

Edible Palm Fruits of the Brazilian Amazon*

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PALMAE

Acrocomia sclerocarpa Mart.

[*Acrocomia* sp.]** MUCAJÁ
*bacaiúva, coco-baboso, coco-
de-catarro, macaíba, macaúba.*

This species is common to nearly all of Brazil; however, it does not appear to reach the State of Amazonas. It is one of the most common palms in the vicinity of the city of Belém, and is found growing singly and spontaneously in open sites or in areas of low second growth.

Mature palms reach a height of 15–20 m, and bear some spines on the trunk. Leaves form a rounded, fairly regular-shaped crown and dead leaves remain attached to the trunk for some time. When the leaves do abscise, the leaf sheaths remain attached and commonly cover the upper half of the trunk. This habit constitutes one of the distinctive characteristics of the species.

* This translation represents the section on palms in the author's longer work entitled *Frutas Comestíveis da Amazônia II*, Museu Goeldi, Belém, Pará, Brasil, 1974.

** Editor's note. Some of the names used differ from those usually accepted today. Owing to a nomenclatural technicality, the name *Acrocomia sclerocarpa* is synonymous with *A. aculeata* (Jacq.) Lodd. ex Mart., a West Indian species, and the correct name for the Brazilian species is not yet clear. The preferred name is included in brackets when different from that given by the author.

The palm generally produces 10–12 fruit clusters which remain partially hidden among the lower, dead leaves. The fruit is a drupe, spherical, single-seeded, and about 4 cm in diameter. The epicarp is coriaceous, rigid, and light-green in color; the mesocarp (the edible pulp) is whitish in color, fibrous, and mucilaginous; the endocarp is of a rock-like consistency, enclosing a small, white kernel or seed, which contains a clear edible oil recommended for the manufacture of soap. The palm fruits from July to November, and into December.

Astrocaryum tucuma Mart.

TUCUMÃ
tucum, tucumã-açu

This palm is found in the states of Pará and Amazonas, but with greater frequency in the latter. It occurs in open sites, or in the midst of low second growth. The single, straight trunk reaches 8–14 m in height, and is adorned with long, black spines, arranged in rings, that are denser in the upper half of the trunk. Leaves have sturdy, enlarged sheaths and are densely aculeate. Fruit clusters are long and cylindrical, measuring about 1.5 m in length. The fruit is a drupe, ellipsoidal or rounded, yellow-green or orange in color, 5–6 cm in length, and weighs 70–75 g. The pulp is yellow in color, oily,

7-8 mm in thickness, and with a flavor similar to that of an apricot (*Prunus armeniaca*). The tree is in fruit from February to May.

***Astrocaryum vulgare* Mart.**

TUCUMÃ

This is the most common of the palms that are popularly called *tucumã* in Pará, and its range also extends to the Northeast Region of Brazil. The fruits of this palm are commonly confused with those of *A. tucuma*, but there are perceptible differences between the two species. *Astrocaryum tucuma* is a solitary palm with an erect trunk and large fruit: *A. vulgare* is a cluster palm and forms clumps of several thin trunks that are somewhat curved in their lower portions. The lower trunk does not have black spines, and the fruits are much smaller than in the other species. Leaves are up to 7 m in length and always erect. The spadix is up to 1.7 m in length. The fruit of this species is commonly found in the open-air markets of Belém in appreciable quantities from January to July. The fruits are eaten fresh, or used to make juice.

The rachis of the leaf furnishes a strong fiber that can be utilized in numerous ways. In addition, the palm yields an excellent heart of palm, although its extraction is made difficult by the quantity of spines on the upper trunk.

The largest consumers of *tucumã* are people of the lower class who, without realizing it, are getting an excellent supply of Vitamin A and other vitamins. The nutritive value of the pulp was demonstrated by the chemical analysis made by Chaves and Pechnik (1947: 17); the first item of their conclusions is quoted as follows:

1. The edible fruit of the *tucumã* reveals itself to be a food of estimable

nutritive value for the following reasons:

a. Its Vitamin A value is 52,000 international units per 100 g, a value equalled only by the pulp of the *buriti* palm (*Mauritia vinifera*). It has 90 times more Vitamin A than the pulp of the avocado, and three times that of the carrot, a vegetable that until recently was considered to be the best source of the vitamin.

b. Its Vitamin B¹ (thiamine) value is important, and its Vitamin C (ascorbic acid) content rivals that of citrus fruit.

c. The food value of the edible pulp is significantly higher than fresh fruits in general, 247 calories per 100 g, due to the presence of 19.1% glycosides, 16.6% lipoids, and 3.5% proteides.

***Elaeis melanococca* Gaert.**

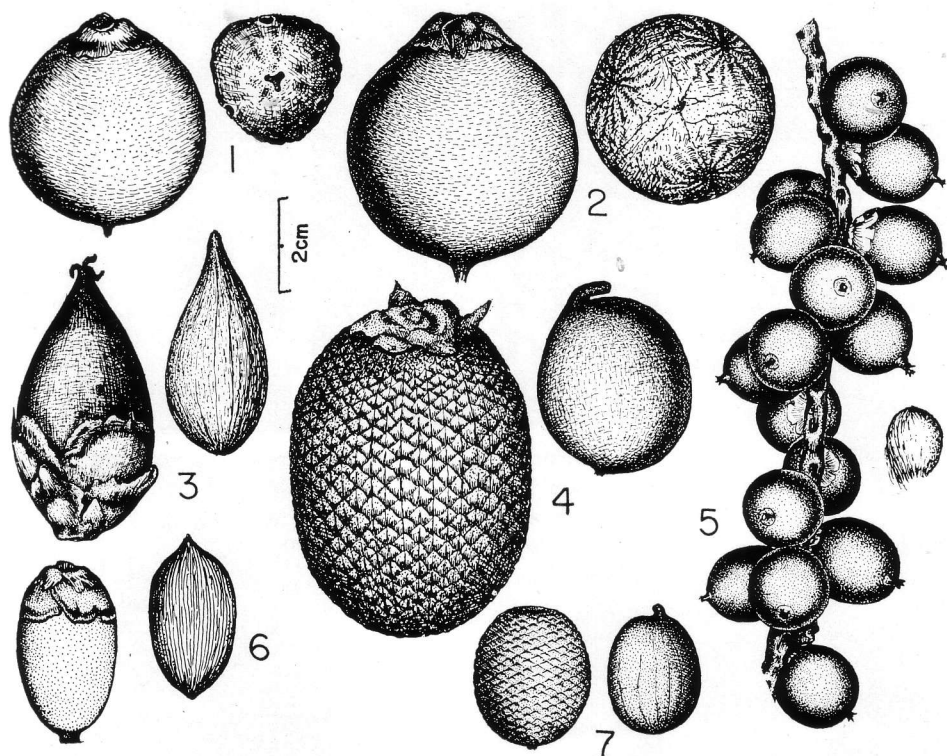
[*Elaeis oleifera* (HBK) Cortés]
(*Corozo oleifera* (HBK) Bail.)

CAIAUÉ

dendê-do-pará

Although this palm does not yield an edible fruit, in its natural state, it is included in this listing because of its importance as one of the typically Amazonian oil palms. The height of the tree, at its maximum, is no taller than a man. While growing, the oldest part of the thick trunk assumes a procumbent position and produces adventitious roots. The oldest part of the trunk dies and decomposes, resulting in an almost imperceptible shift of the plant away from the place where it was originally planted. For that reason, individuals who know the *caiaué* in its habitat, often say that the plant "walks."

The low stature of the *dendê-do-pará* facilitates the collection of fruits. That characteristic has been experimented



1. Palm fruits: 1, *Acrocomia* sp.; 2, *Astrocaryum tucuma*; 3, *Maximiliana martiana*; 4, *Mauritia flexuosa*; 5, *Oenocarpus distichus*; 6, *Jessenia bataua*; 7, *Mauritia martiana*.

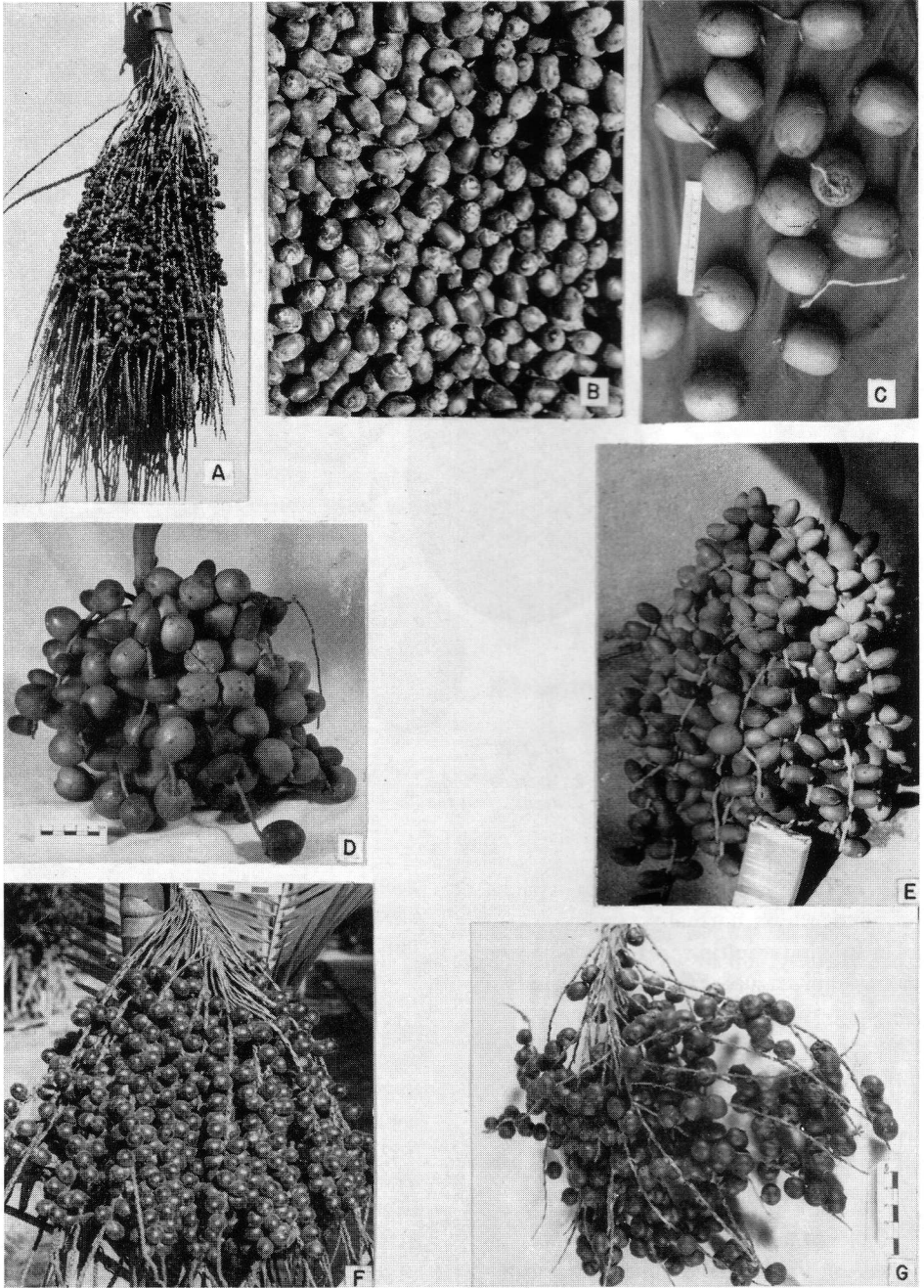
with in cross-breeding with the African oil palm, which normally reaches 15–20 m in height, resulting in hybrids of low or medium stature. The fruit yields two types of oil: the pulp produces a reddish, edible oil, and the kernel contains a white oil that, when refined, can be utilized for the making of margarine.

Euterpe oleracea Mart. AÇAÍ
açaí-do-pará, açaí-do-baixo amazonas

Açaí is one of the most characteristic palms of Pará, found in nearly the entire state. Its major occurrence is in the Amazon estuary, on lands of the floodplains (*várzeas*), the backswamps (*igapós*) and on the uplands (*terras firmes*).

At times the palms are found in almost pure stands, representing, along with *buriti*, the most prominent feature of the vegetation landscape.

One of the characteristics of the species is its growth in clumps, which is the result of basal suckering. The number of individual stems per clump varies according to environmental conditions, and may reach 25, including the suckers. The palm has a thin trunk, sometimes slightly curved, which reaches, on the average, 15–20 m in height. The crown of pinnate leaves with pendulous segments gives the palm its delicate and elegant bearing. For that reason it is not infrequently found in plazas and in private gardens as an ornamental plant.



2. Palm fruits: A, B, *Jessenia bataua*; C, *Astrocaryum vulgare*; D, E, *Bactris gasipaes*; F, *Oenocarpus multicaulis*; G, *Bactris maraja*.

The number of fruit clusters per plant varies up to eight, with three or four being most common. Each cluster is always at a different stage of development, from inflorescences still enclosed in the spathe to clusters with ripe fruit. The fruit is a rounded berry, black-violet in color when ripe, and from 12–15 mm in diameter. Fruiting occurs throughout the year, with the dry season, July to December, being the period of greatest abundance. Fruits from the dry season are said to produce the best-tasting juice. Harvesting the fruit clusters is an arduous and dangerous task, done by individuals accustomed to climbing the *acaí* palms. When someone is atop a palm to harvest the fruit clusters, it is possible to move from one stem to another without descending; in that way all the ripe fruit clusters from a clump can be harvested.

Juice is prepared from the *acaí* fruit, by either manual or mechanical processes, and consumed in the following ways:

- a. With manioc meal or with tapioca and sugar (the most generalized use).
- b. With manioc meal and grilled fish or dried shrimp.
- c. As a porridge (*mingau*), cooked with manioc meal.
- d. As an ice cream or popsickle flavoring.

The juice, called simply *acaí*, is a basic complement to the diet of the lower classes and, in most cases, ceases to be merely a complement, but constitutes the principal food, above all in first form listed above.

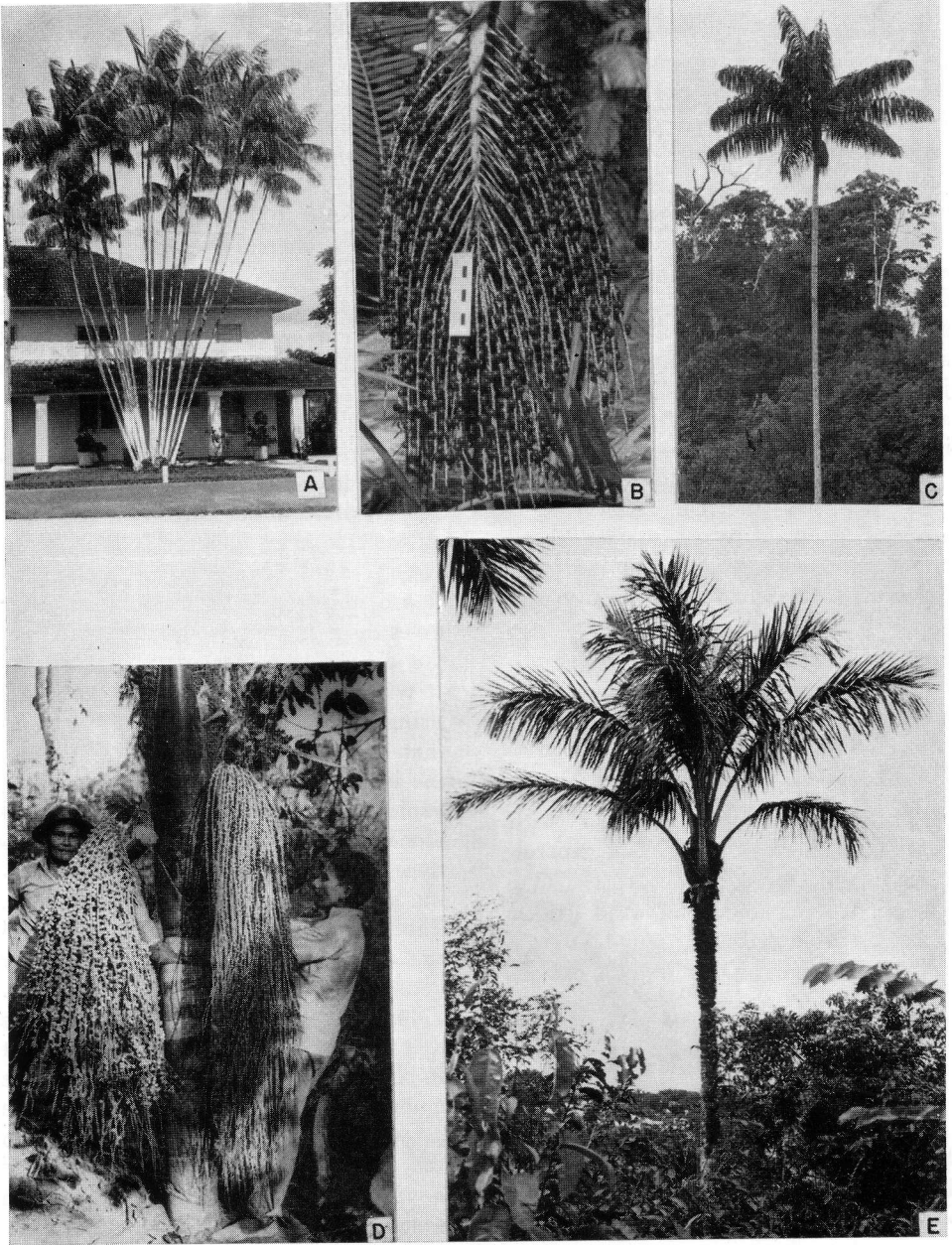
Chaves and Pechnik (1945: 6), in discussing the nutritive value of *acaí*, said: "The interpretation of analytic data permits us to ascertain it to be an

essentially energetic food, with a caloric value higher than that of milk and with a content of lipoids twice as high. It is not very rich in proteides, and the percentage of glycosides is not very high. Nevertheless, *acaí*, as it commonly consumed, with sugar and starch, may be considered a rich food of high caloric value. The content of minerals, calcium, phosphorous, and iron reveals benefit."

Dante Costa (1959: 51) conducted biological experiments with rats, and showed the presence of Vitamin A in *acaí*.

A comprehensive study carried out by Calzavara (1972) addresses all aspects of *acaí* in the Amazon region, notably its economic importance, ecology, agricultural aspects, and methods of cultivation. As far as the chemical composition of the fruit is concerned, Calzavara gives the results arrived at by more than ten different researchers.

Without any doubt, the *acaí* palm brings together exceptional qualities that places it in a primary position as the ideal, highly profitable palm for the exploitation of hearts of palm. One seed alone, after a period of time, can produce a clump of up to 25 palms, counting mature, young, and suckering plants. The mature palms, when they reach old age and die, are gradually replaced by younger plants in a natural sequence. Felling of individual adult palms for the extraction of the heart of palm does not imply, therefore, the destruction of the clump; to the contrary, it stimulates the growth of other plants in the group. On the other hand, the spontaneous and abundant proliferation resulting from fallen seed is another valuable characteristic of the *acaí* palm that encourages its exploitation for the extraction of hearts of palm, without the risk of probable extinction of the *acaí* stands, naturally assuming that rational methods of exploitation are not ignored.



3. Palms and their fruits: A, B, *Euterpe oleracea*; C, D, *Oenocarpus bacaba*; E, *Astrocaryum tucuma*.

Guiljelma gasipaes (HBK) Bailey
 [**Bactris gasipaes** HBK]
 (*G. speciosa* Mart., *Bactris speciosa*
 (Mart.) Karst.)

PUPUNHA

The most common names in Central and South America are: *cachipay*, *chonta*, *chontaduro*, *gachipaes*, *me-canilla*, and *pejibaye*.

A palm which is native to the Americas, and has been widely cultivated for centuries by native peoples. According to historians, the natives festively celebrated the harvest season of the fruit. The country of origin of the palm continues to be a matter of conjecture, presumed to be Peru, Bolivia, or certain areas of Panama, Colombia, and Ecuador. To Huber (1904: 476), the *pupunha*, known only in its cultivated state, could only be a cross between two distinct species: *G. microcarpa* and *G. insignis*. The variation in size, color, and consistency of the pericarp, as well as the reduction or complete disappearance of spines on the entire plant, would be the supporting elements of Huber's hypothesis. Currently it is rare to find a house in Belém or in the interior that does not have a small planting of one or more clumps of this palm.

Beginning with a single palm, the *pupunha* forms a clump of several individual stems and, when mature, it is common to find three to five palms fruiting at the same time. The individual cylindrical trunk grows to a height of 20 m, and has internodes covered with fine, penetrating spines (except in the unarmed varieties). The *pupunha* is a monoecious palm with masculine and feminine flowers on the same spadix, which is enclosed in a persistent, woody spathe that splits longitudinally to release the spadix. The number of inflorescences per plant varies, and may reach as many as ten.

The fruit is in the form of a drupe, and variable in color and size. When ripe the epicarp may be red, yellow, or other intermediary colors, or even completely green. As to its shape, it is ovoid, conical-globose, or rounded, generally having a flattened base. The mesocarp, the edible part, is generally yellow-orange in color, dense, starchy-succulent, with a fat content higher in some varieties and almost absent in others. Fruits are eaten, after being cooked in salted water, and they are widely consumed by people of the lower class. Besides their popular taste, the fruits constitute a food high in Vitamin A. The cooked fruits can be eaten with coffee, with honey, or in the form of sweets, juice, etc. After harvest, and under normal conditions, the fruits will keep for up to ten days before spoiling.

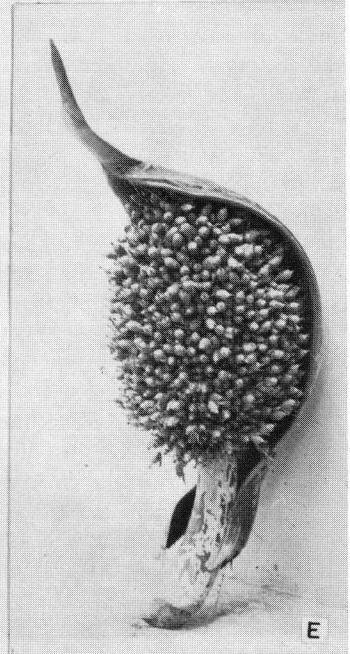
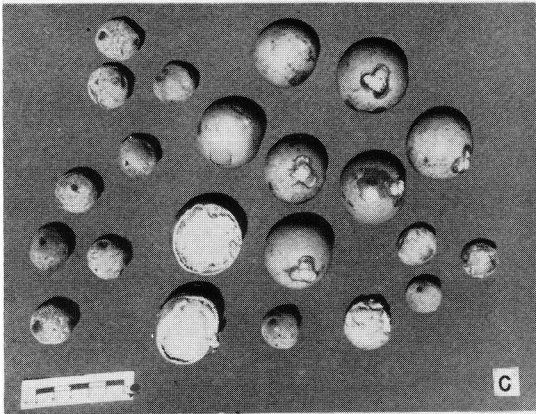
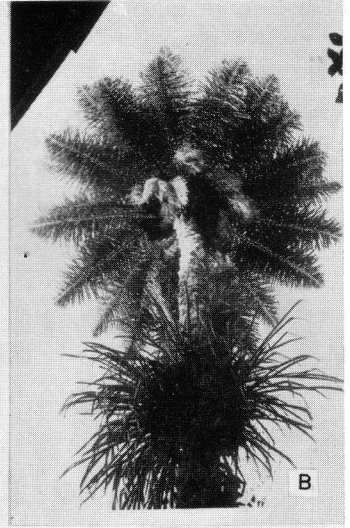
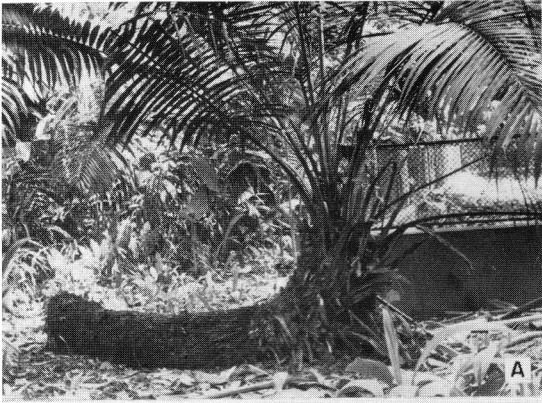
Propagation of the *pupunha* may be accomplished as easily with seed as with basal suckers. Seed propagation has the disadvantage that, many times because of segregation, the desired characteristics are not reproduced and, furthermore, requires a longer period to begin producing fruit. With vegetative propagation using basal suckers, the desired qualities selected for are guaranteed and there is a reduction in the amount of time necessary before fruiting begins. The *pupunha*, furthermore, furnishes an excellent heart of palm, and individual trees can be exploited for it after three to four years.

Appearance of the fruits in the open-air markets begins fairly regularly in November, and continues until June. The peak of the harvest is between March and May.

Jessenia bataua (Mart.) Burret
 (*Oenocarpus bataua* Mart.)

PATAUÁ

batawa (Caribbean), *sacumana* (Peru), *palma seje* (Venezuela)



4. Palms and their fruits: A, *Elaeis oleifera*; B, C, *Acrocomia* sp.; D, E, *Maximiliana martiana*.

A palm of medium height, common in the entire Amazon region. Its area of major occurrence is in the less-flooded lands of the central-west portion of the Island of Marajó (Aramá and Anajás).

The fruit is an oblong berry, 25–33 mm long, with the epicarp a purple-violet color, covered by a light bloom. Juice is prepared from the pulp, using the same process followed for *açaí*; this drink, mixed with manioc meal, should be used sparingly because of its high oil content.

The importance of this palm rests, above all, in the oil extracted from the fruit pulp. Fruits are boiled in water to extract the oil, which can be used as a good substitute for olive oil in cooking. As a result of chemical analyses obtained by various authors cited in Pesce (1941: 29), the following statement is made: "By its chemical constants, by its taste and odor when refined, it closely approximates olive oil; . . . In conclusion, *pataúá* oil can be considered an excellent edible oil."

Notwithstanding such significant characteristics, *pataúá* oil has practically disappeared as a commercial product in Belém, naturally for a simple reason. The palm only exists in a wild state, which results in irregular harvests, and the collection of the fruits is difficult and onerous, a condition which does not exist with the cultivated crops furnishing raw material for the extraction of other oils, such as peanut, soybean, coconut, corn, etc.

The fruits are regularly found in the open-air markets, from October through March, but only in small quantities.

Mauritia flexuosa L. f. MIRITI
buriti, *buriti-do-brejo*; *moriche*
(Venezuela); *palmier bêche*
(French Guiana); *aguaje*, *achual*
(Peru)

A majestic palm found throughout

equatorial America, occurring in the backswamps (*igapós*), riverbanks, and along narrow channels (*igarapés*), almost always in stands forming the characteristic *miriti* groves. It is indisputably the most beautiful palm of the Amazon.

The trunk is straight, cylindrical, 30–60 cm in diameter, with a slight thickening about halfway up, and commonly reaches 25 m in height, rarely more. The palm has a crown of large, fan-shaped leaves, with pendulous ends of leaf segments. The palm is dioecious or polygamous-dioecious, that is, there are individual plants with masculine flowers and others with feminine and hermaphrodite flowers. Inflorescences are large, 2.5–3 m in length, and protected by a spathe of the same length. The number of inflorescences or fruit clusters varies from five to eight per tree. A *miriti* cultivated in the garden of the Museu Goeldi was observed to produce eight fruit clusters at the same time. One of the clusters was cut and a total of 724 fruits was counted, which gives a figure of about 5,700 fruits on that particular tree.

The fruits are globose or oblong, flattened, with an epicarp consisting of shiny, leathery, red-brown, rhomboidal scales. The mesocarp (the edible part) is a thin layer of oily, orange-colored pulp surrounding the more or less spongy endocarp. The large globose seed has a horny endosperm similar to the vegetable ivory palm (*Phytelephas macrocarpa*) but not quite as hard.

Miriti juice is made from fruits, but they must first be soaked for some time in warm water to facilitate removal of the epicarp and to soften the pulp. Another method is to wrap the fruits in leaves for three to four days which, according to some individuals, gives better results. This "softening" is nothing more than a means of accelerating the

ripening of the fruits, inasmuch as they fall from the tree before they are completely ripe. The drink is consumed in the same way as *açai* juice, that is, with sugar and manioc meal. *Buriti* sweet (*doce de buriti*), as it is best known, is also prepared from the pulp and marketed in other states of Brazil. Finally, it is also possible to obtain a reddish, transparent, edible oil from the pulp.

The *miriti* palm produces several other useful products: the new leaves yield a resistant fiber used to make rope, and are also used to wrap the traditional "ropes" of tobacco. The petiole furnishes a light material used to make corks for large bottles and other receptacles containing sugarcane brandy for shipment outside the region; the light material also has considerable use in making handmade toys seen principally during the festival of the Patron Saint of Pará. From the pith of the trunk an edible starch can be obtained, which is identical to sago starch. In addition, the trunk can be tapped for its potable sap.

Fruits appear in the open-air markets, from January to July, sometimes beginning in October, and other times in November or December.

In Belém, it is common to use the terms *miriti* and *buriti* for this palm, even though the names correspond to two distinct botanical species. The first term is Amazonian and refers to the palm *Mauritia flexuosa*. The term *buriti* is attributed to the species *M. vinifera*, found in the States of Bahia, Minas Gerais, Goiás, Ceará, and Mato Grosso. Although the two species are quite similar, they differ in their individual habitats and the morphological characteristics of their inflorescences and fruits, in conformity with the following:

Buriti (*M. vinifera* Mart.)—grows at altitudes above 500 m, in topographic

depressions which have acid soils (Bondar, 1964: 42); male inflorescence is small, fruits ellipsoidal.

Miriti (*M. flexuosa* L. f.)—grows at low altitudes, characteristically in the backswamps (*igapós*) or very wet areas; male inflorescence is larger, fruits generally globose but flattened, with smaller scales.

In many cases, these differences are little noticed by the layman and therein lies the confusion.

Mauritia martiana Spruce CARANÁ *caraná-í, buritirana, burutizinho*

This palm is common in the Amazon estuary, generally found in open swampy areas, quite characteristically in the backswamps (*igapós*). It is cespitose, has a thin trunk covered with strong spines over its entire length, and reaches up to 10 m in height. Leaves are circular, consisting of 30–50 linear-lanceolate segments, with the margins adorned with small aculei. Fruits are ellipsoidal, about 3 cm in length, with an epicarp made up of small, rhomboidal scales, arranged in spirals, similar to *M. flexuosa*. A juice is prepared from the pulp of the fruit which has, to some people, a better flavor than that of *miriti*. The process of "softening" the fruit, as well as the way it is consumed, is the same as for *miriti*. Fruiting is from January to June, but the fruits are not always found in the open-air markets.

Maximiliana regia Mart. INAJÁ [*Maximiliana martiana* Karst.]

This robust palm reaches 10–18 m in height and occupies dry, sandy sites of the uplands (*terras firmes*). It is most common in the Amazon estuary, and extends to the neighboring state of Maranhão, and to Bolivia, Venezuela and Guyana. It has a thick trunk with swellings toward the top, and sometimes

in the middle or at the base. Leaves are pinnate, up to 10 m in length and erect, with leaf segments in groups of three, four, or five, standing out in different directions, making the leaves characteristically crispate in appearance. When the leaves die and dry out, they break at the apex of the petiole and thus, for some time, the upper part of the trunk remains enclosed in the persistent leaf bases.

Inflorescences are large and compact, protected by a large, woody, cymbiform spathe which ends in a sharp point. The fruit is an ovoid drupe, 5–6 cm in length, with the tip pointed and the base protected by induviae. The epicarp is leathery, fibrous, covering a viscous, oily pulp which is slightly acid in taste, but agreeable. The endocarp is stony, with 1–3 seeds. These seeds, or kernels, contain about 60 percent oil, which is similar to *babaçu* palm oil (*Orbignya speciosa*), and has many of the same uses. New leaves are widely used to cover the roof and walls of dwellings, and are also used to make various woven objects. In the rubber-gathering areas, the fruits are burned to smoke latex. The woody spathe, when dried, becomes strongly curved and is used as a seat by the Amerindians. Excellent heart of palm can also be obtained from this tree.

Between January and June the fruits are regularly found in the open-air markets, but occasionally also appear from October to December.

Oenocarpus bacaba¹ Mart. BACABA
bacaba-açu, bacaba-verdadeira

This palm is found in the states of Amazonas and Pará (lower Amazon and Jarí rivers) and cultivated in the garden of the Museu Goeldi. It has a solitary, erect trunk, reaching up to 20 m in

height. The leaves are crispate and 5–6 m in length. The fruit clusters are robust, about 1.5 m in length, with rounded fruits 1.5 cm in diameter, and an epicarp black-purple in color. Fruiting is in the rainy season of the year, from October to June.

Oenocarpus distichus Mart.

BACABA

bacaba-de-leque, bacaba-de-azeite, bacaba-do-pará

This palm is of elegant stature, and one of the most characteristic of the Amazon estuary. It is common in the forest and in areas of second growth of the uplands (*terras firmes*), and its range extends to Maranhão, and to the borders of the states of Goiás and Mato Grosso. The palm grows as an isolated individual plant, up to 10–12 m in height, has a smooth trunk, dilated at the base, and with spaced rings. Leaves are crispate with the sheathing part of the leaf bases elongate and equitant, arranged distichously, that is, in the same plane, in the form of a fan; that characteristic is principal to its easy identification.

The inflorescence is protected by two long, somewhat woody spathes, originating under the lower leaf sheaths. Fruits are rounded or ellipsoidal, 1.5–2 cm in diameter, with a purple-violet epicarp, and yellow-white pulp. The pulp contains 25 percent of a clear, yellow oil that can substitute perfectly for olive oil in its usual cooking usages (Pesce 1941: 34). *Bacaba* juice is a drink of a creamy or milky color, and with a sufficiently good taste (although it has a high oil content).

Fruits are found in the open-air markets beginning in October, and become abundant in the rainy season (January to May), exactly in the period when the *açaí* are scarce, therefore compensating for their lack.

1. All of the *bacaba* palm fruits can be used to make juice, which is prepared and consumed in the same way as *açaí* juice.

Oenocarpus multicaulis Spruce
BACABA
bacabinha, bacaba-i

This palm occurs in the upper Amazon and in Peru. It has been planted in the garden of the Museu Goeldi where it satisfactorily fruits the year-round. It grows in clumps of 5–10 plants, excluding basal suckers. Trunks are thin, sometimes inclined, 7–10 m in height, with distinctive rings. Leaf sheaths are dark green or chestnut brown. The wood is very hard and is streaked with dark and light fibers, reminding one of the wood of the *acapu* (*Vouacapoua americana*). The fruit is almost round, 2.5 cm in diameter, with a black-purple epicarp and a milky-white pulp. Juice made from the fruits and the fruiting season are the same as in *O. distichus*.

Oenocarpus minor Mart.
BACABINHA
bacaba-mirim, bacabí

This palm is found in the states of Pará and Amazonas, although it is not very common. It is characterized by its small size, as the common name *bacabinha*, which means small *bacaba*, indicates. The palm grows as an isolated individual plant to a height of 5–7 m, a diameter of 4–6 cm, and has small fruit clusters. The fruits are a shiny black color, some 1.5 cm in diameter, have a white pulp, and produce an excellent juice. Its fruiting season is from November to April.

Pyrenoglyphis maraja (Mart.) Burr.
[*Bactris maraja* Mart.] MARAJÁ

This small palm with a thin trunk and the rachis of the leaves aculeate, is common in the swampy areas, riverbanks, and narrow channels (*igarapés*) of the Amazon. The wood of the trunk is extremely hard and for that reason is widely used by the Amerindians in making weapons—arrowheads, lances, blowguns, etc. Fruits are globose drupes, purple-black in color, containing a thin mucilaginous pulp which has a bitter-sweet flavor, and is generally appreciated as a snack. The fruits appear in the open-air markets from March to June. Various other species of this genus, whether they have edible fruit or not, are also referred to by the name *marajá*.

LITERATURE CITED

- BONDAR, G. 1964. Palmeiras do Brasil. Bol. Inst. Bot. São Paulo, No. 2.
- CALZAVARA, B. B. G. 1972. As possibilidades do açaizeiro no estuário Amazônico. Bol. Fac. Ciên. Agr. Pará, No. 5.
- CHAVES, J. M. AND PECHNIK, E. 1945. O assaí, um dos alimentos básicos da Amazônia. Amapá (mimeograph).
- AND —. 1947. Tucumã. Rev. Quim. Ind. 16(184): 1–20.
- COSTA, DANTE. 1959. Presença da vitamina "A" no açaí. Bol. Insp. Agr. Pará 9: 53–63.
- HUBER, J. 1904. Notas sobre a pátria e distribuição geográfica das árvores frutíferas do Pará. Bol. Mus. Goeldi Hist. Nat. Ethnogr. 4: 375–406.
- PESCE, CELESTINO. 1941. Oleaginosas da Amazônia. Belém.