

SUMMARY

Two genera, *Oenocarpus* and *Jessenia* are recognized in this complex of Neotropical palms. They are well represented in Brazil, *Oenocarpus* with seven species (*O. distichus*, *O. discolor*, *O. tarapabo*, *O. bacaba*, *O. macrocalyx*, *O. mapora* and *O. minor*, and *Jessenia* with one species, *J. bataua*). Many of these taxa are poorly known and under-represented in herbaria, both in Brazil and elsewhere. A great deal of fieldwork is needed to better understand the basic biology and extent of variation in the populations of these palms.

INTRODUCTION

In 1823, Martius erected the genus *Oenocarpus*, in his classic treatment of the palms, *Historia Naturalis Palmarum*. This first treatment of *Oenocarpus* mentioned five species, all of which were found within the legal borders of Brazil: *O. distichus*, *O. bataua*, *O. bacaba*, *O. minor* and *O. circumtextus*. The generic name referred to the fact that indigenous groups in the Amazon Valley produced a beverage or wine from the fruits, and was thus derived from the Greek, "oinos" meaning wine and "karpos" meaning fruit. Karsten (1857) raised a new genus, *Jessenia*, with no mention of its similarity with *Oenocarpus*. His type species, *J. polycarpa*, was from Colombia. The genus honored Dr. Carl Jessen, a teacher of botany in Eldena, Prussia.

The genera and species were maintained as distinct until Burret (1928) evaluated material of "*O. bataua*" from Brazil and found it to be remarkably similar to *Jessenia polycarpa* from Colombia; except that the staminate flowers from the Karsten material had 14-15 stamens, while that of Martius had 6. The Martius collection was later found to be a mixed collection containing flowers from a different taxon. Burret made the new combination *Jessenia bataua* (Martius) Burret, which redefined the two genera into more natural groupings.

Most recently, Wessels Boer (1965) offered the opinion that *Oenocarpus* was a broad-ranging genus which should include *Jessenia*. Support for this judgement was based on the fact that the leaf sheaths and inflorescences of the two genera were

(*) The New York Botanical Garden, Bronx, New York 10458, E.U.A.

similar. He also noted that the ruminant or homogenous nature of the endosperm, utilized by Burret to support separation, was not a character that could be uniformly applied throughout the Palmae to define generic limits (cf. Euterpe).

My own work, presented in 1980 as a doctoral dissertation, maintained the separation of the two genera, based on characters presented in Table 1.

Table 1. Essential Morphological Differences Between *Oenocarpus* And *Jessenia*

| <i>Oenocarpus</i> | <i>Jessenia</i> |
|---|---|
| Lower surface of pinnae sparsely to densely glaucous. | Lower surface of pinnae with peltate to sickle-shaped to doubly sickle-shaped trichomes. |
| Leaf sheath with straw-like or wiry fibers to ca. 30 cm long. | Leaf sheath with thin, short hair-like fibers and stout knitting-needle-like fibers to 1 m in length. |
| Staminate flowers with 6 stamens. | Staminate flowers with 7-20 stamens. |
| Filaments apically inflexed in bud. | Filaments straight or undulate and rarely curved at apex in bud. |
| Anthers with connective not produced. | Anthers with connective produced. |
| Endosperm homogenous | Endosperm ruminant. |

The present paper comprises information from the 1980 treatment, and data that is from a monograph on the *Oenocarpus*-*Jessenia* complex to appear in 1986. New combinations are presented in the correct form according to the botanical code. Table 2 illustrates the taxonomic system presented in the monograph (Balick 1986, in press).

Table 2. Species In the *Oenocarpus*-*Jessenia* Complex

| | |
|----------------------------------|---|
| <i>Oenocarpus</i> | |
| Subgen. I. <i>Oenocarpus</i> * | |
| 1. | <i>O. distichus</i> * |
| 2. | <i>O. discolor</i> * |
| 3. | <i>O. tarapabo</i> * |
| 4. | <i>O. bacaba</i> * |
| 5. | <i>O. macrocalyx</i> * |
| 6a. | <i>O. mapora</i> subsp. <i>mapora</i> * |
| 6b. | <i>O. mapora</i> subsp. <i>dryanderiae</i> |
| 7a. | <i>O. minor</i> subsp. <i>minor</i> * |
| 7b. | <i>O. minor</i> subsp. <i>intermedius</i> * |
| Subgen. II. <i>Oenocarpopsis</i> | |
| 8. | <i>O. circumtextus</i> |
| <i>Jessenia</i> | |
| 9a. | <i>J. bataua</i> subsp. <i>bataua</i> * |
| 9b. | <i>J. bataua</i> subsp. <i>oligocarpa</i> |

* Brazilian species

In *Oenocarpus* there are two subgenera, *Oenocarpus* and *Oenocarpopsis*, the second containing only *O. circumtextus*, which is found in an area within the present-day frontiers of Colombia. This paper offers a synthesis of the taxonomy of the Brazilian species in the *Oenocarpus*-*Jessenia* complex. The reader is referred to the previously mentioned monograph for information on the ethnobotany, economic value, nutrition, morphology, chemotaxonomy, and detailed taxonomic history. Information on flowering (fl) or fruiting (fr) status of the trees from which herbarium collections were made follows each individual cited collection in the list of representative collections.

TAXONOMIC TREATMENT

Key To The Genera In The *Oenocarpus*-*Jessenia* Complex

1. Seeds with homogenous endosperm; staminate flowers with 6 stamens; pinnae lacking trichomes abaxially or trichomes, if present, needlelike or hairlike.....1. *Oenocarpus*
1. Seeds with ruminant endosperm; staminate flowers with (7-)9-20 stamens; pinnae covered abaxially with peltate to sickle-shaped or doubly sickle-shaped trichomes.....2. *Jessenia*

Taxonomy of the ...

Key To The Brazilian Species of *Oenocarpus*

1. Leaves distichously arranged; solitary palms.
2. Stems thick, 13-25 cm in diameter; central pinnae acute to acuminate, 0.7-1.15 m long, 3.5-5.5 cm wide. (Maranhão, Mato Grosso, Pará and possibly Minas Gerais).
3. Pinnae lanceolate-acute, dark green abaxially, a small swelling present at insertion; petals of staminate flowers oblong-obtuse. (Maranhão and Pará).....1. *Oenocarpus distichus*.
3. Pinnae lanceolate-acuminate, glaucous abaxially, inserted directly into rachis with no swelling; petals of staminate flowers lanceolate-acute. (Mato Grosso, Maranhão and possibly Minas Gerais).....2. *O. discolor*.
2. Stems slender, less than 13 cm in diameter; central pinnae very narrowly acuminate, 40-50 cm long, 2 cm wide. (Rondônia).....3. *O. tarampabo*.
1. Leaves spirally arranged; solitary to caespitose palms.
4. Axis of inflorescence distal to peduncular bract scar greater than 4.5 cm long; pinnae either grouped on the rachis or more or less regular with an occasional grouping of 2-3, usually at midleaf.
5. Rachillae 100-200 or more, usually longer than 80 cm; ripe fruit globose to globose-elongate; pinnae mostly in groups along much of the rachis, except near the apex.....4. *O. bacaba*
5. Rachillae fewer than 100, 75 cm or less in length; ripe fruit ellipsoid-acute to subovoid; pinnae usually (although not always) regularly arranged except for a few and these often at midleaf.
6. Ripe fruit 1.5-1.7 cm long (not including cupule) by 1.1-1.2 cm wide, ellipsoid-acute. (Amazonas only).....5. *O. macrocalyx*.
6. Ripe fruit 1.8-2.9 cm long (not including cupule) by 1.4-2.25 cm wide, ellipsoid to ovoid (Acre and Amazonas).....6. *O. mapora* subsp. *mapora*
4. Axis of inflorescence distal to peduncular bract scar less than 4.0 cm long; pinnae mostly regularly inserted along the rachis, rarely with an occasional grouping of 2-3. Brazil (Amazonas and Pará).....7. *O. minor*.
7. Stems solitary; axis of inflorescence distal to peduncular bract scar 1.3-2.1 cm long, 0.9-1.9 cm wide at scar; rachillae 25-35. (Amazonas and Pará).....7a. *O. minor* subsp. *minor*.
7. Stems caespitose; axis of inflorescence distal to peduncular bract scar 1.4-4.0 cm long, 1.8-2.4 cm wide at scar; rachillae 54-72. (Amazonas and Pará).....7b. *O. minor* subsp. *intermedius*.

DESCRIPTION OF *OENOCARPUS*

Oenocarpus Martius, Hist. Nat. Palm. 2:21-22. 1823.

Type species: *Oenocarpus bacaba* Martius. Lectotypified by H. E. Moore (1963).

Large to medium, solitary to caespitose, erect, pleoanthic, monoecious palms; stems slender to massive, whitish gray to black, smooth to fibrous, or, when young, covered with remains of sheaths and sheath fibers; base sometimes producing a small mass of slender roots.

Leaves pinnate, spirally to distichously arranged in suberect (when young) or horizontally spreading (when mature) coma; sheaths clasping, somewhat split opposite petiole, thick, coriaceous, lightly furrowed on the inside, smooth on the outside, upper portion fibrous, with fibers reaching to petiole base; petiole concave-channeled and smooth adaxially, convex and smooth abaxially; rachis trough-shaped at base, more or less 3- or 4-sided near center, flattened to concave adaxially, flattened to semi-convex abaxially, changing to trigonal towards apex, smooth, more or less ribbed longitudinally, frequently lepidote when young; pinnae numerous, regularly to irregularly inserted along rachis in a single plane or at various angles to rachis; adaxial surfaces glossy green; abaxial surfaces light green to white, linear-lanceolate to oblong-lanceolate at center of rachis, plicate, acute to long acuminate, reflexed at attachment, 1-ribbed with prominent intermediate veins, smooth adaxially, the abaxial surface smooth, usually with waxy coating (at least when newly unfolded) and, in some species, sparsely to densely covered with needle-like to twisted, hair-like trichomes.

Inflorescence interfoliar in bud, protandrous, weakly to strongly hippuriform (shaped like a horse's tail); peduncle short to elongate, flattened adaxially, bracteate, bearing a sharply 2-edged, flattened prophyll with dentate margins and a larger, tubular peduncular bract swollen in the middle, longitudinally somewhat striate, tapering to a sharp point and opening lengthwise; rachis flattened adaxially, frequently lepidote, rachillae simple, inserted laterally and abaxially, arched to pendulous at anthesis, short to elongate, linear to slightly undulate, slender, attenuate.

Flowers unisexual, sessile, borne in triads of two staminate and one pistillate flower proximally on the rachillae, in pairs of staminate or solitary staminate distally or rarely staminate throughout; staminate flowers asymmetrical, sepals three, ovate-lanceolate, acute, centrally somewhat thickened, marginally thin or even somewhat translucent, basally briefly connate to valvate or briefly imbricate; petals three, valvate, longitudinally striate, linear to oblong-lanceolate, acute, slightly fleshy, one or two in each flower often somewhat dissimilar, incurved, stamens six, filaments subulate, slender, linear or sometimes curved and bent, apically inflexed in bud, connective not extending beyond locules; anthers dorsifixed at lower junction of thecae, more or less hastate, rounded or blunt apically, versatile, with two easily separated, bilocular thecae, longitudinally and extrorsely dehiscent; pistillode small, trifid; pistillate flowers symmetrical; sepals three, imbricate, fleshy, suborbicular, hooded-concave,

enclosing corolla in bud; petals three, imbricate (except the briefly valvate apex when mature), suborbicular, hooded-concave, somewhat thin when young, becoming larger and fleshier at maturity; staminodes lacking; gynoecium unilocular, uniovulate; ovule erect, anatropous, rarely aborted; style short, thick; stigmas three, reflexed at anthesis, papillate adaxially.

Fruit green when young, covered with a varying degree of wax, becoming dark purple when ripe, globose to ovoid-ellipsoid, obtuse to acute, basally with a shallow, bowl-like cupule of indurate perianth; stigmatic residue apical to slightly excentric; epicarp smooth; mesocarp fleshy, rich in oil, with, thin, flattened longitudinal fibers adnate to and completely covering seed; **seed** ovoid-elliptic to globose; endosperm horny, white, homogeneous; embryo white, clavate, ca. 2/3 as long as seed.

1. *Oenocarpus distichus* Martius, Hist. Nat. Palm. 2:22-23. 1823.

Type: Brazil. Pará, 1818-1820, Martius 2615 (M, isotype P).

Trunk large, solitary, columnar, 10-20 m high, 13-25 cm in diameter.

Leaves 9-15 per coma, robust, distichous; sheath ca. 70-95 cm long, outer surface dull olive-green, inner surface brown, glossy, upper margins lined with reticulum of slender, flexible brown fibers; petiole green to green-brown, gray(?) -lepidote at first, becoming more or less glabrous; rachis green to dark green, more or less unequally 4-sided towards center with shallow keel protruding upwards along center of adaxial face, extending along part of rachis, 3.5-5 m long, gray-lepidote when young, this vesture frequently falling away with age; pinnae 89-109 per side, fewer on younger specimens, inserted at regular intervals and more or less in same plane at apex, irregularly arranged towards middle and base either singly or in groups of 2-7 at various angles to rachis, pale green abaxially, linear to linear-lanceolate, acute; basal pinnae ca. 0.7-1.1 m long, ca. 2-3.5 cm wide; central pinnae ca. 0.7-1.15 m long, ca. 3.5-5 cm wide; apical pinnae (fourth from apex measured) ca. 38-71 cm long, ca. 2.5 cm wide.

Inflorescences one to few apparent at any one time, creamy white at anthesis, changing to reddish powdery in fruit; prophyll olive-green, ca. 93 cm long, ca. 24 cm wide (a single robust example measured, norm much smaller), gray-brown-lepidote when young; peduncular bract of similar color, ca. 1-2 m long, red-brown-lepidote when young, the indument turning gray with age or falling away, axis distal to peduncular bract scar 25-35 cm long, 2.6-3.5 cm wide at this scar, variable in size depending on individual; rachillae ca. 69-186, ca. 0.9-1.2 m long, 4-5+ mm wide, triads on proximal 50-65% of individual rachillae, this variable; **staminate flowers** creamy white, sepals ca. 1.25 mm long; petals ca. 4 mm long, filaments brown, slender; **pistillate flowers** creamy white in bud, (20-) 51-165 per rachilla, ca. 4 mm long, ca. 4.5 mm wide at time of anthesis of staminate flowers.

Fruit globose to somewhat globose-elongate when mature, variable in size, 1.8-2.1 cm long (including cupule), 1.4-1.6 cm wide, 2-3 gm in weight when ripe, stigmatic residue apical to slightly excentric, sharply pointed, ca. 1.5 mm long, ca. 2 mm wide;



Fig. 1. *Oenocarpus distichus* in a remnant of primary forest along the Cuiabá-Santarém Highway.

cupule tan, ca. 4 mm deep, ca. 9 mm wide; epicarp grainy-waxy; mesocarp pulpy, greenish to purple; fibers ca. 0.5 mm wide.

Distribution: Pará and Maranhão.

Representative specimens: Pará: Belém, rear of Instituto farm, 26 Nov 1946 (fr), **Bailey 341** (BH); Cuiabá-Santarém highway, BR 163, km 878 from Cuiabá, Cachoeira do Curuá, Serra do Cachimbo, 4 Nov 1977, **Balick et al. 910** (BH, ECON, MG, NY); km 876 from Cuiabá, 6 Nov 1977 (fr), **Balick et al. 915** (ECON, MG, NY); km 1231 from Cuiabá, 17 Nov 1977, **Balick et al. 930** (ECON, MG, NY). Goiás: Araguatins, ca. 1 km E of Rio Araguaia on BR 230 (fl) 26 Nov 1981, **Balick et al. 1306** (INPA, MG, NY).

Cultivated: Pará: Belém, EMBRAPA station, 13 Dec 1977, **Balick & Rosa 957** (ECON, MG).

This species is easily recognized because of its 2-ranked leaf arrangement. It is found in primary forest as well as in open pastures that once comprised primary forest. *Oenocarpus distichus* does not seem to thrive in the exposed and neglected environment of a pasture and does not multiply in this type of setting. It is rare to find fruit set comparable to that in a primary forest habitat and thus this species is not considered aggressive. If not for the distinctive ranking of the leaves, this species could be confused with *O. bacaba*. The distribution of *O. distichus* is much greater than indicated by the representative specimens. On a recent field trip heading from north to south through Goiás, I noticed it to be a common palm, disappearing a hundred kilometers or so before Brasília. It is extremely common in the forests around Tocantinópolis, Goiás, where the Apinajé Indians utilize the fruits to make a beverage and weave baskets from the leaves.

2. *Oenocarpus discolor* Barbosa Rodrigues, *Palmae Mattogrossenses*. 8, t. 3. 1898.

Type: Brazil. Mato Grosso, **Barbosa Rodrigues 239** (destroyed); Barbosa Rodrigues, *Palmae Mattogrossenses* (1898) t. 3 (lectotype).

Trunk medium, solitary, columnar, ca. 8 m high, ca. 15 cm in diameter.

Leaves ca. 10 per coma, robust, distichous; sheath ca. 25 cm long, somewhat gibbous dorsally; petiole ca. 1.2 m long, channeled adaxially, gray tomentose (with age?); rachis more or less unequally 4-sided towards center, with a shallow keel protruding upwards along center of adaxial face, extending along part of rachis; rachis ca. 4-5 m long; pinnae numerous, inserted at regular intervals and more or less in same plane at apex, aggregated in groups of 2-6 at various angles to rachis towards middle and base, somewhat erect and deflexed-pendulous, narrowly to broadly linear, weakly acuminate; basal pinnae ca. 1 m long, ca. 1 cm wide; central pinnae ca. 1.1 m long, ca. 5.5 cm wide; apical pinnae ca. 30-40 cm long, ca. 1.5 cm wide.

Inflorescences one to several apparent at any one time; prophyll ca. 50-70 cm long, ca. 20 cm wide, reddish to light brown-lepidote; peduncular bract ca. 0.7-1.1 m long, ca. 15 cm wide, lepidote like prophyll; axis with many deflexed pendulous rachillae ca. 50 cm long, these red powdery in fruit, with densely arranged flowers; **staminate flowers** with sepals lanceolate-acuminate, ca. 1.25 mm long(?); petals ca. 3.25 mm

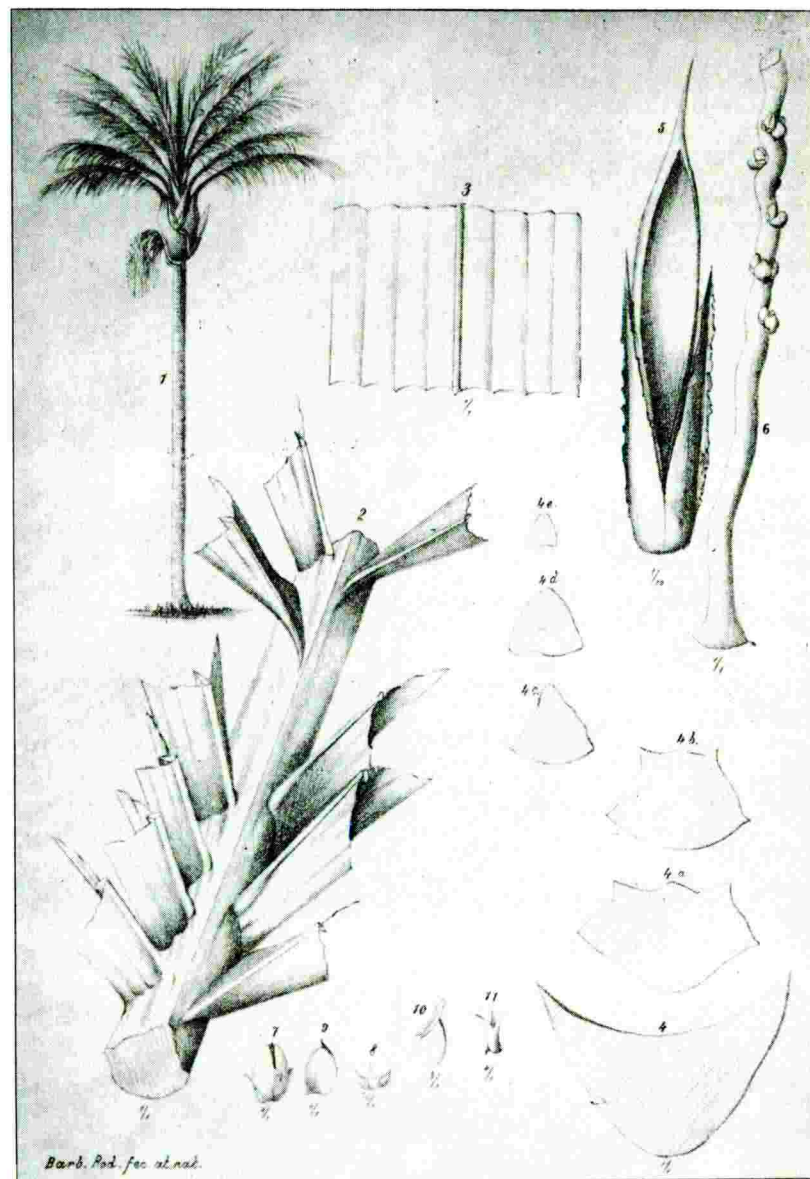


Fig. 2. *Oenocarpus discolor*, from Barbosa Rodrigues (1898).

long(?), oblong-acute, stamens about one-half as long as petals.

Pistillate flowers and fruits unknown.

Distribution: Mato Grosso, Maranhão and possibly in Minas Gerais.

No herbarium material of this species is available for study. The type was destroyed, as was the fate of many of the Barbosa Rodrigues types, and Glassman (1972) designated the lectotype from a drawing. The description presented here is based entirely on writings of Barbosa Rodrigues (1898, 1903). This species is presumed distinct from *Oenocarpus distichus*, based on a number of morphological differences outlined in the key. However, it is necessary to recollect *O. discolor* in order to determine its true taxonomic status.

3. *Oenocarpus tarampabo* Martius, *Palmet. Orbign.* 12, t. 8 fig. 3, t. 18b. 1847.

Type: Bolivia. Beni, d'Orbigny 28 (destroyed); Martius, *Palmet. Orbign.* (1847) t. 18b (lectotype).

Trunk medium, solitary, slender, ca. 8-9 m high.

Leaves 14-15 per coma, elegant, arched-spreading, distichous; petiole 45-60 cm long; rachis rather broad and thick, ca. 2.5-3.5 m long; pinnae in groups of 2-5, linear-lanceolate, narrowly long-acuminate, deep green adaxially, ca. 40-50 cm long, ca. 2 cm wide.

Inflorescences several per tree, creamy white at anthesis; peduncular bract fusiform, longitudinally striate; axis distal to peduncular bract scar ca. 10 cm long; rachillae ca. 30-40 cm long, clustered tightly at base, attenuate; petals of **staminate flowers** oblong-lanceolate, acute.

Fruit subglobose, ca. 1.5 cm in diameter; stigmatic residue somewhat eccentric.

Distribution: Rondônia.

As with the preceding species, there is no herbarium material of *Oenocarpus tarampabo* available for study. While it is reported from Rondônia and Beni, Bolivia, there are few instances of botanists noting it in the wild. I had the opportunity to see a solitary individual of this species in San Joaquín, Beni, Bolivia in 1982, and to make a few notes. Unfortunately, circumstances did not permit intensive study even though local people reported it to be a common palm in a region a few hours drive from the town.

4. *Oenocarpus bacaba* Martius, *Hist. Nat. Palm.* 2: 24-25. t. 26. 1823.

Type: Brazil. Amazonas, Martius s.n. (M ?, n.v.).

Oenocarpus bacaba var. *xanthocarpa* Trail, in Im Thurn, *Timehri* 3: 2-230. 1884.

Oenocarpus baccata, in Cuervo-Marquez, *Trat. Elem. Bot.* 458. 1913. *nomen nudum*.

Oenocarpus hoppii Burret, *Notizbl. Bot. Gart. Berlin-Dahlem* 11: 1041. 1934.

Type: Brazil. Pará: cultivated in the gardens of the Museu Goeldi, Oct. 1932, Hopp 8(B).

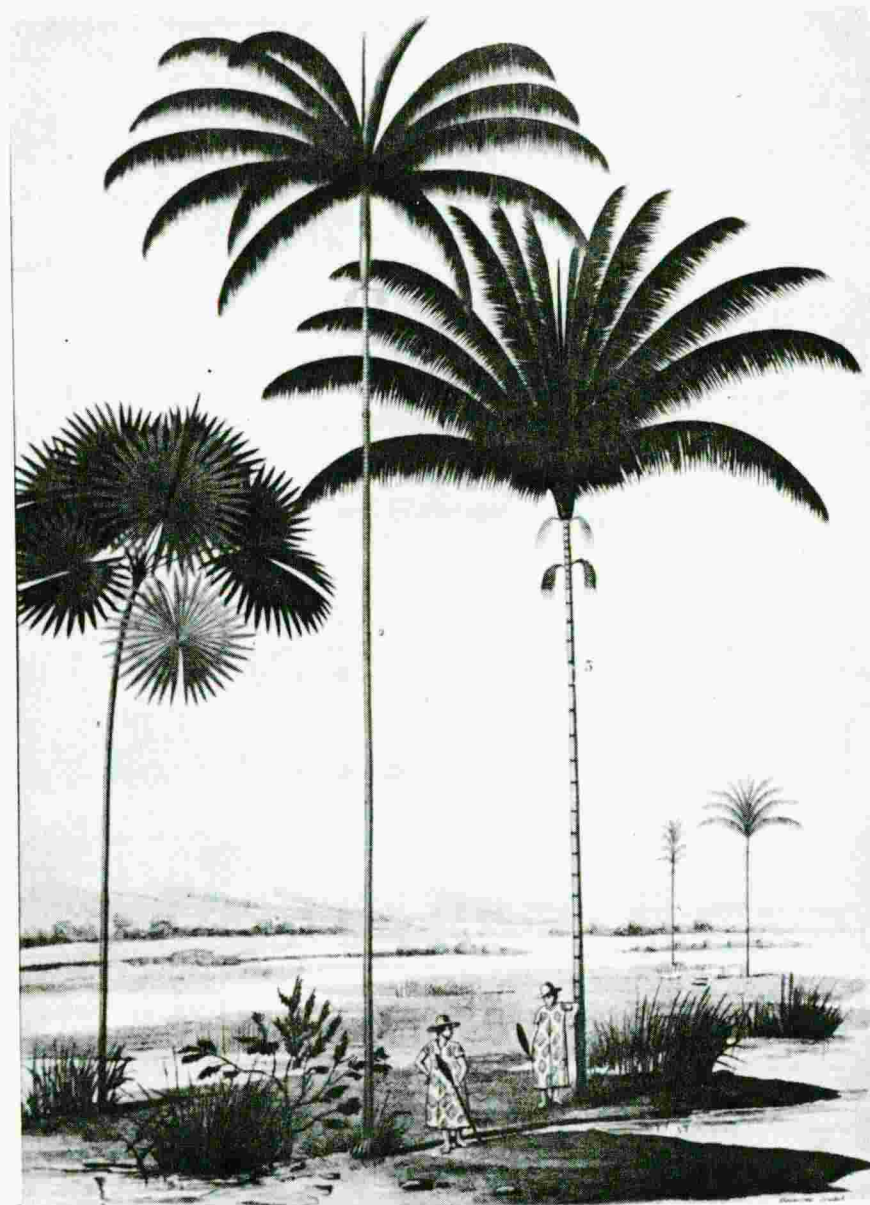


Fig. 3. *Orbignya tarampabo* (right), shown with *Euterpe precatoria* (center) and *Trinax chuco* (left); from Martius (1842).

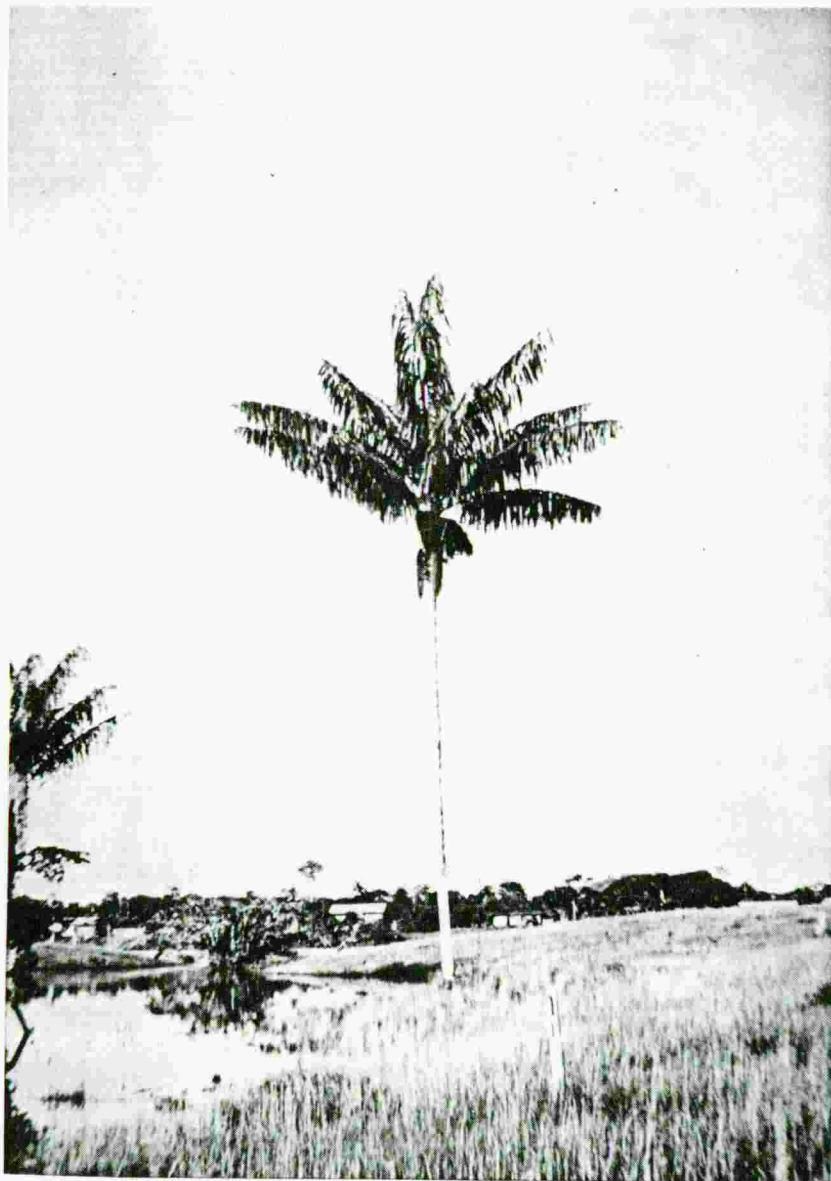


Fig. 4. *Oenocarpus bacaba* in a seasonally inundated pasture.

Oenocarpus grandis Burret, Notizbl. Bot. Gart. Berlin-Dahlem 12: 612. 1935.

Type: Brazil. Amazonas: Manicoré, middle Rio Madeira. 1934, Hopp 1324(B).

Oenocarpus bacaba var. *bacaba*, in Wessels Boer, Acta Bot. Venez. 6: 327. 1971. *nomen nudum*.

Oenocarpus bacaba var. *grandis* (Burret) Wessels Boer, Acta Bot. Venez. 6: 327. 1971. *nomen nudum*.

Oenocarpus bacaba var. *parvus* Wessels Boer, Acta Bot. Venez. 6: 327. 1971. *nomen nudum*.

Trunk large, solitary, columnar, 8-20(-25) m high, (12-)15-25 cm in diameter.

Leaves 7-17 per coma, robust, spirally arranged, fewer in younger or senescent plants; sheath ca. 0.75-1.10 m long, outer surface dull olive green, inner surface glabrous, brown, upper margins lined with straw-like, brown, flexible fibers; petiole green to green-brown, ca. 0.6-1.0 m long, gray-lepidote at first, becoming more or less glabrous; rachis green to dark green, unequally 4-sided in cross section towards center, 3.5-6.0 m long, maroon-lepidote when young, vesture becoming darker or gray with age and frequently falling away, pinnae 75-117 per side, inserted at regular intervals and all in same plane at apex, usually irregularly arranged towards middle and base either singly or in groups of 2-6(-7) at various angles to rachis, linear to linear-lanceolate, acute, somewhat pendulous; basal pinnae (0.65-)0.7-1.2 m long, 1.5-4.0 cm wide; central pinnae (0.7-)0.9-1.6 m long, 3-7 cm wide; apical pinnae (fourth from apex measured) (23-)30-70(-83) cm long, 1.5-2.25 cm wide.

Inflorescences one to several apparent at any one time, creamy-white at anthesis, (changing to reddish powdery in fruit); prophyll olive green, 0.3-1.0 m long, 9-20 cm wide; peduncular bract similar in color, 0.8-2.0 m long, ca. 10+ cm wide, frequently somewhat brown-lepidote; axis distal to peduncular bract scar (7.5-)15-40 cm long, (2.35-)3.5-10 cm wide at scar, axis variable in size depending on individual; rachillae ca. 113-200(-230), (0.55-)0.8-1.2(-1.72) m long, 4-7 mm wide, triads on proximal 43-90% of individual rachillae but variable; staminate flowers creamy-white in bud; sepals ca. 1.5-1.75 mm long; petals ca. 3-5 mm long, ca. 1.5-3 mm wide; anthers ca. 3 mm long, filaments brown; pistillate flowers creamy white in bud, \pm 110-190 per rachilla, ca. 4 mm long, ca. 4 mm wide at time of anthesis of staminate flowers.

Fruit globose to somewhat globose-elongate when mature, variable in size (1.5-)1.6-2.1(-2.2) cm long (including cupule), (1.2-)1.4-2.1 cm wide, (1-)3-6 gm in weight when ripe, stigmatic residue apical to somewhat eccentric, pointed, ca. 1 mm long, 2 mm wide; cupule tan, ca. 4-6 mm deep; epicarp grainy-waxy; mesocarp pulpy, light purple; fibers ca. 0.5 mm wide.

Distribution: Amazonas, Pará.

Representative Specimens: Brazil. Amazonas: Tefé, 25 Sept 1947 (fr), Black 47-1522 (IAN); Manaus, Campos Salles, Oct 1926 (fr), Huebner 83 (B); Reserva Florestal Ducke, km 26 on Manaus-Itacoatiara Highway, 6 Sept 1966 (fr), Prance et al. 2187 (BH, INPA, NY).

Pará: Boa Vista on the Tapajós River, May-June 1929 (fl), Dahlgren & Sella 131 (F); lower Trombetas, Achipicá Lake, 20 Sept 1910 (fl, fr), Ducke (RB herb n° 10973) (MG). Amazônia: Experimental Station at Mazagão, Ilha das Barreiras, 17 Jan 1956 (fr), Ledoux 56-1502 (IAN).

Cultivated: Brazil. Pará: Botanical Garden of Museu Paraense Emílio Goeldi, cult. pl. no. 108, Dec 1977, Balick 966 (ECON).

Oenocarpus bacaba is a widespread species in many terra firme sites up to about 1000 m in altitude. It is exploited throughout its Neotropical distribution for thatch, wood, and fruit, the latter made into a beverage or oil. A number of species and varieties have been placed in synonymy with it as they were based on limited collections of individuals which simply expressed variation due to environmental factors or age. The palms Wessels Boer described as new "varieties" are an excellent example; these were based primarily on panicle size and general stature of the tree, indicative of phenotypic variation, rather than having genetic foundations. It would be of great interest to study populations of *O. bacaba* in an intensive manner to determine if special varieties or forms may be found that are potentially of use in oil production. In the Vaupés of Colombia I found a hybrid between *O. bacaba* and *Jessenia bataua*, and in Manaus, a hybrid between *O. minor* and *O. bacaba*. The topic of hybridization in this palm is an exciting research area which deserves further attention.

5. *Oenocarpus macrocalyx* Burret, Notizbl. Bot. Gart. Berlin-Dahlem 11: 1043, 1934.

Type: Brazil. Amazonas: Livramento near border of Mato Grosso, Jan 1932, Hopp 1155 (B).

Trunk large, stem diameter and habit unknown, to 30 m tall.

Leaves spirally arranged (?); sheath ca. 45 cm long, ca. 20 cm in diameter at base maroon-lepidote abaxially, upper margins lined with a dense mass of slender, short, more or less rigid fibers; petiole and rachis ca. 2.9 m long; rachis at base 3 cm wide, more or less unequally 3-sided in cross section near middle (?), maroon-lepidote; pinnae numerous, usually inserted at regular intervals and all in the same plane but some grouped in pairs and inserted at various angles to the rachis; central pinnae to 75 cm long, 2.5-3.5 cm wide, linear-lanceolate, gently acuminate.

Inflorescences creamy white at anthesis; prophyll ca. 27 cm long; peduncular bract probably ca. 50 cm long; axis distal to peduncular bract scar 4.5-5 cm long, ca. 1.6-1.8 cm wide at scar; rachillae ca. 44, each 26-44 cm long, ca. 3-5 mm wide at center; triads on proximal 44-77% of individual rachillae, this variable depending on individual. **Flowers** unknown.

Fruit ellipsoid-acute, ca. 1.3-1.7 cm long (including cupule), 1.0-1.2 cm wide; stigmatic residue apical, ca. 1 mm high, ca. 1 mm wide; cupule tan, 3-4 mm deep, 6-10 mm wide; epicarp grainy, mesocarp thin, pulpy, fibers ca. 3-4 mm wide.

Distribution: Amazonas.

Representative Specimen: Brazil. Amazonas: Mun. Humaytá, between Rio Livramento and Rio Irixuna, 7-18 Nov 1934 (fr), Krukoff 7052 (A, BH, F, K, LE, MO, NY, U, US).

There are only two collections, Hopp 1155 and Krukoff 7052, available for study. Burret distinguished this species from *Oenocarpus minor* by the larger calyx of *O. macrocalyx*, extending to 2/3 the length of the corolla vs. 1/2 the length in *O. minor*. Better distinction can be based on the panicle size; Burret's species has a larger primary axis in the panicle. However, much more fieldwork is needed before a good understanding of this species can be obtained.

6. *Oenocarpus mapora* Karsten, Linnaea 28: 274. t. 55. 1857.

Trunk medium to large, caespitose, 6-12 per cluster or more rarely solitary, columnar, 3-16(25) m high, 9-15 cm in diameter.

Leaves ca. 6-8 per coma, arching, spirally arranged; sheath ca. 45-95 cm long, outer surface dull olive green to leaden gray, inner surface glabrous, brown, upper margins lined with wiry brown fibers, petiole green to green-brown, ca. 15-95 cm long, ca. 2.5-3+ cm wide at apex, light brown to maroon-lepidote at first, indumentum becoming gray and frequently deciduous, then glabrous; rachis green, unequally 3-sided in cross section towards center, (0.95-)2.8-5.5 m long, lepidote; pinnae 60-71+ per side, inserted at regular intervals and all in the same plane at apex, often more or less irregularly arranged towards center and base, either singly or in groups of 2-4, at various angles to rachis (some to ca. 75°), linear-lanceolate, acute; basal pinnae ca. 55-75 cm long, 2.0-3.5 cm wide; central pinnae 0.6-1.0 m long, 3.5-5.5(-7.8) cm wide; apical pinnae (fourth from apex measured) 20-33 cm long, 1.25-2.75 cm wide. Pinnae generally devoid of trichomes between the intermediate veins abaxially, or if trichomes present, these mostly single and bristle-like and appressed to the lamina, or else on the intermediate veins.

Inflorescences one to several apparent at one time, creamy white at anthesis, changing to reddish powdery in fruit; prophyll olive green, ca. 25-45(57) cm long, somewhat lepidote; peduncular bract of similar color, 50-85+ cm long, ca. 4-8+ cm wide at center, light orange-lepidote when young, becoming dark orange-maroon with age; axis distal to peduncular bract scar 6-20 cm long, 1.9-4.75 cm wide at scar, axis variable in size depending on the individual; rachillae ca. 64-98, 36-73 cm long, ± 2-5 mm wide; triads on proximal 50-60% of individual rachillae; **staminate flowers** creamy white, sepals ± 1.5-1.75 mm long; petals 3-4 mm long, 1.5-2.0 mm wide, anthers ± 1.75-2.75 mm long, filaments brown, slender, straight to somewhat undulate; **pistillate flowers** creamy white in bud, 54-97 per rachilla, ± 3.0-3.5 mm long, 4.5-6.0 mm wide at time of anthesis of staminate flowers.

Fruit ellipsoid to subovoid, variable in size, 1.8-2.5 cm long (not including cupule), 1.4-2.0 cm wide, stigmatic residue more or less apical, ca. 2 mm long, 1-3 mm wide; cupule tan, ca. 5-6 mm deep, ca. 9-16 mm wide, epicarp grainy-waxy, mesocarp pulpy, lavender to purple, fibers ca. 0.5 mm wide.

The preceding description is of *Oenocarpus mapora* Karsten subsp. *mapora*, a subspecies recognized from Brazil (Balick, 1980; 1986, in press). Another subspecies, *O.*

mapora subsp. *dryanderæ* (Burret) Balick, is found along the Pacific Coast of Colombia, in the area near Buenaventura.

6a. *Oenocarpus mapora* Karsten subsp. *mapora*

Type: Venezuela. Zulia: Perija de Maracaibo, without date, Karsten s.n. (isotype, LE).

Oenocarpus multicaulis Spruce, Journ. Linn. Soc. 11: 142. 1871.

Type: Peru. San Martin: Tarapoto, without date, Spruce hb. palm. 63, (K? n.v).

Oenocarpus huebneri Burret, Notizbl. Bot. Gart. Berlin-Dahlem 10: 297. 1928.

Type: Brazil. Amazonas: Manaus, Jan. 1927, Huebner 87 (B).

Oenocarpus panamanus Bailey, Gent. Herb. 3: 71, fig. 50-53. 1933.

Type: Panama. Canal Zone: Summit, experimental garden, 1 Jul 1931, Bailey 441 (BH).

Distribution: Pará.

Representative Specimens: Brazil. Acre: Near mouth of Rio Macauhan, tributary of Rio Yaco, 5 Sept 1933 (fl), Krukoff 5803 (K, NY). Amazonas: basin of Rio Madeira, Humaytã near Três Casas, 14 Sept - 11 Oct 1934 (fl), Krukoff 6402 (A, K, NY).

Oenocarpus mapora subsp. *mapora* is a very widespread species in the Neotropics, from Central America (Costa Rica, Panama) throughout much of the northern half of South America, up to an altitude of about 1000 m. It is found as a caespitose or solitary palm, which has led to some confusion in sorting out taxa as this was presumed a stable taxonomic character. However, observations on populations in the Colombian Llanos show that trees can be either caespitose or solitary in the same population. It is poorly collected in Brazil relative to other countries. In view of its importance for fruit production, and the fact that it seems to grow quite quickly, further collections are warranted.

7. *Oenocarpus minor* Martius, Hist. Nat. Palm. 2: 25-26. t. 27. 1823.

Trunk medium, solitary to caespitose, columnar, 4-10 m high, 4.4-8 cm in diameter.

Leaves ca. 6-10 per coma, gracefully arched, spirally arranged; sheath ca. 30-60 cm long, outer surface green-brown, red-brown-lepidote at first, becoming more or less glabrous; inner surface glabrous, brown, upper margins lined with brown, slender, wiry fibers; petiole green, ca. 20-40 cm long; rachis green, more or less unequally 3-sided and abaxially convex towards center, 1.8-4.0 m long, maroon-lepidote when young; pinnae 49-79 per side, inserted at regular intervals and all in the same plane or rarely with an occasional grouping of 2-3, linear-lanceolate, abruptly acuminate to somewhat irregularly attenuate; basal pinnae ca. 40-70 cm long, 1.2-1.75 cm wide; central pinnae ca. 40-72 cm long, 2.5-4.5 cm wide; apical pinnae (fourth from apex measured) ca. 20-38 cm long, 1.5-2.5 cm wide.

Inflorescences one to several apparent at any one time, creamy white at anthesis, changing to reddish powdery in fruit; prophyll light olive-green, ca. 20-35 cm long,



Fig. 5. *Oenocarpus mapora* subsp. *mapora* in cultivation in the Botanical Garden in Rio de Janeiro.

4-6(-10) cm wide, more or less glabrous; peduncular bract green, ca. 28-68 cm long, 4-6 cm wide, orange-red to maroon-lepidote; axis distal to peduncular bract scar 1.3-4.0 cm long, 0.9-2.4 cm wide at scar, axis variable in size depending on individual; rachillae ca. 25-72, (17-)26-56 cm long, slender, 4-7 mm wide, triads on proximal 35-66% of individual rachillae; **staminate flowers** creamy white, sepals ca. 1.0-1.5 mm long; petals 3.0-4.5 mm long, 1.5-2.0 mm wide; anthers ca. 2.0-2.5 mm long, filaments brown, slender, straight to somewhat undulate; **pistillate flowers** creamy white in bud, 25-104 per rachilla, ca. 2.5-3.5 mm long, 3.5-4.0 mm wide at anthesis of staminate flowers.

Fruit globose-ovoid to ellipsoid, acute, ca. 1.6-2.3 cm long (including the cupule), 1.0-1.6 cm wide; stigmatic residue apical to subapical, ca. 1-2 mm long, 1.0-1.5 mm wide; cupule tan, 3-5 mm deep by ca. 1 cm wide; epicarp smooth, somewhat grainy-waxy, mesocarp pulpy, light purple, fibers ca. 0.5 mm wide.

Two subspecies are recognized from Brazil, *Oenocarpus minor* subsp. *minor* and *O. minor* subsp. *intermedius* (Burret) Balick (Balick 1980; 1986, in press).

7a. *Oenocarpus minor* Martius subsp. *minor*.

Type: Brazil. Amazonas: Manaus, 1810-1820, **Martius 3121B** (M. isotype P).

Oenocarpus macrospadix Burret, Notizbl. Bot. Gart. Berlin-Dahlem 12: 297. 1928.

Type: Brazil. Amazonas: Manaus, Campos Salles, Oct 1926, **Huebner 82** (B).

Distribution: Amazonas.

Representative Specimens: Amazonas: Reserva Florestal Ducke, Manaus-Itacoatiara highway, km 26, 25 Oct 1977 (fl), **Balick et al. 903** (BH, ECON, INPA), 27 Dec 1977 (fl), **969** (ECON, INPA), 4 Apr 1967, **Byron & Elias 67-2** (INPA); Cuieiras-Manaus trail, km 1, 6 Apr 1974 (fr), **Campbell et al. P21875** (INPA, NY); Manaus, estrada velha da BR 17, km 40, 11 Nov 1955 (fl), **Coelho 2886** (INPA); Caviana, Rio Purus, 29 Jan 1955 (fl), **Ernani 765** (INPA); Manaus, Campos Salles, Oct 1926 (fl), **Huebner 81a** (B); Manaus-Porto Velho road, km 245, 3 km S of Igapó Açu, 13 Mar 1974 (fr), **Prance et al. 20470** (BH, INPA); Manaus, Igarapé da Cachoeira, 1855, **Spruce hb. palm. 3** (K); Rio Tarumã near Manaus, 1855 (fr), **Spruce hb. palm. 57** (K). Pará: Rio Jamundã, São Jorge, Faro, 10 Nov 1950 (fl), **Black & Ledoux 50-10686** (IAN). Rondônia: Basin of Rio Madeira, 8 km NE of Porto Velho, 9 Nov 1968, **Prance et al. 8278** (BH, INPA, NY).

Cultivated: Pará: Botanical Garden of Museu Paraense Emílio Goeldi, Belém, cult. pl. nos. 27-28, Dec 1977, **Balick 963** (ECON, MG), cult. pl. no. 880, Oct 1965, **Cavalcante 1422** (MG).

Oenocarpus minor subsp. *minor* is one of the diminutive taxa in this complex. It is a common understory palm in Amazonas and Pará. Literature reports place it in Colombia (Cuatrecasas, 1958), Guyana (Im Thurn, 1884), Venezuela (Jahn, 1908) and "probably" in Peru (MacBride, 1960). However, reports of distribution outside of Brazil are based on misinformation developed through a poor understanding of the species. Additional collections should be made of this taxon; at present just over a dozen are to be found



Fig. 6. *Oenocarpus minor* subsp. *minor* in the understory layer of primary forest.

in herbaria. Barbosa Rodrigues (1903) pointed out that the fruits contain relatively more pulp than some of the other species, and the beverage produced from these is of excellent quality.

7b. *Oenocarpus minor* Martius subsp. *intermedius* (Burret) Balick.

Type: Brazil. Amazonas: Manaus, Campos Salles, Jan 1925, Huebner 1 (B).

Oenocarpus intermedius Burret. Notizbl. Bot. Gart. Berlin-Dahlem 10: 298. 1928.

Distribution: Amazonas and Pará.

Representative Specimens: Amazonas: Reserva Florestal Ducke, Manaus-Itacoatiara highway, 27 Dec 1977 (fr), Balick et al. 968 (ECON, INPA, MG, NY); Colônia Santo Antônio, Manaus-Itacoatiara highway, km 7, 16 Mar 1967 (fr), Moore et al. 9540 (BH, INPA, NY). Pará: 1 km W of Rurópolis on BR 230, 29 Nov 1977 (fl), Balick et al. 953 (ECON, MG, NY).

Balick (1980; 1986, in press) redefined *Oenocarpus intermedius* to be a subspecies of *O. minor*. Field study of this former taxon showed it to be remarkably similar to *O. minor*, except for the solitary habit of "*O. intermedius*", vs. caespitose in *O. minor* and a larger panicle with more rachillae in "*O. intermedius*". Due to the variability of these two characters in this complex I chose to assign the latter taxon to subspecific status, although further field study would be desirable to prove positively the true status.

DESCRIPTION OF *JESSENIA*

Jessenia Karsten, *Linnaea* 28: 387. 1857.

Type: *Jessenia bataua* (Martius) Burret.

Large, solitary, erect, pleonanthic monoecious palms; stem columnar, frequently massive, gray to black, smooth or, when young, covered with remains of sheaths and sheath fibers and spines, obscurely ringed with leaf scars; base frequently producing a small mass of slender roots.

Leaves pinnate, spirally arranged in a suberect (when young) or horizontally spreading (when mature) coma; sheaths partially clasping, somewhat split opposite the petiole, thick, coriaceous, lightly furrowed on the inside, smooth on the outside, upper portion lined with mat of brown fibers of which some are thin, hair-like and interwoven, others stout, needle-like, and marginally persistent on the sheath and extending into the center and along lower margins of petiole; petiole smooth, channeled adaxially, convex abaxially; rachis trough-shaped at base, more or less 4-sided near center, flattened to concave adaxially, flattened to semiconvex abaxially, changing to triangular towards apex, smooth, ribbed longitudinally, lepidote when young; pinnae numerous, regularly arranged and inserted along rachis in a single plane, subalternate towards base,

opposite to subopposite centrally, subopposite to subalternate towards apex, broadly linear-lanceolate at center of rachis, plicate, acute, basally reflexed at attachment, 1-ribbed with prominent intermediate veins, smooth adaxially, covered with pale (or rarely reddish) peltate to sickle-shaped or doubly sickle-shaped trichomes abaxially.

Inflorescence interfoliar in bud, protandrous, hippuriform; peduncle short, flattened adaxially, bracteate, bearing a sharply 2-edged, flattened prophyll with dentate margins and a larger, thick, tubular peduncular bract swollen in middle, tapering to a sharp point and opening lengthwise, both bracts deciduous; rachis flattened adaxially, frequently lepidote, with simple rachillae inserted laterally and abaxially, arched to pendulous at anthesis, elongate, linear to slightly undulate, slender, attenuate.

Flowers unisexual, sessile, borne in triads of two staminate and one pistillate flower proximally on rachillae, in pairs of staminate flowers or solitary staminate distally, rachillae usually devoid of flowers in ultimate portion, occasionally the slender apex of rachillae terminating in several solitary, small, staminate flowers, inflorescence rarely entirely staminate; **staminate flowers** asymmetrical; sepals three, obtuse, acute, imbricate; petals three, valvate, longitudinally striate, more or less lanceolate, acute, slightly fleshy, one or two in each flower often dissimilar, incurved; stamens (7,8-)9-20, filaments awl shaped, slender, straight or undulate and rarely curved at apex in bud, inserted at lower junction of thecae and extending along juncture with a connective produced; anthers dorsifixed, linear, tapering to a point, versatile, with two divergent bilocular thecae, sagittate basally for half their length, longitudinally and extrorsely dehiscent; pistillode rudimentary, trifid; **pistillate flowers** symmetrical; sepals three, imbricate, fleshy, suborbicular, hooded-concave, completely enclosing the corolla in bud; petals three, imbricate (except the briefly valvate apex when mature), suborbicular, hooded-concave, somewhat thin when young, becoming larger and fleshier at maturity; staminodes lacking; gynoecium usually unilocular, uniovulate, rarely 2-locular and with two ovules; ovule erect, anatropous; style short, thick; stigmas three, reflexed at anthesis, papillate adaxially.

Fruit one-seeded or rarely two-seeded, ovoid-ellipsoid, obtuse with a shallow bowl-like cupule of indurate perianth at its base; stigmatic residue apical to slightly eccentric; epicarp slightly grainy-waxy, smooth, thin; mesocarp fleshy, rich in oil, with thin, flattened longitudinal fibers adnate to and completely covering the seed; seed ovoid-ellipsoid, endosperm horny, ruminate, embryo white, cylindrical-clavate, ca. 2/3 as long as seed.

This genus consists of a single species, *Jessenia bataua* (Martius) Burret, with two subspecies, *J. bataua* subsp. *bataua* and *J. bataua* subsp. *oligocarpa* (Grisebach & Wendland) Balick (Balick, 1980; 1986, in press). Only the first subspecies is found in Brazil. The following description is of *J. bataua* subsp. *bataua*.

1. *Jessenia bataua* (Martius) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 10: 302. 1928.

Trunk columnar, 14-25(-28) m high, (12-)19-25(-27) cm in diameter, internodes

spaced 20 cm or more apart on lower portion of stem, much closer towards apex.

Leaves 8-16 per coma, fewer in younger or senescent plants; sheath 0.6-1.4 m long, outer surface dull olive green, inner surface brown, with stout needle-like fibers to 1 m long; petiole green, 0.2-1.0 m long, ca. 5-8 cm wide apically, ca. 8-12 cm wide basally; rachis light green to dark green, 3-8+m long, red to light-brown-lepidote when young, vestiture becoming gray with age and falling away; pinnae 65-108 per side, glossy dark green adaxially; abaxial surface light green to gray, usually densely covered with peltate to sickle-shaped to doubly sickle-shaped trichomes (more apparent in newly emerged leaves); basal pinnae ca. 0.6-1.5 m long, 2.5-2.75+ cm wide; central pinnae (0.75-)1.0-1.7(-2.0) m long, (4.5-)6-11(-14) cm wide; apical pinnae (fourth from apex measured) 15-70 cm long, 1.5-3.5 cm wide.

Inflorescences 1-3(4+) apparent at any one time, creamy white at anthesis, prophyll olive green, variable in size but often ca. 75+ cm long, ca. 20-25 cm wide; peduncular bract of a similar color but frequently thinly striped with yellow or brown, 1-2.3 m long, (8-)9-18(-19) cm wide, often somewhat lepidote; axis distal to peduncular bract scar (15-)22-40(-50) cm long, (4.6-)7-11(-20) cm wide at scar, axis variable in size depending on individual, sometimes developing a reddish-velvety tomentum that is deciduous with age; rachillae ca. (116-)135-270(-285) in number, (50-)70-120(-140) cm long, (2-)4-6(7-9) mm wide, with triads on proximal (20)40-60(-65) percent of individual rachillae; **staminate flowers** creamy white in bud, fragrant; sepals ca. 1.5 mm long; petals 4-7(-8) mm long, ca. 2-4 mm wide; stamens (7-)9-20, ca. 5-6 mm long, filaments brown; **pistillate flowers** usually (15-)40-90(-119) per rachilla, creamy white in bud, subtly fragrant at anthesis; sepals ca. 4-6 mm long at time of anthesis of staminate flower.

Fruit green with a waxy cast when young, becoming dark purple-black when ripe, rounded at the apex, variable in size, (2.3-)2.5-4.0(-4.75) cm long (not including the cupule), 2.0-2.75 (-3.0 in the rare 2-seeded fruits) cm wide at center, (5-)6-15(16+) gm in weight when ripe; stigmatic residue ca. 1-2 mm long, 2-3 mm wide; cupule tan, ca. 5-10 mm deep; mesocarp pulpy, purple or lavender-white; fibers ca. 1 mm wide; endosperm waxy-white, penetrated by light to dark brown rays, embryo white.

1a. *Jessenia bataua* (Martius) Burret subsp. *bataua*.

Type: Brazil. Amazonas, without date, **Martius s.n** (M n.v).

Oenocarpus bataua Martius, Hist. Nat. Palm. 2: 23. t. 24, 25. 1823.

Type: Brazil. Amazonas, without date, **Martius s.n** (M? n.v).

Jessenia polycarpa Karsten, Linnaea 28: 388. 1857.

Type: Colombia. Meta. Llana de San Martín, 1853, **Karsten s.n.** (isotype LE).

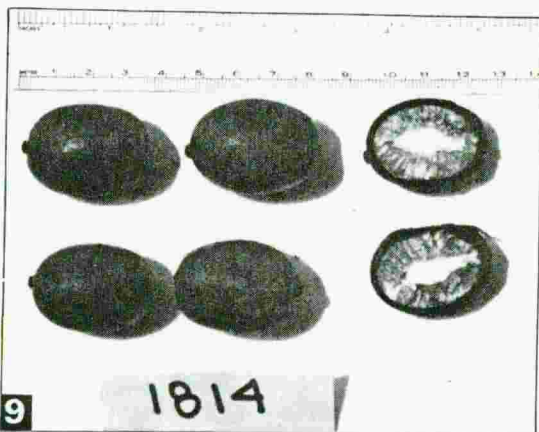
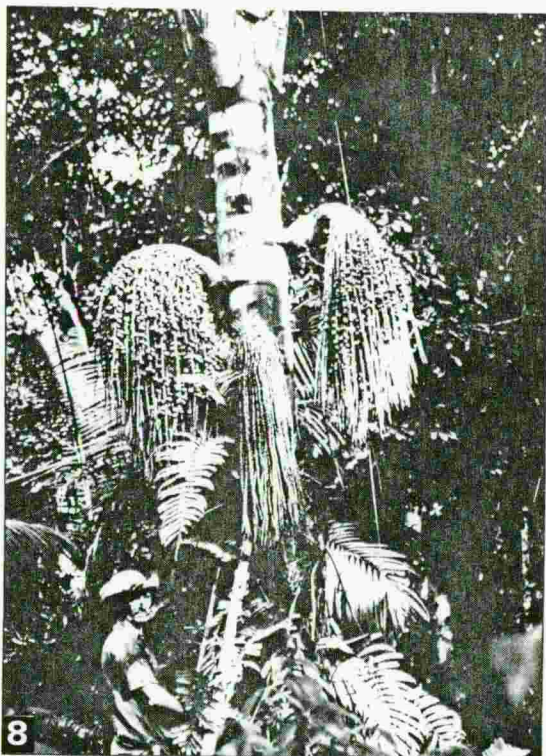
Jessenia repanda Engel, Linnaea 33: 691, t. 3, fig. 6. 1865.

Type: Venezuela. Táchira: La Grita, Linnaea 33: 691, t. 3, fig. 6. (lectotype).

Oenocarpus seje, Cuervo Márquez, Trat. Elem. Bot. 458. 1913. **nomen nudum**.



Fig. 7. *Jessenia bataua* subsp. *bataua* in a primary forest habitat along a river's edge.



Figs. 8, 9. *Jessenia bataua* subsp. *bataua*. 8: hippuriform (horse-tail shaped) panicles with ripe fruit; 9: fruits; note the large embryo relative to seed size.

Jessenia weberbaueri Burret, Notizbl. Bot. Gart. Berlin-Dahlem, 10: 840. 1929.
Type: Peru. San Martín: Moyobamba, 18 Aug 1904, Weberbauer 4561 (B).

Distribution: Acre, Amazonas, Mato Grosso, Pará, Roraima.

Representative Specimens: Acre: near mouth of Rio Macauhan, tributary of Rio Yaco, 3 Sept 1933 (fl), **Krukoff 5758** (BH [photo], F, K, M, MICH, MO, NY, US). Amazonas: Yanomama tribe at Tototobí, basin of Rio Demeni, 23 Aug 1975, **Anderson 188** (BH); Reserva Florestal Ducke, Manaus-Itacoatiara Highway, 25 Oct. 1977 (seedling), **Balick 902** (ECON, INPA, NY); Manaus, Cachoeira alta do Tarumã, 28 Jun 1955, **Chagas 1216** (INPA); Jutica, Varadouro, 16 Nov 1928, **Luetzelburg 23043** (R, M); Reserva Florestal Ducke, 15 Mar 1967 (fl), **Moore 9532** (BH, INPA, NY); Rio Negro, Arivau, 1 Sept 1967, without collector, SPF herbarium no. 7 (IAN). Mato Grosso: Machado Angusturo, Dec 1931 (young fr), **Krukoff 1603** (BH, F). Pará: Cuiabá-Santarém Highway, BR 163, km 1136 from Cuiabá, 16 Nov 1977 (fl, fr), **Balick et al. 929** (ECON, MG, NY); 42 km E of Itaituba on Transamazon Highway, 28 Nov 1977 (fl, young fr), **Balick et al. 952** (ECON, MG, NY); EMBRAPA station, Igapô de Jogo, 11 Dec 1977 (fl), **Balick & Rosa 955** (ECON, MG, NY); River Amazon, 10 Jun 1915, **Booth Steamship Co. 10** (K); without locality, Jul 1923 (fl), **Ducke** (RB herb. n^o 18615) (RB); Belém, 5 Nov 1945 (fr), **Pires & Black 571** (IAN), 14 Oct 1950 (fr), **Pires 2643** (IAN), 14 Oct 1950 (seedling), **2644** (IAN). Roraima: Boa Vista, Jan 1933, **Capucho 536** (F, IAN).

This genus was carefully studied in the field, and as a result only one species with two subspecies are recognized. The balance of the former species, in my opinion, were based upon a poor understanding of the genus throughout its broad distribution in South America. *Jessenia bataua* subsp. *bataua* colonizes a broad range of habitats, from swampy areas to terra firme sites. In inundated locations it often forms monospecific stands while scattered individuals occur in upland primary forest sites. The species is very useful for fiber, shelter, food, medicine, and other functions. A common use of the ripe fruits is to produce a nutritious beverage or oil similar to olive oil. The protein of the fruit has a high biological value and is used as a human and animal food (Balick and Gershoff, 1981). The "pataua" palm, as it is called, has great potential for domestication and increased utilization as a multi-use oilseed/food/shade crop, and a germplasm bank has been established in Belém for this and other members of the *Oenocarpus-Jessenia* complex.

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References

- Balick, M.J. and S.N. Gershoff. - 1981. Nutritional evaluation of the *Jessenia bataua* palm: A source of high quality protein and oil from Tropical America. *Econ. Bot.* 35: 261-271.
- Balick, M.J. - 1980. The biology and economics of the *Oenocarpus-Jessenia* (Palmae) complex. Ph.D. Dissertation, Department of Biology, Harvard University, Cambridge.
- - 1986. Systematic and economic botany of the *Oenocarpus-Jessenia* (Palmae) complex. *Advances in Economic Botany*, in press.
- Barbosa Rodrigues, J. - 1898. *Palmae Mattogrossenses Novae vel Minus Cognitae*. Typographia Leuzinger, Rio de Janeiro.
- - 1903. *Sertum palmarum Brasiliensium*. 2 vols. Imprimerie Monnom, Bruxelles.
- Burret, M. - 1928. Die palmengattungen *Oenocarpus* Mart. and *Jessenia* Karst., nebst bemerkungen zu *Archontophoenix* H. Wendl. et Drude (einschliesslich *Loroma* O.F. Cook). *Notizbl. Bot. Gart. Berlin-Dahlem*. 10:291-312.
- Cuatrecasas, J. - 1958. Aspectos de la vegetación natural de Colombia. *Revista Acad. Colomb. Ci.* 10:221-268.
- Glassman, S.F. - 1972. A Revision of B.E. Dahlgren's Index of American Palms. J. Cramer, Lehre.
- Im Thurn, E.F. - 1884. Memoranda on the palms of British Guiana. *Timehri* 3:219-276.
- Jahn, A., Jr. - 1908. *Las Palmas de la Flora Venezolana*. Tipografía Universal, Caracas.
- Karsten, H. - 1857. *Plantae Columbiana*. *Linnaea* 28:387-462.
- MacBride, J.F. - 1960. *Flora of Peru I. 2. Palmae*. *Field Mus. Nat. Hist., Bot. Ser.* 13: 321-418.
- Martius, K.P.F. von. - 1823. *Historia Naturalis Palmarum* Vol. 2. Leipzig.
- - 1847. *Palmetum Orbignianum*. In: d'Orbigny, A.D., *Voyage dans l'Amérique Méridionale*. Paris.
- Moore, H.E., Jr. - 1963. The types and lectotypes of some palm genera. *Genes Herb.* 9: 245-274.
- Wessels Boer, J.G. - 1965. *The Indigenous Palms of Suriname*. E.J. Brill, Leiden.