing the special frames mentioned above. The palm seedlings now remain in such location until a further transplanting or until they are dug into their permanent location. At such times it will be necessary to loosen the hardened soil around the plants, apply a well-balanced fertilizer, and look for disease and pests.

Transplanting Palms into Gardens and Parks

The palm, as the most elegant product of tropical horticulture, can only attain its full beauty if given its appropriate location and if the soil is of the right type. An appropriate site is determined according to the need of the species for exposure to the sun—whether full daily exposure, semi-shade, or shade. Preparation for planting must take soil conditions into account. When the holes are dug it is always advantageous to add good fertile soil. Two different sizes of holes may be distinguished: for tall growing palms, such as *Roystonea, Acrocomia, Maximiliana, Scheelea,* etc., a hole of one cubic meter (or 1 cubic yard) needs to be dug; for smaller species, a hole of one-half to three-fourths cubic meter is sufficient. While filling the hole, the soil should be firmed to prevent it from sinking later. The soil level around the plant is best kept about 15 centimeters (6 inches) below regular ground level, to insure easier watering. Filling the shallow hollow with straw, leaves, grass, sawdust or similar material helps to keep the soil moist and porous. Now and then weeds need to be hoed and the soil loosened. Regular watering is of particular importance. Two or three times a year, palms of the tropics are given a complete fertilizer. The first application is made in the first days of May, at the beginning of the rainy season, the second four months later, and the last application at the end of the year.

DISEASES AND PESTS OF PALMS

A palm is healthy if its physiological requirements can be met and adjusted harmoniously to its external environment. If this balance is disturbed, the



14. The white infructescences of *Thrinax* are especially decorative for tropical gardens.

plant gets sick. Then in spite of its adaptability it can no longer maintain its normal development and metabolism. As a consequence of such disturbances a palm loses its healthy appearance, its eagerness to grow, and its fertility. The result is, horticulturally speaking, complete or at least partial depreciation of the plant. Diseases are hardly to be distinguished from damages. A disease presupposes that a plant generally reacts actively against influences coming from the outside. Contrarily, no one will consider leaves chewed off by herbivores a disease. One can often distinguish a disease from physical damage, in that the cause of a disease usually requires some research—it is not easily apparent —while damages can be easily recognized by the revealing bruises or wounds.

Susceptibility of Palms

With reasonable treatment, palms are relatively seldom subject to diseases or

physical damages. The degree of susceptibility of a palm depends on its state of development, on its heredity, and on its environment. Damages caused by bacteria, fungi, or animals will be more effective if favored by faulty cultivation. In fact, faulty cultivation alone, without the help of parasites, can be the cause of diseases and physical damage.

Diseases Caused by Bacteria and Fungi

Bacteria and fungi belong to the plant kingdom. As a cause of disease, both are responsible for severe losses among palms. The bacteria are their worst enemies. Resulting damages are irreparable, because the presence of bacteria is only recognizable after the harm is done, when, for all practical purposes, the plant is dying. The best known example is the red ring disease of the coconut palm *(Chitinoaphelenchus cocophilus)*. Infected plants show the typical drooping of the leaves, soon followed by the death of the plant. Such trees must immediately be cut down and burned. The African oil palm *Elaeis guineensis* is subject to similar destruction. A new disease in Venezuela, commonly called *pudrición del cogollo*, is presently beginning to evoke much concern among plantation owners.

Among the fungi, rusts may cause severe damages. The rust disease is recognizable by yellowish to rusty brown spots formed on the upper leaf surface. Similar damages are inflicted by the so-called brown-spot disease. Both of these fungi may even attack small seedlings. Palms in this stage are especially susceptible and the loss may be extremely heavy if preventive measures are not taken immediately. To protect seedlings from fungus diseases in general, it is advisable to disinfect the seed before sowing. Otherwise palms infected with leaf rust must be treated repeatedly with copper or sulfur compounds until the disease has completely disappeared. As rusts and brown-spot diseases may occur in the tropics throughout the year and particularly during the rainy season, periodical spraying proves useful, especially for susceptible palm genera. Botrytis fungi which attack plants especially in propagation frames are practically unknown here among the palms. Botrytis may eventually appear if seedlings or young plants are kept too moist, especially if the frames are kept tightly shut. Frequent airing is an easy remedy here. Infected seedlings should always be removed immediately to avoid further spread of contamination.

Damages Caused by Animals

Quite a number of animal pests may attack the palms. Mentioned here are especially: mice, caterpillars, leaf aphids, root aphids, mealy bugs, scale insects, thrips, red spiders, slugs.

Mice and rats show a preference for oily palm seed. In attacking seedbeds and pots they are capable of causing considerable damage in a short time. Even seedlings and young plants are not safe; young shoots and stems are gnawed off, and even spiny species are not spared. It is therefore advisable to protect both seed and young plants from these rodents. Disinfecting the seed (which includes a protective, obnoxious coating against animal pests) is therefore recommended especially for large-scale undertakings. Seed and seedlings may also be protected by wire fences or similar means. In individual cases, traps or poisons may prove sufficient.

The main damage caused by animals comes from a large number of insects. In order not to exceed the scope of this paper, only the most important and most common insect pests will be men-

15. A leaf attacked by comma scales showing the light-colored spots caused by their sucking activities.

tioned here. Leaf aphids are found primarily on young leaves not yet unfolded. Their presence is usually easily recognizable by the simultaneous presence of ants which benefit from these insects. The young leaves of delicate palm species in particular are easily harmed or even stunted by the sucking activities of these insects. In individual cases aphids are gotten rid of by washing the leaves with soapy water. Otherwise, control can be obtained by spraying with chemicals, such as Endrin or Nicotin.

Control of root aphids creates a greater problem. As they live in the soil and are thus hidden from view, the first task is to find them. Potted plants are attacked by them most frequently, since they also suffer the most from drought. Infected palms more or less cease to grow and lose their healthy appearance. Suspected plants should therefore be examined for such pests. As a remedy, the plants are first soaked in water for some time, then a solution of 0.5% Endrin or Nicotin is applied to the soil. Plants regularly kept moist are rarely attacked by root aphids.

Several species of scale insects have a preference for palms. Among these the comma scale is the best known and doubtlessly also the worst enemy of decorative palms in this country. Named because of its appearance, it affects the plant like other scale insects by sucking leaf sap, leaving behind the well-known light-colored leaf spots. Scale insects may spread so rapidly that within a short period of time the plants appear almost blackish. Affected plants not only suffer considerably but also lose their horticultural value. Control of all scale insects will be achieved by using an oil emulsion spray at a rate of 50 cubic centimeters (16.9 fluid ounces) per 10 liters (10.5 quarts) of water. Severely attacked plants will have to be treated at monthly intervals until they are free from these pests. In general, it is advisable to apply three protective sprays annually, since in the tropics scale insects multiply prolifically throughout the year.

In contrast to scale insects, mealy bugs are more mobile, do not occur as frequently, and are more easily controlled. They are found almost exclusively on the underside of leaves, and then usually in such dense crowds that plants soon lose their good appearance and value. Control can be gained by weekly spraying with 1% Endrin.

A large number of butterflies choose palms to deposit their eggs. The caterpillars soon feed voraciously on the leaves. The damage often presents a sorry sight: all that is left are leaf stalks with some remnants of vascular tissue hanging from them. Such plants lose their value until new leaves are put forth. If the presence of caterpillars is established, spray must be applied immediately to avoid further damage. A single spraying with 1% Endrin usually will suffice. Then there is also the so-called cutworm which feeds at night and creeps back into the soil near the plant early in the morning. These cutworms show a preference for seedlings and therefore are found in seed beds. Preventive measures are here called for, such as treating the soil with Hexa. If damage has occurred already the presence of these worms needs to be verified in the early morning hours, and a spray of 0.5% Endrin applied.

Much more difficult to control are two insect pests attacking the coconut palm *(Cocos nucifera)* and the African oil palm *(Elaeis guineensis)*. *Strategus aloecus* (known as *cigarron* or *coco* in the vernacular) of the beetle family Scarabaidae and with a length of about

6 centimeters (2½ inches), bores holes into the soil near the tree trunks for the purpose of mating. The adult insects fly out and feed on the shoot apices of the young palms which mostly leads to the loss of such plants. The larvae are found in old plants or in rotted trunks. Hardly noticeable during the dry season, these insects start their destructive work at the beginning of the rainy season. They cause considerable damage to young palm plants, especially during the first two years of cultivation. So far it has not been possible to find a remedy guaranteeing 100% protection to the plants. The only effective measure has been to attack the adult insects by pouring 2 liters (about 2 quarts) of 0.2% Endrin into the bored holes around the tree trunks. This work takes much time and has to be carried out painstakingly.

Rhynocarpus palmarum of the family Curculionidae is a beetle with a length of about 5 centimeters (2 inches). The females lay their eggs in any wound found on both of these palm species. The large larvae begin their destructive work by penetrating the tree trunk, thereby destroying the tissue in which they feed. Control is extremely difficult. It is most important here to keep the plants healthy, so that the female insects cannot find any wounds in which to deposit their eggs. Existing wounds, especially on young palms, should be sealed off immediately.

Spider mites, called red spider, also attack palms. Damage can be recognized by a change in leaf color from fresh to dull green, later to yellow with the partial destruction of the chlorophyll. Often the leaves are covered with a fine web. Plants infested with red spider show poor growth and eventually die. Effective are spray treatments, repeated one or twice after 8–10 days, with such chemicals as Gusathion, Phosdrin, Phosphomidin, Malathion, Diagion.

During the humid season snails may cause damage to seedlings and young plants. Such damage is easily recognized by the holes eaten in the leaves and the slime traces left behind. Effective control is accomplished by depositing snail poison near the plants and whereever possible in such a way that rain cannot dissolve it. In individual cases it might be advisable to keep a lookout for the snails during the night.

Damages of a Non-parasitic Nature

Non-parasitic damages are non-infectious and are caused by unfavorable influences of the environment, such as climate, temperature, humidity, and light. The palms make certain demands on their environment. If kept in cultivation, they require conditions similar to those of their natural habitat. It is not always possible to meet these requirements, particularly such factors as temperature. As a rule the palms cultivated in Venezuela come from hot or warm regions, so a lack of warmth usually is not a problem here. On the contrary, I want to point out that many of these palms can be cultivated successfully even to an altitude of about 1000 m. (3,280 feet). With increasing altitude the number of species adaptable to the lower temperatures decreases. On the other hand, no successful results have been obtained by trying to cultivate the palms of higher elevations, such as *Geonoma, Ceroxylon, Dictyocaryum,* in the hot lowlands.

Humidity as a factor needs to be mentioned especially. The palms of most gardens, parks, and roadsides as a rule suffer more from lack of water than from water excess. Lack of water is aggravated by the asphalt and cement

pavements used for streets and sidewalks. Leaving open places or wells around the trees in the course of paving still leaves too little room to supply the plants with sufficient irrigation water. Aeration of the soil essential for healthy roots is also impeded.

The following will be briefly mentioned concerning the watering of palms in gardens and parks. A palm in a tropical climate needs at least one thorough watering per week and this throughout the year. The opinion that watering needs to be done only during the dry season is fundamentally wrong. Even during the rainy season there are often weeks when the rainfall is not sufficient to keep all the roots moist.

Excess of water in pots and containers caused by the clogging of drainage holes usually results in the death of the plants within a short time unless the situation is quickly remedied.

Most palms enjoy a high degree of relative humidity which is vital for their health and development. The degree of relative humidity required may differ considerably, depending on the natural habitat of a palm. Certain palm species, such as those of the cloud forest, accordingly need high degrees of humidity. This concerns especially the many species of genera like *Geonoma*, *Chamaedorea*, *Ceroxylon*, *Dictyocaryum*. If humidity is lacking, as during the hot and dry season, the development of new leaves may suffer. Dry air, such as in living rooms, also favors the appearance of many pests.

Requirements with regard to light, again differ, depending on the place of origin of a palm. Consequently one distinguishes in cultivation between locations with either bright sunshine, semishade, or full shade. Palms exposed to excessive sunshine show the typical scorched leaves which may be the cause of the ruin of the plant. Kept in the shade, a palm coming from a sunny zone remains weak in development. It needs to be emphasized, though, that all palms require morning sun; this should not be denied to them. Most palms prefer light or full shade during the afternoon hours. Seedlings and young plants are more sensitive than adult plants and should be shaded after 10 A.M.

Concerning the influences stemming from soils and substrates it should be mentioned that neither too high nor too low pH values are favorable. Here again it is important to know the natural habitat of a palm species. In general the palms of Venezuela are more responsive to acid soils. Of importance, first of all, is good nutrition and the general condition of the soil. Palms are particularly responsive to nitrogenous fertilizers. If nitrogen is deficient, the growth of the shoots is poor, the color of the leaves unsatisfactory, and the initiation of flowers reduced. Bronze-colored leaves indicate that a palm suffers from lack of potash. When potash is lacking, palms also are more sensitive to a lack of water. Fertilizing with phosphorous stimulates flower and fruit initiation. Results of deficiency or excess in trace elements are so numerous that they cannot be dealt with here in detail. A deficiency in magnesium causes yellowing of the leaves. Excessive salt concentrations in the soil result in depression of growth, malformations, and absorption of water and nutritive salts in the root is reduced or entirely obstructed. Preventive measures consist of an adequate fertilizing program at periodical intervals of time, using fertilizers with too low rather than too high salt concentrations, appropriate soils, adequate moisture, and careful tilling and loosening of the soil in containers, and in spaces around the trees.

NOTES ON PALMS CULTIVATED IN VENEZUELA*

Acrocomia Mart.

Medium-sized, strongly armed, monoecious palms with pinnate leaves, native from Mexico and Cuba to South America; inflorescences prickly, among the leaves, with a large, often prickly or hairy upper spathe, once-branched into numerous rachillae with few female flowers near the base and many male flowers in little cups toward the tip; male flowers with 6 stamens; fruit 1-seeded, with bony endocarp having 3 pores near the middle, endosperm homogeneous, embryo near one pore. Two species occur in Venezuela. Both prefer moist and hot savannas. In Venezuela, and particularly in Brazil, the stems are tapped to obtain palm wine.

Acrocomia aculeata (N. J. Jacq.) Lodd. ex Mart.

Stem 8–12 m. high, covered with long black spines; leaves 20–30, 4–5 m. long; petiole densely covered with long bristles and spines; pinnae narrow, linear-lanceolate, about 1 m. long, 2–2.5 cm. wide; spathe 1 m. long, armed; fruit roundish, hard, about 4 cm. in diameter. Widely distributed in the states of Miranda, Barinas, Cojedes, Portuguesa, etc. Known locally as *corozo*. The exact identity of this species is not certain and it may be that another name will ultimately be found to apply to it.

Acrocomia lasiospatha Mart.

Attains a height of about 12 m. and has a slight bulge in the middle of the stem. Found most frequently in Guayana. Known locally as *corozo* or *mucuja*.

Cultivation: as seeds of *Acrocomia* are difficult to germinate, they should be sown in hotbeds. To stimulate germination, it is recommended that seeds be soaked for 2–3 weeks in warm water. Seeds do not lose viability even after being stored for one or two years. Plants require an open and sunny place and are suitable for parks.

Aiphanes Willd.

Medium-sized, very strongly armed, monoecious palms with pinnate leaves, native in tropical America; pinnae wedge-shaped or linear, truncate to two-pronged at tip, usually wide and armed on both sides; inflorescences prickly, among the leaves, with a spiny upper spathe, usually simply branched into rachillae with flowers of both sexes, the male flowers with 6 stamens, and more numerous toward tip; fruit round, with bony endocarp having 3 pores near the middle, pulp mostly conspicuously colored; endosperm homogeneous. One of the three species native to Venezuela is cultivated.

Aiphanes caryotaefolia (HBK) H. Wendl.

Stem 5–10 m. high, strongly armed; leaves 2–2.5 m. long, strongly armed, particularly the petiole and sheath, with 17 pairs of pinnae; pinnae lanceolate to quadrangular, about 20–30 cm. long and 8–15 cm. wide, truncate and toothed at the tip; inflorescence about 0.6 m. long; fruit roundish, about 1.5 cm. in diameter.

This palm is usually found growing in the half-open to dense forests of the upper Orinoco region, then by the Río Caroni and about 80 km. south of El Dorado, consequently in Venezuela's hottest climate. Plants are fine decora-

* Measurements in descriptions are given in the metric system, temperatures in degrees Centigrade. The following equivalents are useful for conversion into the English system of weights and measures: 1 meter (m.) = 3.28 feet; 10 millimeters = 1 centimeter = 0.3937 inches; 1 kilometer = 0.62 miles. To equate degrees Centigrade to Fahrenheit, multiply by 9/5 and add 32°, thus 15° C. = 59° F.

16. *Acrocomia aculeata* on an open plain near Barinitas, Barinas State.

tive palms for gardens and parks. They should be kept in an open place with sun in the morning and shade in the afternoon. Seeds germinated in Caracas after 65 days. Growth satisfactory.

Aristeyera H. E. Moore

Solitary, unarmed, monoecious palms with pinnately nerved leaves not divided into pinnae; stem slender, ringed; leaf elongate-wedge-shaped; sheath short;

17. A young plant of *Aiphanes caryotaefolia*.

petiole roundish with sharp edges; inflorescence among the leaves, spicate or with few branches, erect, elongate, with 2–3 spathes; flowers in groups of 2 male and a female sunken in pits which are arranged in vertical series; male flowers with 12–24 stamens; female flowers with 5–18 staminodes, stigmas 3; fruit elliptic-ovoid, slightly compressed laterally, exocarp smooth, mesocarp dry, fibrous;

18. *Aristeyera spicata* in its native habitat.

seed elliptic to egg-shaped, slightly compressed laterally; endosperm homogeneous, embryo laterally basal. A new genus related to *Geonoma*, *Welfia*, and *Asterogyne* but differing in number of stamens, arrangement of flowers, and undivided leaves in combination. Named after the botanists L. Aristeguieta and J. Steyermark. Two species have been described from Venezuela.

19. The dense *selva* (jungle) of Guatopo, Miranda State, is the natural habitat of *Aristeyera spicata.*

Aristeyera spicata H. E. Moore

Stem 2–8 m. high, 3.5 cm. and more in diameter; leaves numerous, more than 10, long, wedge-shaped, dark green on upper side, silver-green beneath; sheath open to or nearly to the base; petiole about 35 cm. long; blade 68–70 cm. long, with 24–27 nerves on each side; inflorescence 70–86 cm. long, the flowering portion 25–40 cm. long; fruit 12–14 mm. long, 6–7 mm. wide. Known locally as *palmito*. Occurs in the Parque Nacional de Guatopo, Miranda State, in moist evergreen forests on the banks of Río Santa Cruz, between Santa Teresa and Altagracia del Orituco, 520 m. above sea level. Cultivated in the Botanical Garden, Central University of Venezuela, since 1958.

Cultivation: fresh seeds germinated after 3 months; plants should be raised in partial shade and require high atmospheric humidity. Extremely attractive and rare palm for indoor use, well-kept home gardens, etc. The young leaf is almost copper-colored and the plant is therefore an unrivalled adornment for tropical gardens. Unfortunately the species is highly susceptible to various scale insects, particularly if kept in dry rooms.

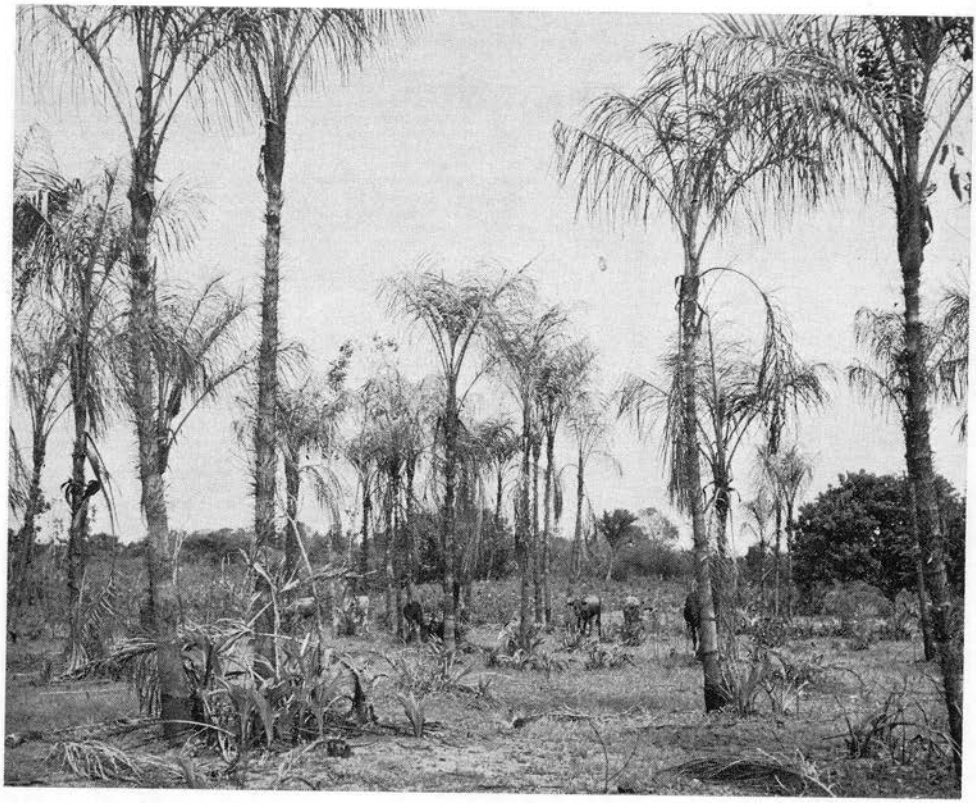
Astrocaryum G. F. W. Meyer

Low or nearly stemless to tall, strongly armed, monoecious palms with solitary or clustered stems and pinnate leaves; petiole mostly short and prickly; pinnae regularly arranged or in groups, grey

20. *Aristeyera spicata* in the third year of cultivation. The propagation of this magnificent plant is somewhat difficult and requires many years.

to silvery on lower surface, margins prickly; inflorescences among leaves, usually once-branched into rachillae with female flowers at or near the base, male flowers numerous in little cups toward the apex; male flowers with 6 stamens; fruit 1-seeded, with bony endocarp having 3 pores near the middle with star-like arrangement of fibers; endosperm homogeneous. A genus of about 40 species from Mexico to South America, about 7 occurring in Venezuela but not cultivated.

The star-nut palms of Venezuela are typical of the moist and hot climates of Guayana. Generally they grow in forests and are a characteristic of the evergreen rain forests of the Orinoco region. The seeds of most species yield a fine cooking oil and are collected by the pop-



21. *Astrocaryum* sp. in the north of Bolívar State.

ulation. The fiber furnished by *Astrocaryum vulgare* is worked up into hammocks in Colombia. In the dry season, when pasture becomes scarce, cattle feed on the still young and unarmed leaf tips.

Cultivation: as a rule, seeds of *Astrocaryum* are difficult to germinate, therefore are sown in hotbeds. Seeds should be soaked for 2–3 weeks in a hot water bath of 30–40° C. At temperatures of 40° C., fresh nuts usually germinate after 4 months; slow-germinating seeds may follow after a year or even later. Young plants must be kept hot and in a location where protected from wind with morning sun and shade in the afternoon. At present only cultivated in the Botanical Garden of the Central University of Venezuela.

Bactris N. J. Jacq. ex Scop.

Low to medium, very spiny, monoecious palms with solitary or clustered stems and pinnate leaves; inflorescences among the leaves, with prickly upper spathe, usually once-branched into rachillae with flowers of both sexes in groups of 2 males and a female or irregularly arranged; male flowers with 6–12 stamens; fruit 1-seeded, with bony endocarp having 3 pores at or about the middle; endosperm homogeneous. A large genus with numerous species from Mexico and Cuba to South America, about 30 species occurring in Venezuela.

Although many species are extremely interesting and of graceful aspect, they are rarely cultivated. Some furnish

22. Strongly armed *Bactris* species with clustered stems in the Botanical Garden of the Central University of Venezuela, Caracas.

valuable wood for carpentry. Even today, the straight stems of several species are worked up into walking sticks. The country people use the fleshy fruits of some species to make vinegar.

Cultivation: as a rule, *Bactris* seeds are difficult to germinate, consequently they are sown in hotbeds. Time for germination varies greatly according to the species, but most species usually require several months. The soil should be nutritive and mixed with coarse-grained sand. Most species prefer a site with morning sun and afternoon shade. Still rarely cultivated in Caracas. It is to be hoped that this genus soon will find more use as decorative plants in gardens and parks.

Bactris Gasipaes HBK

Stems several, 8–10 m. high, strongly armed with black spines 2–5 cm. long; crown of more than 10 leaves, these 3.5–4 m. long, slightly drooping and densely pinnate; pinnae about 0.4 m. long with short-spined margins; inflo-

23. A group of *Bactris* palms in Bolívar State.

rescence about 0.5 m. long; fruit the shape of an obtuse cone, about 5 cm. in diameter at base, yellow or red when mature. Known locally as *pirijaho, bichiguao* (peach palm).

A useful palm growing in the region of the upper Orinoco. An adult plant yields 3–5 infructescences per annum, each with 50–70 fruits. The richest fruiting is in February; occasionally a

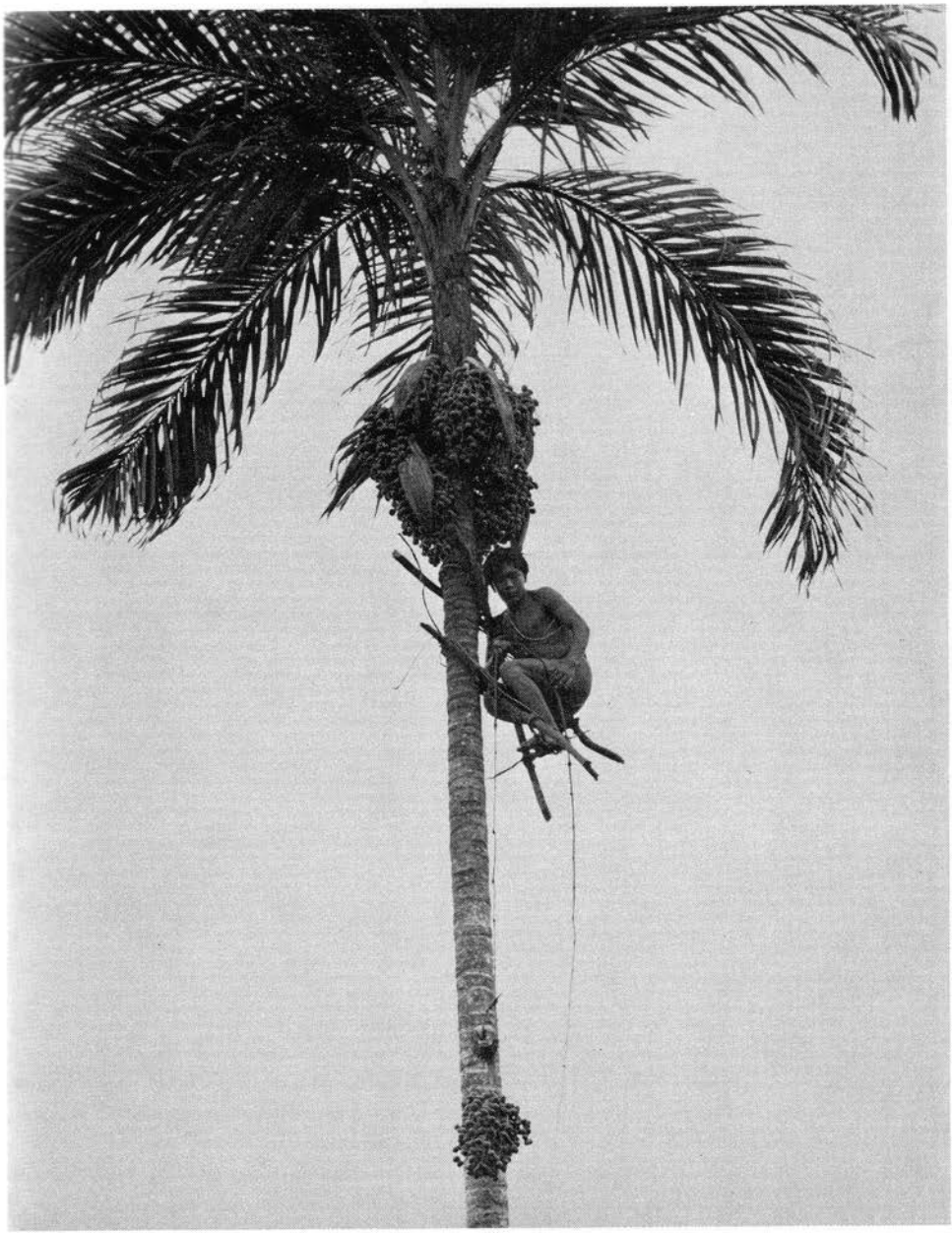
24. *Bactris* sp. (left) with *Syagrus* sp. (right) at Santa Barbara, Barinas State.

second but less profuse fruiting occurs in August. Fruits cooked in salt water are wholesome and nutritious. Roasted they yield a kind of flour used to flavor soups and other dishes. Cultivated from Central America to Peru.

The Waika Indians from the upper Orinoco celebrate the festivals of their

25. *Bactris Gasipaes* near San Fernando de Atabapo, Amazon Territory.

tribe each year at fruiting time. Using a shifting scaffold, a particularly alert Indian climbs up the strongly armed trunk to cut off the infructescences. In the night of the full moon they celebrate and dance, the *pirijaho* fruits being the chief meal; the men not rarely become ill from eating too many of them, as all fruits must be gathered and eaten at one time. This species also fur-



26. A Waika Indian of the upper Orinoco collecting the infructescences of *Bactris Gasipaes*.

nishes the tough wood from which the Indians make their bows for hunting.

Cultivation: fresh seeds germinated after 65–70 days in Caracas. Seeds should be sown in hotbeds. If well cared for, plants grow quite rapidly. After 4 years the first infructescences are formed. Extremely ornamental palm

27. *Bactris major* in its natural habitat in Yaracuy State.

for open and sunny locations. Up to now no special susceptibility to diseases reported.

Bactris major N. J. Jacq.

Stems several, reaching 3–6 m. in height, usually growing closely in colonies; stem 3–4 cm. in diameter, strongly armed; crown of about 4 leaves; sheath 26 cm. long and 4.5 cm. wide, armed with many fine bristle-like spines and distally with interrupted groups of dark spines 2–5 cm. long; petiole 17 cm. long and 1 cm. in diameter, greyish-brown, armed with spines 3–7 cm. long; rachis 65 cm. long, armed on both sides with pointed brownish-black bristles 3–10 cm. in length; blade with about 38 pairs of pinnae, those in the middle of the leaf 25 cm. long and 2 cm. wide, marginally armed with small sharply pointed spines; peduncle of inflorescence 28 cm. long, laterally compressed, arched; rachillae usually 8 in number, 7–12 cm. long and about 3 mm. in diameter; upper spathe very strongly armed; fruit 3.5 cm. long, 2.4 cm. in diameter, dark brown, seed more oblong than roundish, 1.8 cm. long, 2.1 cm. in diameter, dark brown. Widespread in Venezuela, e. g. in the states of Mérida, Zulia, Barinas, and particularly in Yaracuy State where it grows with *Heliconia*, *Roystonea venezuelana*, and *Scheelea*. Grows on open sites as well as in forests but always in moist to flooded ground.

Cultivation: seeds germinated after 5 months but slow-germinating seeds

required more time. This dark green shrubby palm is very well suited for well kept home gardens and parks.

Catoblastus H. Wendl.

Medium-sized, unarmed, monoecious palms with pinnate leaves and prominently ringed stems, the base of the stem with many thick stilt roots; leaves fewer than 10, with lanceolate to wedge-shaped parallel-nerved pinnae; inflorescences with either male or female flowers but both types on the same plant; spathes several; male flowers with 9 or more stamens; fruit 1-seeded, with basal embryo. A genus of a few species native to Venezuela and Colombia, allied to *Iriartea* and *Socratea*.

Catoblastus praemorsus (Willd.) H. Wendl.

Stems 5–8 m. high, ringed, about 15 cm. in diameter, surrounded at the base by many stilt roots up to 1 m. long; the few leaves attain a maximum length of 2 m. and have 10–21 pairs of pinnae, terminal pinnae usually shaped like a half-opened fan, the remainder lanceolate to wedge-shaped at the base, truncate at the tip, pendulous, 20–40 cm. long, 5–10 cm. wide; inflorescences several on the same plant, below the sheath; spathes 6, the 3 surrounding the main axis tubelike; rachillae numerous, helical; flowers yellowish; seeds about the size of a pigeon egg. Locally known as *palma prapa*.

These extremely beautiful palms are most characteristic of the steep cloud forests at an altitude of 1700–2200 m. in the Venezuelan coastal range. The plants blossom approximately from August to October and fruits mature from the end of April until June. The climate of these montane forests is fairly well balanced regarding humidity and light. The plants grow here on acid, often rich humus, but are also found between rocks; they have sun during some morning hours but later the sun is hidden by veils of mist. The temperature varies from 12–17° C. (maximum 23° C.) during the day but may cool down at night to 5° C. in February and March. During the rains (April to October) these forests may be hidden for weeks in hazy mist.

Cultivation: seeds germinated in Caracas after 9–11 months. This palm is one for high regions with temperatures not above 23° C. and high atmospheric humidity. Its site should have morning sun until 10 A.M. and shade afterward.

Ceroxylon Humb. & Bompl.

Unarmed, dioecious palms with usually tall columnar stems covered with a layer of wax and the leaves pinnate; inflorescences axillary, several times branched; spathes several; male and female flowers similar in size and shape but males without a well developed ovary; fruit with basal stigmatic residue. A South American genus with about 16 species indigenous to the Andes and coastal range forests of Colombia and Venezuela; known as wax palms.

Ceroxylon Klopstockia Mart.

Trunks producing the appearance of columns and attaining a height of 12–18 m., an average diameter 0.3–0.4 m., are covered with a layer of wax; leaves more than 10, these 3–4 m. long, somewhat stiff, drooping at the tip; petiole sharp-edged, surrounded by fibers, grooved at base; pinnae linear, stiff, green above, silvery beneath; inflorescence 1.5–2 m. long with numerous spathes; rachillae numerous, spirally arranged, robust; fruit bright red when mature, roundish, 2 cm. in diameter; seeds black to grey, 1.6–1.9 cm. in diameter. Known in Venezuela as *palma bendita* (blessed palm).

28. *Catoblastus praemorsus* in the open mountain forest of the Venezuelan coastal range at about 1900 m. (6232 ft.) altitude.

These magnificent palms grow in the highest cloud forests of the Avila region (Distrito Federal) at altitudes of about 1800–2200 m. and also in the forests between Portachuelo and the road to Tovar at approximately 1850 m. elevation. The leaves are used to adorn processions during Holy Week, hence the name *palma bendita*. The name *Ceroxylon ceriferum* used for this palm by

29. The native habitat of *Ceroxylon Klopstockia* in the cloud forest of the coastal range at the foot of the Silla de Caracas (Federal District) at about 2200 m. (7216 ft.) elevation.

some writers is a synonym of *C. Klopstockia.*

An undetermined species grows in almost the same region as *C. Klopstockia* in Junquito at an elevation of about 2000 m. In contrast to *C. Klopstockia,* it shows a less compact crown and the upper surface of the leaves is of much brighter, even silvery color. The inflorescence of *C. Klopstockia* is larger and more strongly developed. It is worth remarking that as a rule *C. Klopstockia* grows as solitary individuals among high trees whereas the other species grows in abundance on open places surrounded mostly by low or high shrub flora. The fruiting of both species may begin in April and continue until July and August.

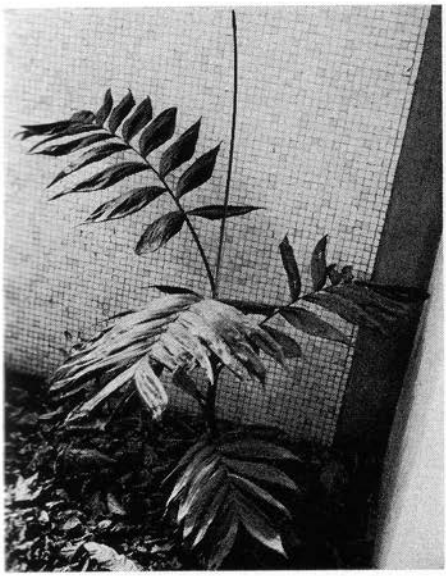
Cultivation: *Ceroxylon* seeds germinated in Caracas after 10–16 months. All species require a moist and fresh

30. *Ceroxylon* sp. in the cloud forest zone of the Junquito (Federal District) at about 1900 m. (6232 ft.) altitude.

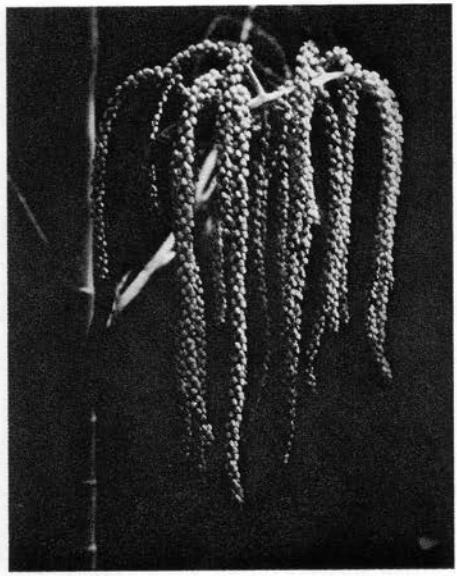
climate with temperatures of 15–20° C., sun until about 10 A.M., and partial or full shade afterward.

Chamaedorea Willd.

Mostly low to medium-sized, unarmed, dioecious palms with solitary or clustered stems and leaves undivided except for forked tips or more often pinnate; petiole often cylindrical with a narrow groove on upper side; pinnae few to many; inflorescences among the leaves, with several spathes, simply branched or spicate; flowers sessile, yellow or orange to greenish or white, the male with 6 stamens, the female with triloculer ovary and 3 stigmas; fruit a 1-seeded berry; endosperm homogeneous, embryo lateral. A genus of more than 100 species from Mexico to South America. None of the approximately 8 species indigenous to Venezuela is much



31. *Chamaedorea pinnatifrons* in the third year of cultivation in Caracas.



32. A male inflorescence of *Chamaedorea pinnatifrons*.

cultivated. The species grow mostly in montane forests but occasionally also in moist and hot forests. Recently they have become much favored as decorative plants.

Chamaedorea pinnatifrons (N. J. Jacq.) Oerst.

Stem about 1.8–2.4 m. high, 1.5 cm. in diameter, rings 8–12 cm. apart; leaves 4–6, 0.8–1 m. long; petiole strong, roundish; pinnae alternate, rhombic, about 5–8 on either side, broad at base, about 30–37 cm. long, greyish-green, the terminal pinnae concrescent; spathes 5; inflorescence 40–60 cm. long, the male pendulous and very conspicuous, the female more stiff and erect; rachillae orange-colored in fruit; fruits first red, later turning black. Blooms beginning in August, fruits from December to February (but blooming and fruiting times vary when the plants are cultivated). The species occurs naturally in Venezuela in the extremely moist forests of the coastal range which afford deep shade, that is in the region of Avila (Distrito Federal) at about 1800 m. elevation, and is known locally as *caña molinillo*.

Cultivation: seeds germinated in Caracas after 115–125 days. The species is rarely cultivated but is a fine decorative palm for altitudes with a fresh climate.

Cocos L.

Unarmed, solitary, monoecious palms with ringed stem and pinnate leaves borne in a terminal crown; pinnae lanceolate, regularly arranged; petiole grooved on upper side, with smooth margins; sheaths short, coarsely fibrous, not forming a crownshaft; inflorescence among leaves, the upper bract large and woody; rachillae with one or a few basal trilocular female flowers and numerous male flowers distally, these with 6 stamens; fruit large, 1-seeded, with bony endocarp having 3 pores

33. Stems and crowns of *Cocos nucifera.*

near the base; endosperm homogeneous, hollow in center, embryo near one of the pores. A genus of one species, the coconut.

Cocos nucifera L.

The irregularly ringed, crooked stem attains a height of 20–30 m. and a diameter of 0.5–0.7 m.; leaves 5–7

34. Coconuts maturing in the light partial shade afforded by the rich foliage.

m. long, drooping, yellowish-green, pinnae oblong-lanceolate, pleated, about 1 m. long, about 240 pairs per leaf; spathe 0.8 m. long; inflorescence simply branched, the female flowers large; fruit (the so-called coconut) about 20–30 cm. long, covered by a dense layer of fibers, outer husk smooth and light green.

The coast of Panama is supposed by some to be the original habitat of the coconut palm but this opinion is generally disputed and it is thought to have originated in the Old World. Today, the coconut palm is found along all tropical shores of the world. It is the "elegance of the coasts" celebrated in numerous poems and songs. It is the most useful palm of the world and for many countries one of the most important sources of revenue. The most valuable commercial product is coconut oil. The refreshing watery content of the unripe nut is rich in vitamins A, B, and C. People of the tropics like to use the hard endocarp as drinking cups.

35. *La quiebra de coco* is a favorite game of the Venezuelan people during Holy Week.

Thousands of small country houses have been made from the leaves of this coastal palm. The stem is also used for various objects. The fibers are worked into mats, ropes, baskets, etc. By tapping the young inflorescences, a juice is extracted which serves for the production of vinegar and alcohol. The flowers are of high curative power with regard to dysentery, diabetes, and bladder trouble. The roots contain substances effective against constipation. No wonder that the picture of the coconut palm has found a place of esteem on innumerable postage stamps of most tropical countries.

During Holy Week, it is the custom among young and old people to devote themselves to "breaking coconuts" *(La quiebra de cocos)*. It is a game loved for generations in Venezuela which is experienced with pleasure in the capital as well as in the country. In addition to striking ability, the players also must

know the rules of the game and the necessary preparations for it. The players seek carefully for a nut with fibers removed, look for veins and weak spots, then the game begins. Small nuts with thick husks are preferred. In the country even liturgical ceremonies with songs praising the coconut take place before the great test starts. The winner is the one who succeeds in breaking the nut in the hand of his partner.

In Venezuela the palm does not grow at altitudes over 1000 m. and indeed always more slowly as the altitude increases. Cultivation is also possible inland provided there is ample water supply. Propagation, when not accomplished by itself, has been directed by man for a long time and by cross-breeding and selection, valuable varieties have been developed with superior properties, e.g. dwarf forms with greater fruit production. In the moist and hot coastal regions, the nuts take 4–5 months to germinate and plants begin to yield after the 6th year. Later the single plant yields as many as 70–80 nuts a year. Pollination is done by the wind. The average output of copra in Venezuela amounts to 17,000 tons per annum. The coconut palm is subject to many diseases and pests; the most serious disease certainly is that called red ring which destroys the plant; the greatest damage is done by the so-called *cigarron*. Both are dealt with in the section on diseases and pests of palms.

Copernicia Mart.

Medium-sized to tall palms with sharp teeth along the petioles, the leaf-sheaths persistent or tardily deciduous; leaves palmate, the blades pleated; inflorescences among the leaves, branched, with several bracts encircling the peduncle and bases of branches; flowers perfect; fruit with apical stigmatic residue; seed with ruminate endosperm and basal embryo. Named after the astronomer Nicolaus Copernicus. About 30 species from Cuba to Brazil, Paraguay, and Argentina.

Copernicia tectorum Mart.

Palm of erect growth, the stem covered for a long time with old leaf sheaths, 6–10 m. high; leaves 0.5 m. in diameter; petiole with sharp marginal teeth; inflorescences appear at the end of December and extend beyond the leaves; fruit yellowish-green, about the size of an olive. Known locally as *palma redonda, palma de cobija, palma llanera, palma de abanico, palma de cana.*

The somewhat stiff *Copernicia* palm is most frequently found in the vast flat *llanos* of Guárico and Anzoátegui States. It is a unique characteristic of the Venezuelan landscape, extending over many square kilometers as a main element of the flora. Seen from above, it is striking to notice at what regular distance from each other plants grow; each plant has ample space around it. During the rainy season the palms stand in flooded areas for months but they endure the dry season just as long in dry grassland because of their deep roots. The *Copernicia* species in general tend to form deep roots in order to reach the water table. This easily explains the fact that many young plants do not develop any stem for years but only leaves. In the juvenile state they produce first of all roots going deeply into the ground to get the necessary water and then the plants progress rapidly, forming stems and within a few years they reach the height of the mother plant.

As palms of grassy plains, they prefer pasture land with thousands of cows and cattle roaming on it. It may happen that stock farmers set enormous regions on fire to destroy the unwelcome bush

36. *Copernicia tectorum* predominates on the vast *llanos* of Guárico State.

vegetation burning thereby also many palms. But the palms are often surprisingly vigorous; even partly burnt palms put forth fresh leaves again in the rainy season. In the country the leaves are still used for roofing. The extremely tough stems serve for building purposes even now.

Cultivation: growing from seeds takes much time. Seedlings grow very slowly. The site for planting should be open and sunny. Cultivated only in the Botanical Garden of the Central University of Venezuela.

Desmoncus Mart.

Strongly armed, monoecious palms with pinnate leaves, early forming shoots (suckering), the stems more or less slender, erect or climbing; leaves regularly or irregularly pinnate, tip ending in a series of hooks by means of which the plant climbs; pinnae narrow to broad, lanceolate or ovate, frequently with pointed spines on the lower surface along the middle nerve; inflorescence axillary; spathes 2, the upper usually spiny; flowers sessile on undulating rachillae; female flowers sporadic along the base of the rachillae but frequently also crowded, ovary trilocular, style short, stigmas 3; male flowers with 6 stamens; fruit 1-seeded, with bony endocarp having 3 pores near the middle; endosperm homogeneous, embryo below one of the pores.

About 40 species are included in the genus *Desmoncus* which inhabits the hot moist regions of tropical America. They are botanically very interesting palms which climb through the branches of the surrounding trees by means of hooked whips at the ends of the leaves in order to reach the light. Where they grow in large stands they form impenetrable barriers. The author remembers a journey where densely growing

37. The clawed leaves of *Desmoncus horridus* groping for something to climb on.

Desmoncus blocked the way so that a new route had to be chosen.

Cultivation: these climbing palms are very seldom cultivated. Seeds must be sown in hotbeds. It is most important to take fresh seeds because their viability decreases rapidly. Fresh seeds of *Desmoncus orthacanthos* germinated after 40 days; slow-germinating seeds followed during a period of 2 months. Another batch of seed of the same species began germinating after 10 months and the slowest seeds only after 29 months. In general, *Desmoncus* are fast growers under good conditions. Seedlings can be transplanted after a year. The plants must be put where they may climb. Sufficient light is important for their development. They should be planted in good nutritive country soil mixed with coarse-grained sand and get ample water. *Desmoncus* is extremely responsive to heavy manuring and fertilizer should be applied during the rainy season. Of about 8 species native to Venezuela, the following are cultivated.

38. Partial view of a young plant of *Desmoncus orthacanthos*.

Desmoncus horridus Splitg.

Climbing palm growing up to 20 m. and more, densely armed; leaves 1.5 m. long including the terminal hooked whip or flagellum 40–50 cm. long; pinnae loosely arranged, irregularly distributed, up to 20 on either side of the leaf, narrow-lanceolate, 20–25 cm. long, 2.5 cm. wide, main nerve of pinnae with 1–3 prickles 3 cm. long on the under side; spathe strongly armed, brown-scaly, 20–30 cm. long; rachillae 30–40, 9–12 cm. long; fruit elliptical, about 16 mm. long, 9.9 mm. in diameter. Known locally as *matamba, rabo de iguana, voladora*. Habitat in Venezuela: Valle del Tuy near Cúa, Miranda State, and region of the upper Orinoco, Bolívar State.

Desmoncus orthacanthos Mart.

Stem strongly armed, completely covered with leaf sheaths; petiole strongly armed with long, pointed, black spines expanding rectangularly and irregularly

39. The bolt upright stem of *Dictyocaryum fuscum* in evergreen forest, Junquito, Federal District, about 1750 m. (5740 ft.) altitude.

spaced; leaves with 8–9 pairs of unevenly arranged, broad-lanceolate pinnae 14–16 cm. long, 3–6 cm. wide; sheath 30–40 cm. long; rachillae 10–15, 6–8 cm. long. Occurs in La Paragua, Bolívar State, in Apure State, and in the region of the Alto Ventuari, Amazon Territory.

Dictyocaryum H. Wendl.

Tall, unarmed, monoecious palms of tropical America with pinnate leaves; stem cylindrical, smooth, with prominent rings, surrounded at the base by numerous stilt roots; leaves reduced in number (5–9), petiole short, pinnae grouped in distant clusters, long-linear, erose at the tip, spathes 6–7, deciduous, the outer and smaller ones open at the tip, the inner completely closed and sharply pointed, opening lengthwise at flowering time; inflorescences below leaves, with male flowers or with flowers of both sexes, then one female flower between two male flowers; male flowers with 6 stamens; fruit usually globose; seed with reticulate surface, hence the Latin name "net kernel" for the palm; endosperm homogeneous, embryo basal.

Dictyocaryum fuscum (Karst.) H. Wendl.

The rarest species, *Dictyocaryum fuscum*, grows in the cloud forests of the Venezuelan coastal range among leafy woods. The stem reaches a height of 15–20 m. and about 30 cm. in diameter; leaves 5–6, about 4 m. long, with short sheath; pinnae dark green on the upper surface and silvery beneath; inflorescences 2–3, very long, narrow when closed, often strangely curved, white when expanded; fruit almost globose, 3.5 cm. high, 3 cm. in diameter, yellowish-green when mature, seed maroon, covered with light brown network of veins.

Cultivation: seeds germinated in Caracas after 112–160 days. An extremely beautiful palm loving fresh climates with temperatures of 15–20° C. and high atmospheric humidity.

Euterpe Mart.

Moderate-sized to tall, unarmed, monoecious palms with solitary or clustered, straight, ringed stems and pinnate leaves; pinnae narrow, linear-lanceolate, spreading or pendulous; sheath cylindrical, long, forming a crownshaft; petiole 3-angled; inflorescence simply branched, borne below the crownshaft; spathes 2, membranous; male flowers with 6 stamens; fruit 1-seeded, roundish, smooth; seeds covered with fibrous tissue; endosperm homogeneous or ruminate, embryo near the base. A genus of about 40 species from Central to South America; about 10 species occur in Venezuela.

Euterpe belongs among the most graceful palms of tropical America. In Venezuela, species are found in the coastal range and the Andes as well as in the moist and hot lowlands of southern Guayana. All of them prefer moist forest soil; frequently they occur in flooded areas. Usually they grow intermixed in green forest, more rarely almost in pure stands.

The undeveloped leaves (i. e. the "heart") of *Euterpe* sp. are processed in the Amacuro Delta and sold as preserves. Sometimes the people living in the forests use the leaves for roofing, but they are not durable. The straight tough stems of the palm commonly called *manaca* are frequently used for building purposes, e. g. to build a missionary station in Esmeralda in the upper Orinoco region, one thousand stems were cut down and divided lengthwise thereby getting 2000 boards for use as floors and walls. In this region of the country the palms sometimes grow in such dense stands that frequently 5 palms occur in a square meter.

The cultivation of *Euterpe* in Caracas has not been successful. To be sure, the seeds usually germinate after a few weeks, the seedlings and young palms grow readily, but die after some years. Probably conditions of vital importance to the palm do not exist in Caracas.

40. *Euterpe precatoria* is probably the palm species predominating in the region of the upper Orinoco.

Geonoma Willd.

Unarmed, usually low, monoecious palms sometimes growing to 10 m. high, with thin canelike stems and pinnate leaves; leaves clustered at the tip or alternate along the stem; pinnae of unequal width, frequently irregularly divided, many-nerved, or sometimes blades undivided; inflorescence axillary, simple or branched; spathes usually 2; flowers in groups of 2 male and a female sunken in pits arranged spirally or in whorls, male flowers with 6 stamens; fruit 1-seeded, with fleshy outer coat;

41. Infructescences of *Euterpe* sp. collected in the upper Orinoco region; a wholesome beverage is obtained from its dark blue fruits.

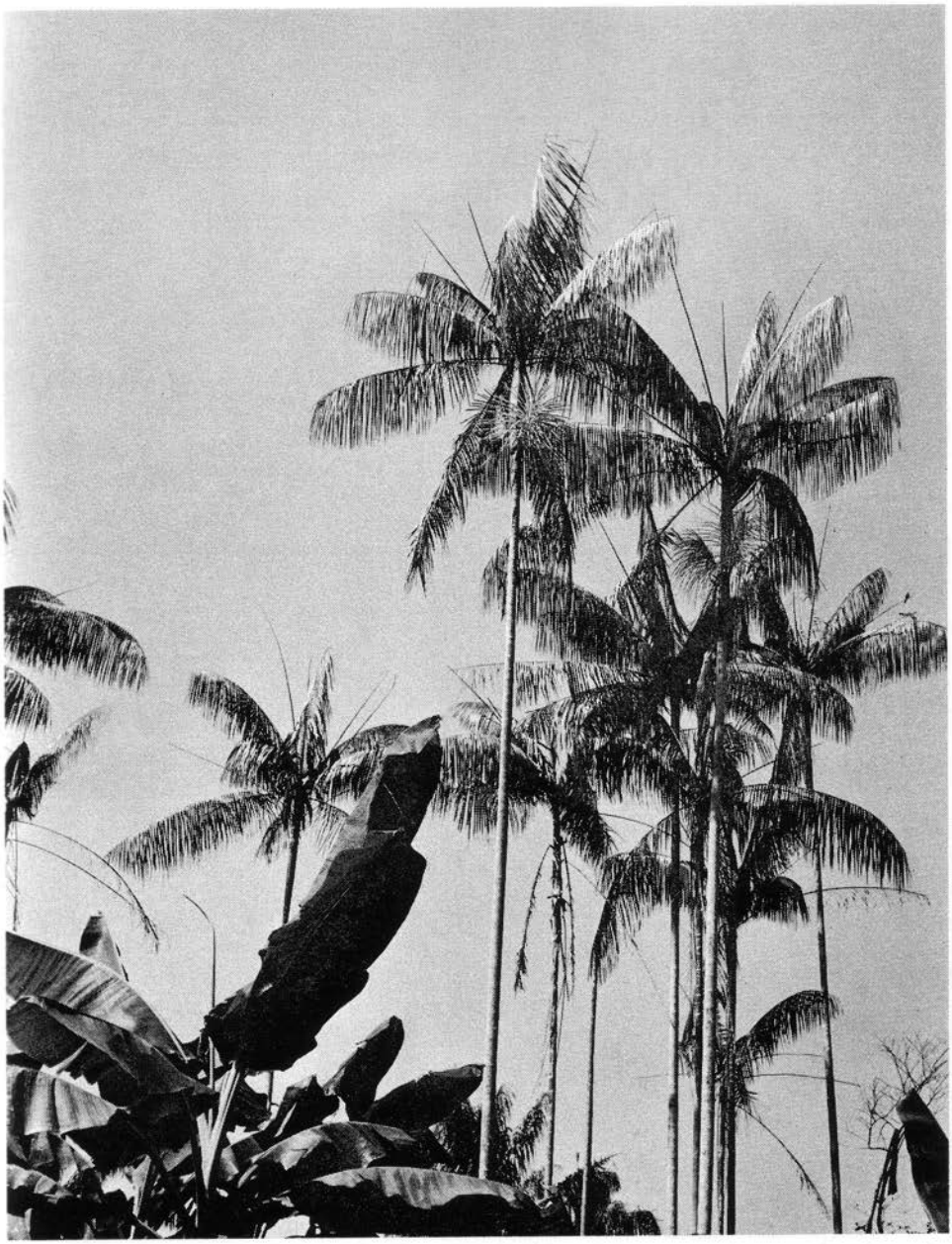
endosperm homogeneous, embryo basal. A large genus native in tropical America, 30 species occuring in Venezuela where they are mostly shade-loving palms of montane forests but equally grow in the forests of damp and hot lowlands.

In areas with large stands of *Geonoma*, the leaves are used for roofing. The roofs of the more than 40-meter-long huts of the Motilon Indians of Zulia State are mainly made of *Geonoma* leaves. The Indians pile the leaves in several layers so that the roofs are able to withstand torrents of rain and last for many years. The Waika Indians of the upper Orinoco build huts with one-sided thatch roofs having an area of 100–140 square meters which require about 13,000 *Geonoma* leaves each to cover them, and often they build 3–5 huts in a group.

Cultivation: as a rule, the seeds germinate readily; germination time varies from 2–3 months depending upon the species. Plants should be reared in half-shade with high atmospheric humidity and temperatures according to the origin of the species. Very rarely cultivated in Venezuela. Young plants with still undivided leaves are very beautiful and are suitable for home gardens.

Geonoma pinnatifrons Willd.

Stem canelike, 4–5 m. long, 4–5 cm. in diameter; crown of 15 or more leaves, the leaves of old plants up to 2 m. long; number and size of pinnae varies depending upon the age of the plant, young



42. The foliage of this *Euterpe* of the upper Orinoco region is of unrivalled elegance.

plants usually have only 2–4 leaves with a width up to 23 cm. for a long time, while on older specimens the leaves have up to 20 pinnae on each side, these often not wider than 3 cm.; spathes 25–29 cm. long, 4.5 cm. wide; inflorescence about 0.5–0.6 cm. long, branched; male flowers lilac; the berry-like fruit is

43. *Geonoma pinnatifrons* growing as an understory palm in the cloud forest of the Venezuelan coastal range at about 1900 m. (6232 ft.) elevation in the Federal District.

nearly egg-shaped, almost 1 cm. long and 0.7 cm. in diameter. Known locally as *caña molinollo*.

The native habitat of *Geonoma pinnatifrons* is the steep cloud forest of the Venezuelan coastal range at an altitude between 1600–1900 m. Frequently plants occur in extensive stands forming a belt

44. Typical cloud forest of the Venezuelan coastal range: *Geonoma pinnatifrons* in association with *Catoblastus praemorsus* are the dominant tree flora.

of dense growth in association with climbing *Anthurium*, *Philodendron*, *Carludovica*, tree ferns, etc. Because of the great difference in appearance of the young and old plants, one might believe, upon seeing them for the first time, that they represent at least two species. Even the habit differs with

45. *Iriartea ventricosa*, upper Orinoco region, Amazon Territory.

age; the young plants are stemless with few broad leaves; the adult plants have elegant stems several meters high with many leaves having mostly narrow pinnae. From the seedling to the adult plant at least eight different leaf forms

46. Seedling of *Iriartea* in its native habitat in the deeply shaded virgin forest near Cuchimo, Bolívar State.

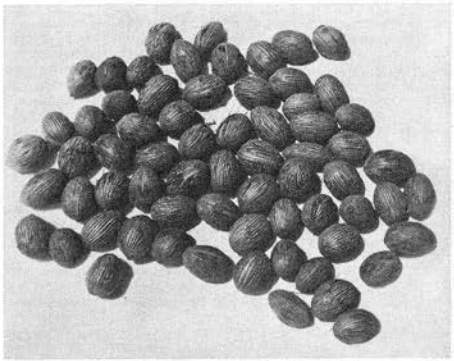
can be recognized. The plants occur only in situations protected from strong light; indeed it is astonishing that they can grow with such low light intensities. In the cloud forest they receive only very modest, often minimal quantities of light. The author has observed this region for many years and has accumulated some climatic data. In 1958 this region of the cloud forest was covered with clouds on 199 days, half-covered on 62 days, and clear on 103 days. In the following year the same region was completely covered on 179 days, half-covered on 145 days, and was clear on 41 days. The high atmospheric humidity of these zones therefore is easily understandable and it may be added here that the hygrometer in isolated places with extremely dense stands of palms never falls below 85 per cent and this only during a few hours on clear days of the dry period. The best proof of the degree of humidity in a cloud forest is the moss flora covering the palm leaves. The precipitation here amounts to 1.5–1.7 m. and is fairly well balanced throughout the year. For only two months it is somewhat dryer than during the greater part of the rainy season. The same applies to the temperatures. Although the thermometer from December to February may fall to 5° C. at night, it rises again to 10° C. during the day. On the whole, the temperature, too, is well balanced, varying from about 11° C. at 7 a. m. to about 15° C. between 11 a. m. and 2 p. m. Where the forest is less dense, the temperature rises, the atmospheric humidity decreases, and the *Geonoma* stands also decrease.

Iriartea R. & P.

Magnificent monoecious palms with straight stems surrounded by long cylindrical stilt roots and with pinnate leaves; stem unarmed, tall, ringed, wood hard, bark blackish; leaves graceful, terminal, with cylindrical sheath; pinnae trapezoidal, truncate and toothed toward the tip, dark green; spathes several, half-cylindric, deciduous, rarely persistent; inflorescences borne below the crownshaft formed by sheaths, simply branched, slightly covered with tomentum; flowers densely arranged in groups of 2 male and a female, yellowish-white; male flowers with 12–20 stamens; fruit 1-seeded, the pericarp greenish to brown or yellowish, pulp scanty, white, half-gelatinous; endosperm homogeneous, embryo lateral. A genus with few species native to tropical America, especially to the Amazon region. None of the few species growing in Venezuela is being cultivated. A remarkable species occurring in the region of the upper Orinoco is the following.

Iriartea ventricosa Mart.

Stem 15–20 m. high, about 20–30 cm. in diameter, swollen to 0.4–1 m. in diameter at about its middle, hence the name "big-bellied," base of stem



47. Seeds of *Jessenia Bataua.*

surrounded by many aerial roots about 2 m. long; leaves usually 5–6, to 6 m. long; pinnae paired, numerous, wedge-shaped or fanlike with truncate tips, 0.5 m. long; tip of leaf truncate, fan-shaped to rhomboid, largely lobulate and toothed; inflorescence 1–2 m. long; fruit more or less globose, 2–2.5 cm. in diameter, brown. Common name in Venezuela—*palma barrigona* (big-bellied palm).

Large stands of this palm are found in the region of the upper Orinoco, with some specimens occurring near Platanal; specimens with the biggest swellings grow several kilometers farther up river. This palm species usually prefers the moist and hot climate of dense virgin forest with fairly well balanced precipitation where it grows in association with *Mauritia, Euterpe, Couratari* sp. (*coco de mono* of the Lecythidaceae), all plants likewise requiring high moisture in the soil. Big parrots often build their nests on top of the stems of this palm.

Iriartella H. Wendl.

A genus closely allied to *Iriartea* but with small, clustered stems, only six stamens in male flowers, and fruit with basal stigmatic residue.

Iriartella setigera (Mart.) H. Wendl.

Stem erect, 3–7 m. high, 4–10 cm. in diameter, surrounded at the base by stilt roots; leaves 1–2 m. long; pinnae 7–10 pairs, oblong-rhomboid, irregularly lobulate to dentate, usually 30 cm. long, sometimes longer, 10 cm. wide, terminal pinna roundish, obtuse and dentate; inflorescence 30–60 cm. long, with 20–25 rachillae about 10 cm. long; spathes 4–5, deciduous; fruit ovoid to cylindrical, 2 cm. long, 1 cm. in diameter. Known locally as *palma de cerpatana.* Widely distributed in the Amazon region of Brazil, in the southern part of Bolívar State, and in the region of the upper Orinoco.

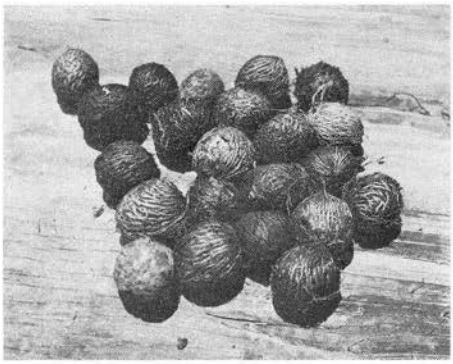
The Indians of the Amazon region make blowpipes from the straight stems of this palm. For this purpose the stem is skillfully divided lengthwise and both parts hollowed out. Then the blowpipe proper, slightly greased with palm oil, is put in and both parts of the stem closely fitted into one another again and the hunting piece is completed. But there are also similar instruments consisting of only one piece made of thin and relatively short stems of this palm.

Jessenia Karst.

Magnificent, elegant, erect, solitary, monoecious palms with pinnate leaves; stem columnar; leaves drooping; sheath short, surrounding the stem, fibrous in age; pinnae equally distributed, narrowly lanceolate; spathes 2, the upper greatly exceeding the lower one, opening along its length, both falling off when the inflorescence expands; inflorescence simply branched, pendulous or taillike; flowers in groups of 2 male and a female in the lower part of the rachillae with only male toward the tip; male flowers with 12–20 stamens; fruit ovoid to almost globose, the pericarp thin, fleshy and fibrous; endosperm irregularly ruminate, embryo basal.

48. A girl of the Maquiritara tribe with seedlings of *Jessenia polycarpa*.

The *Jessenia* species are among the most beautiful and elegant pinnae palms of South America, distributed mostly in the Orinoco and the Amazon region, where they grow singly in moist and hot forests. For the people living in those regions the palm is very useful, furnishing wood for building purposes, leaves



49. Seeds of *Leopoldinia Piassaba*.

for roofing, and oil for cooking. The common name is *seje*. Two species occur in Venezuela.

Jessenia Bataua (Mart.) Burret

Stem 10–20 m. high; leaves 8–10 m. long; pinnae numerous, linear-lanceolate, to 2 m. long, 10 cm. wide; inflorescence 1–2 m. long with numerous rachillae; fruit cylindrical to ellipsoid, 3–3.5 cm. long, 2–2.3 cm. in diameter, varying from violet to purple. Widespread in the southern Orinoco region of Venezuela.

The pulp contains a fine cooking oil extracted by boiling the fruits in hot water; the same oil is known to have a high curative value for asthma. The fresh fruits, soaked for some days in water, yield *agua de seje*, a most refreshing drink.

Cultivation: fresh seeds germinate very easily within 40–90 days. Extremely difficult to transplant. Growth is slow and unsatisfactory in Caracas. It is imperative to keep plants in partial to full shade, at high temperatures, and in an atmosphere with adequate humidity.

Jessenia polycarpa Karst.

Stem 15–20 m. high; leaves 7–8 m. long, bluish on the lower surface, with about 100 pairs of pinnae; pinnae lanceolate, with short or long tips, 1 m. long, 15 cm. wide, many-nerved and pleated; spathes 2, the larger one about 1.4 m. long, the smaller one about 0.4 m. long; inflorescence 2 m. long; male flowers with 16–20 stamens; fruit ellipsoid to cylindrical, 2–3 cm. long. The distribution in Venezuela is mainly the southern part of Bolívar State and the region of the upper Orinoco. Young plants are covered with spinelike fibers which disappear with age and therefore they differ in appearance from adults.

Leopoldinia Mart.

Medium-sized, unarmed, monoecious palms with pinnate leaves, native in tropical South America; stem completely covered in interwoven fibers, wood somewhat spongy; inflorescence among the leaves, paniculately branched, covered with brown tomentum; flowers small, sessile, the male with 6 stamens, the female with trilocular ovary; fruit drupelike, laterally flattened, dry, 1-seeded; endosperm homogeneous, embryo lateral near the base.

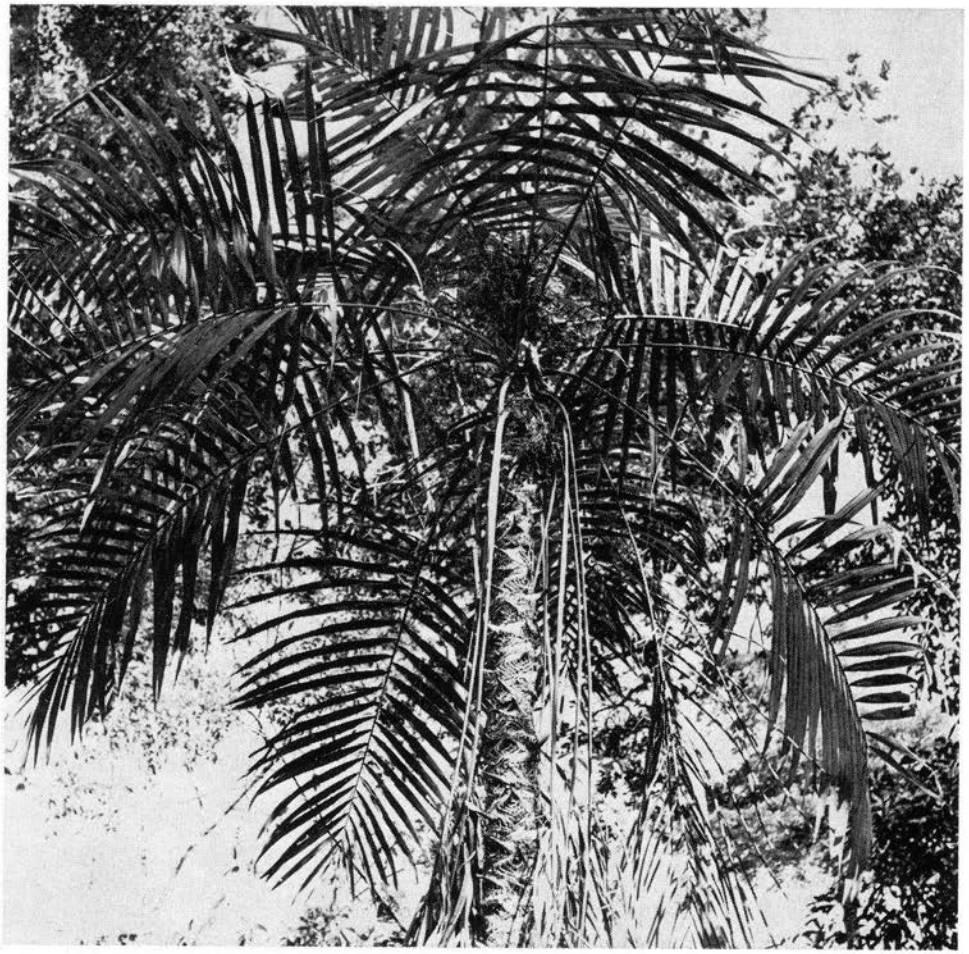
Three species are known, all indigenous to Venezuela where they grow in periodically flooded or at least moist and hot forests from the upper Orinoco down to the Amazon region.

Leopoldinia Piassaba Wallace

Stem erect, robust, solitary, 7–10 m. tall, about 0.5 m. in diameter, enveloped by rough fibers; crown of more than 10 leaves, these 4–5 m. long with about 60 pairs of pinnae; pinnae to 1 m. long, 4.5 cm. wide, linear with pointed tip; spathes 2, membranous, reddish; inflorescence 1 m. long, branches 0.3–0.4 m. long and about 2 cm. thick at base; fruit 4.5 cm. long, 3–4 cm. wide, fibrous, the pericarp rather dry, reddish when mature. Known for its economic

50. A Waika Indian of the upper Orinoco cutting the *chique-chique* palm (*Leopoldinia Piassaba*).

importance and called *chique-chique*. In Venezuela, this species occurs mainly in the region of the upper Orinoco in deeply shaded and moist forests. The leaves are used for roofing. All houses near San Fernando de Atabapo are thatched with the leaves of this palm. Such roofing lasts for 10–21 years. The



51. *Leopoldinia pulchra* growing in the extremely moist selva of Samariape (Amazon Territory).

sheath fibers are manufactured into brooms, brushes, etc. A beverage is sometimes made from the fruits. Not thus far in cultivation.

Lepidocaryum Mart.

Elegant, dwarf, dioecious palms with thin stems and palmate leaves; stems erect to curved with fairly hard, reddish wood; leaves unequally divided into segments and spiny along the margins; inflorescences among the leaves, with several tubular bracts, the rachillae catkin-like, rose-colored to reddish; male flowers with 6 stamens; fruit with heart-shaped scales covering the outside, 1-seeded; endosperm homogeneous, embryo lateral.

Lepidocaryum casiquiarense Spruce

Stem 1–3 m. tall and about 2 cm. in diameter; leaves 70–80 cm. long with 16–20 segments about 40 cm. long and 1.5 cm. wide; female inflorescence 50–60 cm. long; fruit 25 mm. long, 16 mm. wide, top-shaped, pointed at the base and obtuse at the tip, with long persistent pointed scar, scales broad and

52. One of the few *Leopoldinia pulchra* palms growing directly on the brink of the upper Orinoco.

rhomboidal. Occurs in the region of the upper Orinoco, Río Negro and Río Casiquiare.

Lepidocaryum gracile Mart.

Stem graceful; leaves 1.1–1.3 m. long; blade 60–70 cm. long; male inflorescence up to 1 m. long including the main peduncle 50–60 cm. in length; fruit red, cylindrical, short-pointed at both ends, 2.5 cm. long, 1.5 cm. wide, scales 3–4 mm. long, 5 mm. wide. Occurs in the blackwater region of the upper Orinoco, Río Negro and Río Casiquiare.

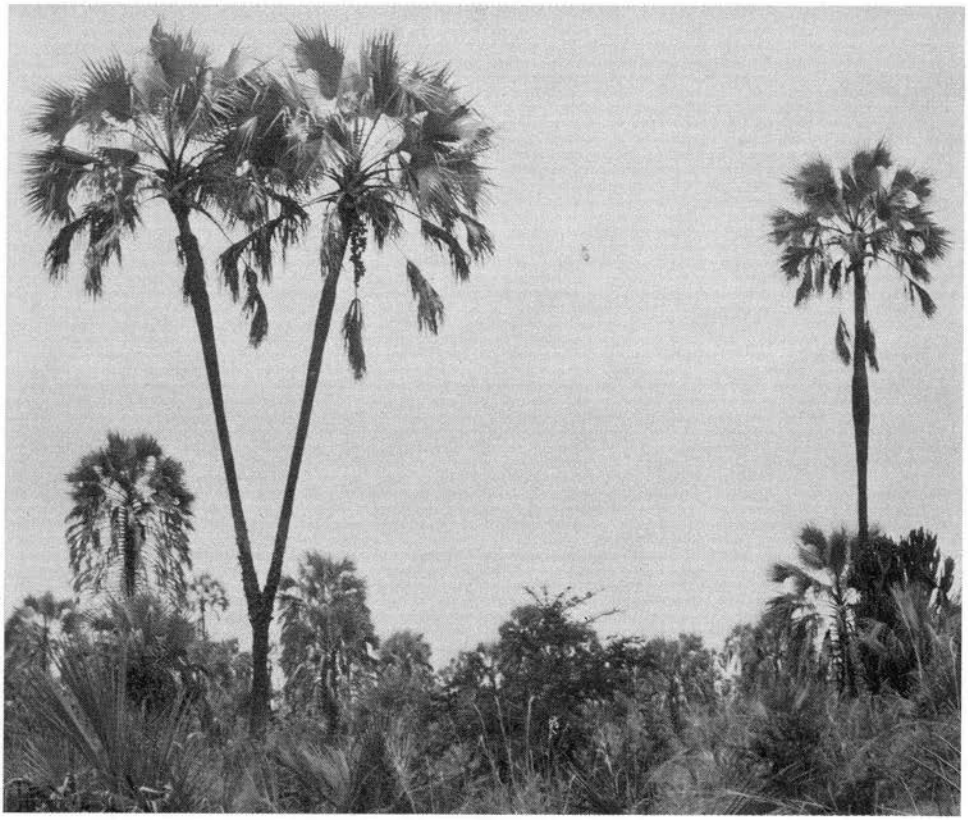
Lepidocaryum guainiense Spruce

Small graceful stems 1 cm. in diameter; leaves 80 cm. long with about 20 linear-lanceolate, pointed segments about 40 cm. long, 1–1.5 cm. wide; inflorescence 40 cm. long with 3–4 branches; fruit of different shapes. Known in the southern part of Bolívar State.

Lepidocaryum tenue Mart.

Stem 2–3 m. tall; leaves 12–15, each with 12 nerves; segments about 50 cm. long, petiole 1 m. long; fruit ellipsoid, roundish with persistent pointed style at the tip, scales about 3 mm. wide, blackish at the tip. Known in the region of the upper Orinoco and the Río Negro where limited to the blackwater region.

(Continued in October issue)



Hyphaene ventricosa, Rusizi Plain, Burundi. Branched and unbranched specimens. Younger specimens have stems with persistent leaf bases.

PALM BRIEFS

A Note on Hyphaene ventricosa

The genus *Hyphaene* is familiar as one in which a regular dichotomy of the trunk is evident. Not all species of *Hyphaene*, however, have branched stems. Odoardo Beccari in his *Palme della tribù Borasseae* (Florence, 1924) divided the genus into two sections, a larger one with 20 species in which the stem is divided and a smaller one with 8 species in which the trunk is undivided. In this small group, *Hyphaene ventricosa* Kirk is most widespread in Central and East Africa and Beccari described a large number of subspecies. A distinctive feature, which gives *H. ventricosa* its name, is the swelling on the upper part of the trunk in tall specimens.

A number of unusual individuals of this species with divided stems have been located and they are illustrated in the accompanying photographs. The palms are growing on the Rusizi plain in Burundi. The Rusizi River is the river between Lake Kivu and Lake Tanganyika. The plain has a special savanna vegetation with some tall trees of *Euphorbia candelabrum* and many Capparidaceae as well as *Hyphaene*.

It is curious to know if branching in these specimens was induced patho-

logically since this type of stimulus to branching is known in many palms. However, since *Hyphaene* includes so many species in which the trunk is habitually branched, these trees may represent a genetic reversion. This latter interpretation is supported by the small area to which the branched palms are restricted. In this area there are eight or nine palms of different sizes. On the other hand all the specimens had only divided once. The location on the Rusizi plain is 3° 14′ S, 29° 15′ E and at an altitude of 800 m.

It seems likely that the palms in question can be referred to *Hyphaene ventricosa* subspecies *rusisiensis* Beccari which was described from the same general locality.

PROFESSOR J. LEWALLE
University of Bujumbura, Burundi, (Central Africa).

NEWS OF THE SOCIETY

Dr. Furtado Studies Hyphaene

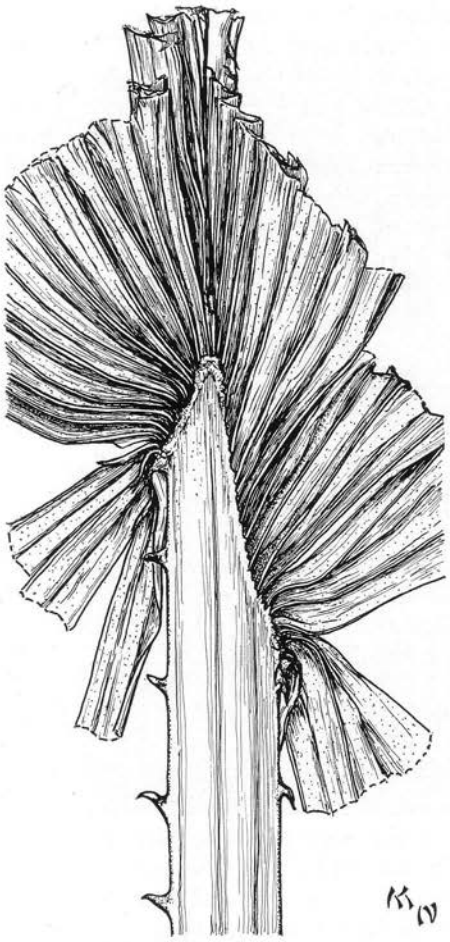
Dr. C. X. Furtado, long active at the Botanic Gardens, Singapore, Cluny Road, Singapore 10, now retired, has been a student of the palms for many years. In a letter recently received by The Palm Society, he writes:

"For health reasons I spent last summer in Lisbon and to keep myself busy, I tried to get myself acquainted with *Hyphaene*, a small genus almost entirely confined to Africa. But what an appalling confusion over the species I found in floras, books, etc. I note PRINCIPES is publishing some papers containing references to these palms. Though Kew has mislaid its specimens, Florence's were unavailable for consultation because of floods in 1966, and Berlin's were destroyed during the war, I persisted in my inquiry of some species that occurred in Portuguese Africa. Though Beccari's nomenclatural treatment was unserviceable, his photographs were most useful; and I think I have solved also the puzzles *re H. coriacea* and *H. crinita*—two binomials that have been misapplied most. A paper is already in press.

"In view of this I wonder if some members of The Palm Society could help to prosecute my study of the genus further by sending me (even from cultivated specimens): (1) about 2 fruits of each species, (2) a specimen of the ligule or hastula of the leaf. In absence of specimens photos could be sent; photos of the plants to show their habit would be useful.

"Please do not send me spathes, spikes, leaves, petioles, etc. I want the specimens to be as small as possible, for the important characters are found in the fruits. But whatever is sent to me would be retained here for future consultation and perhaps revision, so the material or the photos should be adequately numbered so that when a determination is made, the material of the sender could be easily identified from the number. The fruits, ligule and the photo of the plant should receive the same number so that when the species is identified from the fruit, one could study what sort of ligule the species has, and what the habit of the plant is. Most of the species are named on the fruit alone and so one does not know the habit of the palm that produces the fruit.

"I have received excellent photos from Africa showing the habit of the palms (mostly wrongly named as *H.*



The hastula or ligule, that elevated portion at the apex of the petiole, as it appears in *Hyphaene Schatan* (*Read 751*, BH).

coriacea), but since they are without a fruit or its photo, they are of no use to me.

"Any help you may give me in this inquiry will be highly appreciated.

Yours truly,
C. X. FURTADO"

Your secretary replied that she felt sure there would be members of the Society interested in helping unravel this puzzle. While awaiting publication of his appeal in PRINCIPES, she wrote to one of our newer members, Mr. John Avery, in Salisbury, Rhodesia, with whom she had been corresponding about palms. Mr. Avery responded that he would be happy to send Dr. Furtado specimens of fruits and their corresponding ligules or hastulas, but that he had never looked at a ligule, so would like further clarification. Dr. Furtado sent the secretary a copy of a letter he had written to Mr. Avery:

"Through a letter of Mrs. Wait of Miami, Florida, I learnt that you have volunteered to help me in my study of *Hyphaene* spp. Many, many thanks.

"The ligule (hastula) presents some peculiarities which might help to divide the genus into large groups; at least that is the impression I got after studying some specimens from Angola and Monzambique in the herbaria of Lisbon.

"In *H. ventricosa* and *H. benguellensis*, for instance, I found the ligule is obscurely developed on one side and well developed above where it is horizontal and unarmed. In *H. guineensis* (= *H. togoensis*) the ligule is marginal and spinulose on both sides and acute at the apex. In *H. indica* (?) (I have no fruit of this specimen), the ligule is developed into a broad plate with spinulose margins, but horizontal above; owing to the ligule's broad development, the base of lamina is shielded from the view. In *H. doreyi* (new from Angola) the ligule is very thick, woody, unarmed and forms a rounded corner at the apex. In view of this I think the ligule should be studied.

"*H. doreyi* is a stemless plant for long many years, but when the time for flowering comes it grows to a height of 2–3 metres; but one can identify the stemless plants from the ligule, and also male ones.

"Sometimes collectors have taken fallen fruits from a tree and collected leaves

from a juvenile plant nearby. In this case the ligule often shows that the leaf and the fruit do not belong to the same species. Of course the ligule of a juvenile plant differs much from that of the adult leaf, but there is some resemblance. But if you have difficulties to get ligules of adult leaves, you need not trouble yourself. Ligule is not essential for the identification of the species.

"Rhodesia is very rich is *Hyphaene* spp. especially in Matabeleland, Zambesi basin and Victoria Falls. In many dialects and perhaps in Kiswaili *Hyphaene* species is known as *Mateba* or *Mateva*. Kirk, who accompanied Livingstone's expedition, collected several species, though he described only one, *H. ventricosa*. Some of his specimens were identified by Beccari. But Kew has lost or mislaid most of his specimens including the type of *H. ventricosa*.

"I saw in Lisbon two or three pamphlets by Purdy issued on *Hyphaene* by the Rhodesian Agricultural Department. Are these available?"

Dr. Vivi Tackholm, Faculty of Science, Cairo University, Giza, Egypt, also has been appealed to for help in Dr. Furtado's studies of Hyphaene, and Mr. Hein Wicht of Durban, South Africa, is sending material as well.

* * *

Microfilming of Principes and Gentes Herbarum

University Microfilms, Inc., 300 N. Zeeb Rd., Ann Arbor, Mich., 48106, has obtained permission from The Palm Society and from the L. H. Bailey Hortorium, Cornell University, Ithaca, N.Y., to make microfilm copies of back numbers of *Principes* and *Gentes Herbarum*.

Since far fewer than the necessary 100 orders were received by our members in California who have volunteered to reproduce the palm fascicles of *Gentes Herbarum*, it is good news that eventually they will be available on microfilm. The photocopies of out-of-print numbers of *Principes* made in Miami turned out to be expensive and of poor quality, so the project was abandoned. Some copies are still available to anyone who wants them in spite of poor quality (see the Classified Section).

Member Robert M. Montgomery, of Cocoa Beach, Fla., writes that several fascicles of *Gentes Herbarum* dealing with palms are still to be had from Dr. W. J. Dress, at the Bailey Hortorium. He sent us copies of letters he had received from Dr. Dress and from University Microfilms. (See the Classified Section for *Gent. Herb.* palm fascicles available, with prices).

Mr. Montgomery also suggested that we call attention of members to Dr. P. B. Tomlinson's "Anatomy of the Monocotyledons," II Palmae. The price of this book is $12.00, and it can be ordered from Fairchild Tropical Garden, 10901 Old Cutler Road, Miami, Fla. 33156 (include postage). Be sure to specify the book on palms, and not one on grasses.

* * *

Professor T. S. Mahabele, Department of Botany, University of Poona, Ganeshkhind, Poona 7, India, is studying fossil palms and would be happy to receive material from various parts of the world. Professor Mahabele writes that if pieces of stem have roots or leaves attached it is easier to decipher relationships. He needs information regarding locality, geological horizon, age, and a sketch map as well as notes on the condition in which the fossil was found—whether *in situ* and if so in whether vertical or horizontal. Readers may communicate directly with Dr. Mahabele.

L. H. WAIT

CLASSIFIED SECTION

RATES: 5¢ per word, payable when the ad is submitted. (Non-members 10¢ per word). Please send in your copy and payment six weeks ahead of publication date to THE PALM SOCIETY, 7229 S. W. 54th Ave., Miami, Fla. 33143.

GENTES HERBARUM: Palm articles still available in varying quantity:

Vol. IV fascicle	4	$ .50	Vol. VIII fascicle	2	$2.50
	5	.75		3	1.00
	6	1.00		4	2.25
	7	1.00		6	1.25
	10	.75		7	2.00
	12	1.25			
			Vol. 1X fascicle	1	1.00
Vol. VI fascicle	1	1.00		2	4.00
	7	2.00		3	1.00
Vol. VII fascicle	2	.75	Vol. X fascicle	2	2.50
	4	2.00			

Order from Dr. W. J. Dress, Bailey Hortorium, 467 Mann Library, Cornell University, Ithaca, N. Y. 14850.

****

PRINCIPES: Photocopies of out-of-print numbers: Vol. 1, no. 1, Vol. 2, no. 2, Vol. 3, no. 1, $1.50 each. Single back numbers: Vol. 1, no. 2, Vol. 3, nos. 3, 4, $.50 each. Complete volumes 4–11, $2.00 per volume, except Vol. 7 (which contains "Checklist of Cultivated Palms") $3.35. Order from The Palm Society, 7229 S. W. 54th Ave., Miami, Fla. 33143.