

Notes on *Mauritiella*, *Manicaria* and *Leopoldinia*

RODRIGO BERNAL
AND
GLORIA GALEANO
*Instituto de Ciencias
Naturales, Universidad
Nacional de Colombia,
Apartado 7495,
Bogotá, Colombia*
*rgbernalg@unal.edu.co,
gagaleanog@unal.edu.co*

A study of palms in the upper Río Negro area, in northern South America, reveals two previously misinterpreted species, *Mauritiella pumila* and *Manicaria martiana*, and shows that the enigmatic *Leopoldinia major* is actually not different from the better-known *Leopoldinia pulchra*.

The small South American genera *Mauritiella*, *Manicaria* and *Leopoldinia* include some of the most conspicuous palms growing in the white-sand forests and savannas of the upper Río Negro and the black-water tributaries of the upper Orinoco, in the bordering area of Colombia, Brazil and Venezuela. This region is the center of diversity for them, and all of their species but one are found in this area.

In spite of their small size (eight species in total), no modern revision of any of these genera is available. The most recent accounts were made by Henderson (1995) and Henderson et al. (1995), and, although not intended as formal revisions, they have been taken as a standard reference by further authors (e.g. Stauffer 2000, Govaerts & Dransfield 2005, Dransfield et al. 2008, Pintaud et al. 2008).

Recent field work in the upper Río Negro area and along the Río Atabapo, a black-water tributary of the Orinoco, and the study of herbarium specimens at several herbaria, have shown that some changes in the taxonomy of these genera must be made, awaiting their badly needed revisions.

Mauritiella

The genus *Mauritiella* was established by Burret (1935) to include several species of palms related to the large and widespread, *moriche* or *burití* palm, *Mauritia flexuosa*, from South America, but differing from it in their usually caespitose habit, spiny stems and their waxy, grayish green leaf undersurface. One of the names transferred to *Mauritiella* was *Mauritia pumila*, a binomial applied by Wallace (1853) to a small palm from the upper Río Negro area. This palm has been scarcely mentioned after its original description and its further transfer to *Mauritiella*. Although no formal revision of the genus has been made, Wessels Boer (1988) considered *Mauritiella pumila* as a depauperate form of the widespread *Mauritiella armata* (treated by him as *M. martiana*), resulting from growing in the poor soils of savannas. Wessels Boer's treatment has been followed by Henderson (1995), Henderson et al. (1995) and Stauffer (2000). Henderson et al. (1995), however, suggested that the small palms from white sand savannas did appear to represent a distinct species, apparently *M. pumila*. In the last years we used this name for some determinations, and it has recently been used

by Cárdenas López (2007). A formal reinstatement seems therefore appropriate.

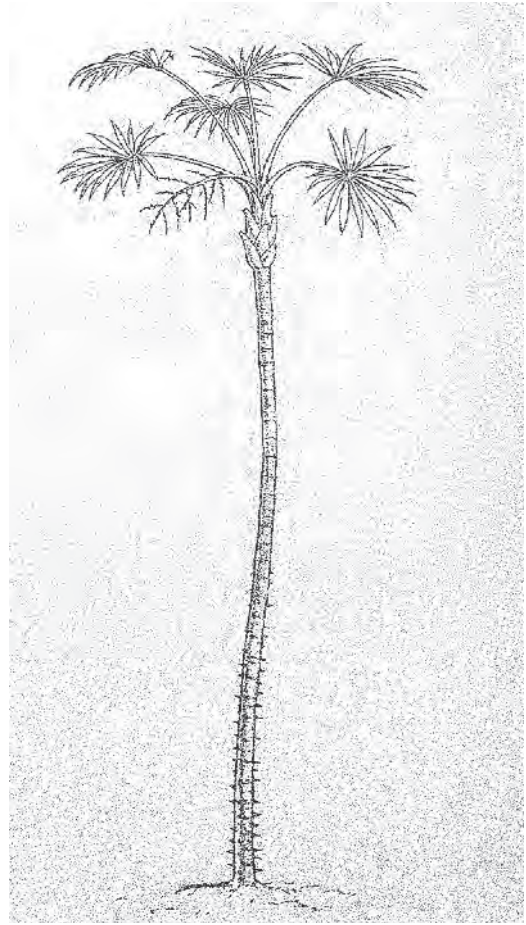
The name *Mauritia pumila* is not associated with a specimen; Wessels Boer (1988) designated as a lectotype the illustration accompanying the protologue (Wallace 1853, pl. 21) (Fig. 1) in spite of its rather crude nature. However, Wallace's description is good enough to identify the species among the palm flora of the Upper Río Negro area. We have collected this small palm in the savannas of the Orinoco basin in eastern Colombia and have studied several collections from neighboring areas in Colombia and Venezuela, as well as many specimens of the other species of *Mauritiella*. We conclude that it differs from *M. armata* in many respects, and it is not just a reduced form of that species. Therefore, here we reinstate *Mauritiella pumila* as a distinct species and include *Mauritiella subinermis* (Spruce) Burret in its synonymy. Table 1 compares the three species of *Mauritiella* occurring in the Río Negro area.

Mauritiella pumila (Wallace) Burret, Notizbl.

Bot. Gart. Berlin-Dahlem 12: 611. 1935. *Mauritia pumila* Wallace, Palm Trees of the Amazon 59. 1853. Lectotype (Wessels Boer 1988). Wallace, Palm Trees of the Amazon, t. 21. 1853. *Lepidococcus pumilus* (Wallace) H. Wendl. & Drude in Kerch., Palmiers. 249. 1878. Figs. 1–5 & Front Cover.

Mauritiella subinermis (Spruce) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 12: 611. 1935. *Mauritia subinermis* Spruce, J. Linn. Soc., Bot. 11: 171. 1871. *Orophoma subinermis* (Spruce) Drude in Martius, Fl. bras.: Cyclanthaceae et Palmae I, fasc. 85, vol. 3(2): 296. 1881. *Lepidococcus subinermis* (Spruce) A.D. Hawkes, Arq. Bot. Est. Sao Paulo, n.s. 2: 174. 1952. Type. Venezuela. Amazonas: confluence of Casiquiare and Río Guainía, n.d., R. Spruce 39 (holotype K, n.v.).

Caespitose, with 1–5 developed stems and several shoots. Stem 1–3 m tall, 4.5–5 cm diam., gray to brown, with a few conical spines to 1 cm long, the upper part of the stem covered with persistent leaf bases. Leaves 5–7, forming a hemispherical crown, with 2–3 persistent dead leaves; sheath 20–29 cm long; petiole 59–80 cm long, 1–1.5 cm diam., cylindrical, in young leaves completely covered with whitish wax; costa 1–1.5 cm long; blade divided into 16–26(–38) rigid segments, middle ones 38–45(–57) cm long, 2–3.8 cm wide, pointing upwards and arched at the tip, the



1. Lectotype of *Mauritia pumila* (Wallace 1853, pl. 21).

lower surface with a thick layer of wax, and completely lacking scales, the margin lacking spines. Inflorescence interfoliar; staminate inflorescence with peduncle 29 cm long; rachis 60–68 cm long, with 20–23 branches arranged in one plane, the longest ones 22–24 cm long, with 26–34 rachillae ca. 1 cm long; flowers not seen; pistillate inflorescence with peduncle 31–48 cm long; rachis 30–47 cm long, with 6–11 branches 12–23 cm long, each bearing 13–31 rachillae up to 1.6 cm long, arranged in one plane; flowers not seen. Fruits obovoid, 1.8–3 cm long, 1.7–2.4 cm diam., with dark yellowish brown scales arranged in 24–30 rows, individual scales 2–3 mm long, 2.5–5 mm wide, with the margin usually slightly scarious.

Distribution and habitat. White sand savannas and rocky outcrops in the Upper Río Negro and adjacent areas in Colombia and Venezuela, between 90 and 250 m elevation. Grows on well drained soils or occasionally in areas with a high water table.

Common names: *cahuayo*, *caguaya*, *morichito*

(Spanish); *cadanaripi* (the palm) *cadanarite* (the fruit) (Curripaco); *cadanari* (Baniwa); *caranaí*, *mirichimiri* (Géral).

Selected specimens: COLOMBIA. **Guainía:** Río Inírida, 0–6 km on rd. from Huesito to El Pato, ca. 150 m, 23 May 1994, *Bernal 2111* (COL); Huesito, 3°26'23"N, 67°54'00"W, 100–120 m, 3 Aug 2004, *Cárdenas 15211* (COAH); Caño Nabuquén, 3°02'86.5"N, 68°20'52.7"W, 3 Jan 2007, *Cárdenas 20384*

(COAH); 1–2 km W of Río Guainía, 5 km N of Boca de Casiquiare, 1°57'N, 67°08'W, 120 m, 5 Feb 1980, *Liesner 9134* (COL, MO); Corregimiento de Cacahual, caño Garza, ca. 500 m upstream from its confluence with Río Atabapo, 3°28'20.5"N, 67°25'18.3"W, 91 m alt., 8 Mar 2009, *Bernal 4373* (COAH, COL), *4374* (COAH, COL). **Vaupés:** municipio de Mitú, Río Vaupés, comunidad de Los Cerros, Jul 1993, *Martínez 318, 509* (COL); Serranía de Taraira, 10 km NW from Raudal de La Libertad,

Table 1. Comparison among the species of *Mauritiella* growing east of the Andes.

Character	<i>Mauritiella pumila</i>	<i>Mauritiella armata</i>	<i>Mauritiella aculeata</i>
Habitat	Savannas or rocky outcrops	Forest swamps	River banks
Stems per mature individual	1–5	1–7	(5–)10–50
Stem height	1–3	(2.5–)3–18	5–12(–20)
Stem diameter	4.5–5	7.5–12(–20)	(5–)7.5–15
Persistence of leaves	Persistent	Cleanly abscising	Cleanly abscising
Wax on petiole	Present	Absent	Absent
Primary leaf folds	16–26(–38)	(54–)86–104	61–80
Leaf base	Not peltate	Peltate, funnel-shaped	Peltate, funnel-shaped
Costa length (cm)	1–1.5	(1–)3–20	2–3.5(–13)
Scales on the main veins leaf underside	Absent	Usually with long, narrow, purplish brown ramenta	Usually with long, narrow, purplish brown ramenta
Mid-segment length (cm)	38–45(–57)	(60–)70–133	62–87
Mid-segment width (cm)	2–3.8	1.5–3.7	1–2
Segment margins	Smooth	Sometimes spiny	Usually spiny
Segment orientation	Straight	Straight	Pendant
Number of female inflorescence branches	6–11	12–32	9–18
Length of female branches	12–23	16–50	11–45
Number of rachillae per branch	13–31	(21–)26–63	(15–)21–48
Fruit length × width (cm)	1.8–3 × 1.7–2.4	2.5–3.5 × 2–3	4–5 × 3–4.5
Rows of scales	24–30	21–32	32–55



2 (above). *Mauritiella pumila*, habit. 3 (below). leaf.

0°58'S, 69°45'W, 250 m, 26 Jul 1993, *Cortés 597* (COL). VENEZUELA. Amazonas, Dept. Atabapo, Caño Yagua at Cucurital de Yagua, 3°36'N, 66°34'W, 120 m, 8 May 1979, *Davidse 17386* (MO); Dept. Atabapo, Caño Caname, nearly opposite Cucurital de Caname, 3°40'N, 67°22'W, 95m, 2 May 1979, *Davidse 17039* (MO); N side of Laja Suiza, Río Guasacaví, 3.5 km SSW of Santa Cruz, 3°14'N, 67°24'W, 100 m, 4 Mar 1996, *Berry 5966* (MO); Dept. Atures, 2 km upstream of San Juan de Utaca on the Caño Utaca, a black water affluent of the Orinoco, 4°20'25"N, 67°44'12"W, 120–150 m, 15 Jun 1992, *Berry 5101* (MO); Dept. Casiquiare, Caño San Miguel, 2°40'N, 66°50'W, 160 m, 21 Apr 1991, *Aymard 9097* (MO); Dept. Río Negro, carretera near San Carlos, 75–120 m, *Hoffmann 90-3-40* (MO).

As currently understood, the three species of *Mauritiella* growing east of the Andes have different distribution and habitat: *M. armata* is widespread in northern and central South America, from Venezuela and Colombia to Bolivia, where it grows on poorly drained, soils, sometimes derived from white sands; *M. aculeata* grows on sandy soils along the margins of black-water rivers in the upper Río Negro area and neighboring black-water tributaries of the Orinoco and the Amazon,





4 (left). *Mauritiella pumila*, staminate inflorescence after anthesis. 5 (right). fruits.

where it forms large clumps; *M. pumila* is known only from sandy soils or rocky outcrops on open savannas, in the upper Río Negro and adjacent areas of the Orinoco basin in eastern Colombia and western Venezuela. Where the three species converge, they are sometimes found in close proximity, although each in its particular habitat.

Mauritiella pumila is indeed closely related to *M. armata*, from which it differs in the shorter and thinner stems covered with persistent leaf bases, the smaller leaves with a thick cover of wax on the petiole, the lower number of leaf segments (and of veins), the absence of ramenta on the main veins below, the shorter inflorescence branches with fewer rachillae, and the smaller fruits (Table 1). Although some of these characters overlap, particularly with small individuals of *M. armata* from Bolivia, leaf characters are absolutely contrasting; thus, for example, not even the smallest individuals of *M. armata* have fewer than 54 leaf segments, whereas no plant of *M. pumila* is known to have more than 38 leaf segments.

Manicaria

The genus *Manicaria* was established by Gaertner (1791), with one species, *Manicaria saccifera*, from the coasts of northern South

America and adjacent Curaçao. This species was later recorded from the mouth of the Amazon by Martius (1823) and Wallace (1853). A new species, *Manicaria pluckenetii* Griseb. & H. Wendl., was later described from Trinidad (Grisebach 1864), but it was afterwards treated by Drude (1881) as a variety of *M. saccifera*.

The first botanist to record *Manicaria* in inland Amazonia was Trail (1876), who described *Manicaria saccifera* var. *mediterranea* Trail from sandy soils near Manaus, on the Río Negro. A second Amazonian record was introduced by Burret (1928), who described *Manicaria martiana* Burret from near Manaus, Brazil. He separated this new species from *M. saccifera* by its shorter bracteoles, sharper fruit projections, and brown trichomes on the leaf undersurface. He considered that *M. martiana* was identical to Trail's *M. saccifera* var. *mediterranea*, which he included in synonymy. Shortly thereafter, he (Burret 1930) added a third species, *Manicaria atricha* Burret, from the Río Vaupés, on the border between Brazil and Colombia. No attempts to revise the genus have been made since Burret's appraisal, and the only modern treatments are those of Wessels Boer (1988), Henderson (1995) and Henderson et al. (1995).

Wessels Boer (1988) recognized three species from Venezuela, *M. pluckenetii*, *M. atricha* and *M. martiana* but suggested that they could all represent one single species, *Manicaria saccifera*. Henderson (1995) and Henderson et al. (1995) recognized only one species, *Manicaria saccifera*, a treatment followed by subsequent authors (e.g. Borchsenius et al. 1998, Stauffer 2000, Govaerts & Dransfield 2005, Dransfield et al. 2008, Pintaud et al. 2008).

Recent field work along the Río Vaupés, a tributary of the Río Negro, and the study of specimens at COAH, COL, MO and US has shown that there are two different species of *Manicaria* in northwestern Amazonia, where they are scarce, and they are therefore poorly represented in herbaria. One of them is the one called by Burret *Manicaria martiana*, which we now reinstate. It is a slender palm with clean stems, smaller, deciduous leaves divided into narrow segments composed of one to a few folds, the undersurface provided with

conspicuous, brown, scale-like trichomes, and small inflorescences with shorter branches, simple or divided into 2–4 rachillae that have small bracteoles, and bear only a few fruits (Fig. 6), with sharp woody projections.

The other species, in contrast, is a massive palm with thick stems covered, at least in the upper part, with persistent leaf bases that accumulate debris, with large leaves that persist for a long time after drying, most often divided into segments composed of many folds, glabrous underneath, large inflorescences with longer rachillae that are unbranched or forked, have conspicuous bracteoles, and bear numerous fruits with pyramidal, blunt projections (Fig. 7). From the specimens available to our study, we cannot separate this large species from the typical *Manicaria saccifera* that grows along the coasts of northern South America and in Central America as far north as Belize; they do seem to differ in habit, though – Amazonian

Table 2. Comparison of *Manicaria saccifera* and *Manicaria martiana*.

Character	<i>Manicaria martiana</i>	<i>Manicaria saccifera</i>
Stem diameter (cm)	5–11	13–35
Covering of stem	Naked throughout; leaves deciduous	Covered, at least in the upper half, with leaf bases
Leaf rachis length (cm)	154–171(–265)	(330–)470–740(–800)
Number of primary leaf folds	58–70	(92–)100–130
Division of leaf blade	Almost regularly pinnatisect, most segments narrow, with few folds	Irregularly pinnatisect, most segments broad, with many folds
Largest number of folds in leaf segments	6	55
Length of middle pinnae (cm)	72–150	135–186
Distance between folds at the center of the lamina (cm)	1.0–1.8	1.8–2.5
Trichomes on leaf undersurface	Abundant, persistent, crustose, reddish brown	Absent
Length of inflorescence rachis (cm)	16–28	(21–)45–81
Branching of basal rachillae	Unbranched or divided into 2–4 rachillae	Unbranched or occasionally forked
Length of basal rachillae (cm)	7–15	27–30(–62)
Bracts below staminate flowers	Almost as long as calyx, inconspicuous	Usually longer than flowers, conspicuous
Fruit diameter (cm)	3–4.5	4.5–5.5
Fruit projections	Usually long and sharp	Usually short and blunt



6. *Manicaria martiana*, infructescence.

populations comprise solitary, unbranched palms, whereas coastal populations often have multiple stems, as a result of basal, dichotomous branching (Fisher & Zona 2006).

Until differences between coastal and Amazonian populations are well established, we continue to keep *M. pluckenetii* and *M. atricha* in synonymy of *M. saccifera*, and we include also in its synonymy Trail's var.

7. *Manicaria saccifera*, infructescence.



mediterranea, which Burret considered as conspecific with *M. martiana*. Trail's description corresponds to a palm with stem 15 cm in diameter and leaves 3.2–3.6 m long, which is beyond the range of *M. martiana*, and agrees with some of the smaller individuals of *M. saccifera*.

Some of the differences between the two species (Table 2) are not easily detected in herbarium material, and since field notes are usually as poor as the specimens themselves, the two species can be easily confused in the herbarium.

Manicaria martiana Burret, Notizbl. Bot. Gart. Berlin-Dahlem 10: 392. 1928. Type. Brazil. Amazonas: Manaus, n.d., *G. Hübner* 2 [holotype, B, destroyed; neotype (here designated): COLOMBIA, Vaupés, Río Vaupés, Naná, 01° 00'N, 69° 55' W, 175 m, 24 Nov 2004, *Bernal* 3615 (COL)]. Fig. 6.

Solitary or cespitose with a few stems 2.5–4 (–6) m tall, 5–11 cm diam., naked, dark brown, with conspicuous leaf scars, with internodes ca. 2 cm long. Leaves 6–20, suberect to horizontally spreading; sheath together with petiole 102–150 cm long, ca. 1 cm wide at apex; rachis 1.5–2.6 cm long; pinnae 13–26 on each side, mostly composed of 1–6 folds, and the leaf thus appearing as almost regularly pinnatisect, multi-fold pinnae deeply dentate at apex, in total 58–70 primary folds on each side, 1–1.8 cm apart; basal pinnae 80–122 cm long, middle pinnae 72–150 cm long, apical pinnae 22–40 cm long, all glabrous above, covered below with abundant, persistent, crustose, reddish brown trichomes, easily seen with the naked eye. Inflorescence interfoliar, 2–4 simultaneous in different stages; prophyll bicarinate, ca. 15 cm long, 2.5 cm wide,

reddish brown; peduncular bract ca. 50 cm long, seamless, made of interwoven reddish brown fibers, disintegrating in fruit; peduncle 30–60 cm long, 1.5–2 cm wide, provided toward apex with 1–2 bracts less than 5 cm long; rachis 16–28 cm long; flowering branches (8–)14–25(–56) simple or the basal ones divided in up to 4 rachillae; rachillae 7–15 cm long. Staminate flowers subtended by 5–7 mm long bracts, inconspicuous and scarcely projecting among the flowers; sepals ovate, imbricate, 2.5–3.5 mm long; petals lanceolate, valvate, thick, 4.5–6 mm long. Pistillate flowers with sepals 3–3.5 mm long; petals lanceolate, valvate, 6–7 mm long; ovary ca. 3 mm long, obovoid, minutely verrucose. Fruits usually less than 6 per infructescence, with 1–3 seeds, subglobose or 2–3-lobed, and then each lobe subglobose, 3–4.5 cm diam.; exocarp brown, formed by woody pyramidal projections that are conspicuously pointed at apex; seed subglobose, 2.5–3 cm diam.

Distribution and habitat. Northwestern Amazonia in the bordering area between Colombia and Brazil, and extending as far south as Manaus (where known only from the type). Probably found also in adjacent areas of Peru. Extremely rare and local, growing on sandy soils.

Common names. *Coco* (Amazonas, Colombia); *ubí* (Río Vaupés, Colombia); *wachi* (Cubeo), *taahiye* (Miraña), *bohsumuh* (Siriano), *ampiapúne* (Tariano), *hubi*, *ngumaku* (Tikuna), *bohsumuh* (Tukano), *bohsum* (Tuyuca). Some of these names are probably applied also to *M. saccifera*.

Uses. Leaves are used for thatching; immature endosperm is edible. Ripe fruits are said to be eaten by tapirs (*Tapirus terrestris*) and wild boars (*Tayassu tajacu*).

Selected specimens. COLOMBIA. Amazonas: Río Loretoyacu, near San Agustín 18 Jan 1973, *Glenboski* C-233 (COL, US); Río Cahuinari, between lake Carijona and lake Pescado, tertiary hills, ca. 300 m, 10 Sep 1988, *Galeano* 1677 (COL, COAH); La Pedrera, Río Caquetá, near the airstrip, 13 Jun 1996, *Tuberquia* 454 (COAH, COL, HUA); Corregimiento Tarapacá, 2°34'32.8"S, 70°05'34.6"W, 6 Mar 1999, *López* 4917 (COAH); between Alegría and Porvenir Grande rivers, 2°35'44.8"S, 70°04'45.2"W, 110 m, 24 Aug 2004, *López* 8472 (COAH). Vaupés: Cerro de Circasia, 300–500 m, 10 Oct 1939, *Cuatrecasas* 7181-A (COL, US); Río Apaporis, between the confluence of Ríos Pacoa and Cananarí, Soratama, 19–23 Mar 1952, *Mora*

APA-357 (COL); Río Apaporis, Caño Peritomé, left tributary of Piraparaná river, 18–20 Feb 1952, *Schultes* 15517 (MO); Río Vaupés, Naná, 01°00'N, 69°55'W, 175 m, 24 Nov 2004, *Bernal* 3615 (COL); Mun. Mitú, vereda Makayuka, 1°10'51.2"N, 70°08'20.8"W, 26 Nov 2001, *López* 7250 (COAH); Pacoa, Río Kananarí, caño Malla, Buenos Aires, camino hacia el cerro Totuma, 0°0.1'S, 70°58'W, 517 m, 19 Mar 2009, *Betancur* 3594 (COL); Pacoa, raudal Jirijirimo, Río Apaporis, pathway between Jirijirimo and Piraparaná, 0°0'19"S, 70°56'00"W, *Cárdenas* 22177 (COAH).

Leopoldinia

The genus *Leopoldinia* was established by Martius (1824), who described two species from the lower Río Negro – *Leopoldinia puchra* Mart., and *L. insignis* Mart. Two additional species were added by Wallace (1853) – *Leopoldinia piassaba* Wallace and *Leopoldinia major* Wallace. The former is a remarkably distinct species, and its identity poses no problem. The latter, however, was separated by Wallace only on account of its taller and thicker stem, with a larger bare portion, larger infructescences with bigger fruits, and on the information of the natives, who used it to obtain salt by burning the fruits and filtering the ashes, a use for which *L. pulchra* was purportedly not appropriate.

Spruce (1869) stated that both species grow together over a large area on the Río Negro and along the black-water tributaries of the

8. *Leopoldinia pulchra*, variation in fruit size and shape among fruits from two neighboring individuals. Fruits were arranged according to size.





9. *Leopoldinia pulchra*, habit. Note some leaves with somewhat hanging pinnae.

Casiquiare and the Orinoco. He provided a detailed description of *L. major* and separated it from *L. puchra* on account of its caespitose habit, taller stem, frailer leaf sheaths, more numerous and pendulous pinnae, more closely spaced flower pits and different shape of the bracteoles. Spruce himself, however, was

unable to assign to either species some of his own specimens, which he suspected might correspond to *L. pulchra*.

The identity of *L. major* has remained obscure since the time of Wallace and Spruce, and later authors have not been able to separate it



10 (left). *Leopoldinia pulchra*, detail of stem. 11 (right). *Leopoldinia pulchra*, infructescence.

properly from *L. pulchra* (Wessels Boer 1988, Henderson 1995, Guánchez & Romero 1995), as specimen labels seldom mention number of stems or arrangement of pinnae, and there is much variation in the other characters pointed by Spruce. Wessels Boer (1988) doubted that any difference existed between them but followed Spruce in keeping them separate. Guánchez and Romero (1995) were unable to find any plant referable to this species, although they visited localities cited by Spruce and examined numerous specimens in several herbaria. Henderson (1995) separated *L. major* from *L. pulchra* on account of habit, width of leaf sheath fibers, arrangement of pinnae, fruit size and shape, and several minor floral characters. However, he recognized that differences between both species were still not well established.

Our own field work in the upper Río Negro area and along black-water tributaries of the Río Orinoco, in the bordering area of Venezuela, Colombia, and Brazil, and the study of 83 herbarium specimens kept at COAH, COL, MO and NY, have shown that the differences established by Wallace (1853), Spruce (1869) and Henderson (1995) do not

actually exist. In some cases, variation covering most of the range for a particular character is found in a single population or even in a single individual, as is the case with fruit shape and size (Fig. 8); in other cases, as with caespitose vs. solitary habit, the difference is due to a misinterpretation, as the clumps are often loose, and are easily mistaken for separate, solitary individuals. In many cases, only after digging out the connecting rhizome is it possible to determine that two separate stems belong to the same genetic individual. This situation is further complicated by the fact that the palms remain submerged up to a considerable height every year, during the months of the rainy season.

As to the arrangement of the pinnae, horizontally spreading vs. pendulous, this is a mistake introduced by Spruce, who stated that *L. major* has pinnae completely pendulous "as in the Assai palm" (*Euterpe oleracea*). During our own field work along more than 350 km on the Rio Atabapo, Rio Negro and some of their small tributaries, we searched for *Leopoldinia* palms with pendulous pinnae, and did not find a single individual agreeing with Spruce's description. Most individuals that we

saw had pinnae horizontally spreading, and only occasional palms had them slightly pendulous (Fig. 9), but never as strongly pendulous as described by Spruce. These individuals were identical in every respect to those with horizontal pinnae. Palms with pendulous pinnae reminding Spruce's description are probably occasional, however, as one has been illustrated by Dransfield et al. (2008).

As to variation in the density of flowers, Guánchez and Romero (1995) have documented that there is a wide range of variation in the number of staminate and pistillate flowers and in their arrangement on the rachillae. Our conclusion is that besides the fiber-yielding *piassaba* or *chiquichiqui* palm, *Leopoldinia piassaba*, there is only one other species of *Leopoldinia*, for which the oldest name is *Leopoldinia pulchra*.

The fourth species in the genus, *L. insignis*, was not recognized by Martius in the field as distinct, and was only separated on the base of the herbarium specimen. A study of digital images of this specimen, however, reveals that it is a mixture of two different species, including leaf fragments of *Oenocarpus bataua*, and fruits and inflorescence of *L. pulchra*. Martius himself expressed his doubt that the inflorescence actually belonged to the specimen. We, therefore, include *L. insignis* as a partial synonym of *L. pulchra*.

Leopoldinia pulchra Mart., Hist. nat. palm. 2: 59. 1824. Type: Brazil. Amazonas: Barra do Rio Negro (Manaus), s. f., Martius s. n. (holotype, M). Figures 8–12.

Leopoldinia insignis Mart. Hist. nat. palm. 2: 60. 1824. Type: Brazil. Amazonas: Canumá, s. f., Martius s. n. (holotype, M) (*pro parte*, inflorescence only).

Leopoldinia major Wallace, Palm Trees of the Amazon 15. 1853. Lectotype (Wessels Boer 1988): Wallace, Palm Trees of the Amazon t. 5. 1853.

Caespitose, with several adult stems and sometimes with basal shoots, occasionally up to 20 stems or more, but usually in loose clumps, and then the stems appearing as if they were solitary. Stem 2.5–8 m tall, 4–7 cm diameter, covered with persistent leaf bases, which make up a dense network of gray fibers, so that the covered stem appears to be ca. 10

cm in diameter, sometimes the stem naked near base, but always covered in fibers towards apex. Leaves 5–14, plus 3–4 dead leaves hanging down on the crown, usually 1–2 of the dead leaves conspicuously colored yellow or orange, and easily recognized from a distance; sheath 18–35 cm long, formed by a network of reddish brown fibers 1–4 mm wide, which turn gray with age; petiole 31–63 cm long, ca. 1 cm wide at apex with brown, fimbriate scales; rachis 48–70(–136) cm long, with indumentum like that of the petiole; pinnae (14–)17–29(–37) on each side, regularly arranged, horizontally spreading or occasionally somewhat pendulous, sometimes 2–3 basal pinnae slightly closer to each other than the remaining pinnae; basal pinnae 29–36 cm long, 1.2–2.0 cm wide; middle pinnae (28–)43–72 cm long, 2.2–4 cm wide; apical pinnae 15–22 cm long, 1–1.3 cm wide, all pinnae glabrous on both sides, with conspicuous transverse veins. Inflorescence interfoliar, ca. 1 m long, branched to 3rd order in predominantly pistillate inflorescences or to 4th order in predominantly staminate inflorescences, covered with a short and dense, reddish brown, persistent tomentum, velvety in appearance, sometimes falling off in some areas of the peduncle; peduncle 25–38 cm long; peduncular bract 20–38.5 cm long, 4 cm wide, flat, bicarinate, reddish-brown, inserted ca. 20 cm above the base of the peduncle, with dense, velvety indumentum of short, white, penicillate hairs; rachis 20–35 (–66) cm long; branches 19–28, the last-order rachillae 0.6–1.5(–5) cm long, 1(–2) mm diam. in staminate inflorescences, 5–6(–12) cm long, 1.5–2 mm diam. in pistillate inflorescences. Staminate flowers 0.8–1 mm long; sepals broadly ovate, imbricate, scarious, 0.3–0.4 mm long; petals ovate, obtuse, and slightly cucullate at apex, 0.6–0.8 mm long; stamens 6; filaments broad and flattened; anthers ca. 0.2 × 0.2 mm; pistillode minute. Pistillate flowers similar in shape to the staminate ones but slightly broader; sepals broadly ovate to reniform, 0.8–1 mm long; petals ovate, 0.8–1 mm long. Fruit laterally compressed, variable in shape, even in one infructescence, circular in profile (and then lenticular), or irregularly circular, kidney-shaped, comma-shaped, ovoid or almost squarish, 2.5–3.8(–4.4) cm long or diam., to 1.5 cm thick, passing from yellowish to wine red, and finally dark purple when falling onto the ground; mesocarp fleshy, whitish, covering a network of thick fibers that surround the seed.



12. *Leopoldinia pulchra*, habitat on riverine white sands.

Distribution. Sandy soils near black water tributaries of the Amazon and the Orinoco in western Venezuela (Amazonas), Colombia (Vichada, Guainía) and Brazil (Amazonas, Pará), between 6°48'N and 7°58'S latitude, and between 55°00' and 68°52'W longitude, at 25–200 m elevation.

Common names. *Palmito, palmalito, palmarito, palmiche* (Colombia); *chiquichiquito, morichito, palmiche* (Venezuela); *jará* (Brazil); *manicoli, manicore* (Curripaco); *jará, yará* (Geral).

Uses. Stems are used today for fencing, in the same way described by Wallace (1853); they are also used for house walls (Fig. 13) and courts.

The palm heart is edible. A beverage is obtained by kneading the ripe fruits in water.

Selected specimens. BRAZIL, Amazonas, Alto Rio Negro, ca. 10 km N of Barcelos, 00°52'28"S, 62°58'13"W, 100 m, 6 Aug 1996, *Acevedo 8026, 8027* (NY); Borba, Rio Madeira, 3 km south of town, 4°23'20"S, 59°35'37"W, 29 m, 29 Dec 1990, *Henderson 1504* (NY); Manaus, Taruma, 6 Aug 1986, *Henderson 650* (NY); Munic. Careiro, Manaus-Porto Velho highway, km 22, 2 km on rd. to Purupuru, 3°30'N, 60°00'W, 1 Apr 1985, *Henderson 179* (NY); Munic. Humaitá, BR 230, Estrada Transamazônica, km 126, on Rio Marmelos, 7°58'S, 62°02'W, 17 Apr

1985, *Henderson 255* (NY); Río Paporí, 12 Sep 1928, *von Luetzelburg 23047* (NY); **Pará**. Munic. Santarem, Vila de Alter do Chao, 2°31'S, 55°00'W, 27 Dec 1991, *Ferreira 56* (NY). **COLOMBIA, Guainía**. Near Coitara, ca. 7 km S of San Fernando de Atabapo (Venezuela), 3°55'N, 67°43'W, 95 m, 28 Apr 1979, *Davidse 16846* (MO, NY); road Puerto Inírida to Caño Vitina, 4–11 km from Puerto Inírida, 3°50'N, 67°52'W, 200 m, 21 May 1994, *Bernal 2105* (COL); Mun. Inírida, Resguardo indígena Almidón-La Ceiba, comunidad La Ceiba, near caño Agujón, 3°32'N, 67°51'W, 80 m, 21 Mar 1998, *Rudas 7165* (COL); Comunidad Guamal, 3°52'32.4"N, 67°51'51.2"W, 13 Dec 2005, *Arias 2010* (COAH); Río Atabapo, between Maviso and Comunidad Chaquita, 4°2'15.38"N, 67°42'43.11"W, 9 May 2007, *Cárdenas et al. 20531* (COAH); Corregimiento Cacahual, Caño Garza, ca. 500 m above the confluence with Río Atabapo, 3°28'20.5"N, 67°25'18.3"W, 91 m, 8 Mar 2009, *Bernal 4372* (COAH, COL); Corregimiento La Guadalupe, Caño Macacuní, south branch, ca. 7 km upstream from confluence with Río Negro, 1°17'37"N, 66°55'0.8"W, 73 m, 11 Mar 2009, *Bernal 4407* (COAH, COL). **Vichada**: Puerto Carreño, 14 Jul 1997, *Acero 13* (COL); Mun. Cumaribo, selva de Matavén, Caño Matavén, 4°30'28"N, 68°03'32"W, 190 m, 28 Mar 2007, *Prieto 6118* (COAH); Inspección de Policía Amanavén, Caño Jota, 4°4' 8.4"N, 67°54'10.1"W, 7 Jul

2008, *Cárdenas et al. 21562* (COAH). **VENEZUELA, Amazonas**, 3–5 km NE and E of San Carlos de Río Negro, 1°51'N, 67°03'W, 120 m, 22 Jan 1980, *Liesner 8608* (MO); Cerro Arauicaú, Río Yatua, 1°35'N, 66°10'W, 125–150 m, 11 Apr 1970, *Steyermark 102653* (COL, NY); Cerro Yapacana, Caño Catua (Caño Yapacana), 19 Nov 1953, *Maguire 36558* (NY); Depto. Atures, 47 km N of alcabala of Puerto Ayacucho, 6°00'N, 67°20'W, 80 m, 8 Sep 1985, *Steyermark 131605* (MO, NY); Depto. Río Negro, lower part of the Río Baria, 1°27'–1°10'N, 66°32'–66°25'W, 80 m, 22, 23 Jul 1984, *Davidse 27714* (MO, NY); Dpto. Atabapo, Alto Orinoco, San José del Orinoco, 10 km al SW de La Esmeralda, 3°5'N, 65°35'W, 150 m, 27 Feb 1990, *Aymard 8327* (NY); Dpto. Atabapo, Macabana, Río Ventuari, 4°15'N, 66°20'W, 90 m, Sep 1989, *Delgado 692* (NY); Dpto. Río Negro, Río Pasimoni, between its mouth and its junction with the Río Baria and the Río Yatua, 1°53'–1°27'N, 66°35'–66°32'W, 80 m, 23–25 Jul 1984, *Davidse 27845* (NY); **Apure**, Distrito Pedro Camejo, E of the southern tip of the Galeras de Cinaruco, 6°35'N, 67°15'W, 50 m, 23 Feb 1979, *Davidse 15646* (MO); Atures, Bosque de rebalse al pie de la Serranía de San Borja, 6°48'N, 67°22'W, 24 Jan 1989, *Cuello 566* (NY); **Bolívar**, Along rd. from Puerto Ayacucho to Puerto Páez, 5°50'N, 67°30'W, 2 Aug 1967, *Wessels Boer 1943* (NY).

13. A house made with stems of *Leopoldinia pulchra*, and thatched with leaves of *Leopoldinia piassaba*, on the Venezuelan margin of Río Guainía.



Acknowledgments

We thank the Corporación para el Desarrollo del Noroeste Amazónico (CDA) and Instituto Sinchi, and in particular Luis Fernando Jaramillo, Maryi Varón, and Dairon Cárdenas for facilitating field work along the rivers Guainía, Negro, and Vaupés; División de Investigación, Universidad Nacional de Colombia, Bogotá (DIB), Colciencias, the Royal Embassy of the Netherlands, and the Jardín Botánico del Quindío for supporting field work; the Smithsonian Institution and the Missouri Botanical Garden for support to visit their herbaria; and the curators of COAH, COL, MO, NY and US for allowing study of their collections. We also acknowledge field support of Adriana Alzate, Wilson Devia, Diana Marmolejo, Gustavo Trinidad and Juan Carlos Garcés. Hans-Joachim Esser kindly provided digital images of the type of *Leopoldinia insignis* at M, and Andrew Henderson reviewed the manuscript.

LITERATURE CITED

- BORCHSENIUS F., H.B. PEDERSEN AND H. BALSLEV. 1998. Manual of the palms of Ecuador. AAU Report 37. Aarhus University Press, Aarhus.
- BURRET, M. 1928. Die Palmengattung *Manicaria* Gaertn. Notizbl. Bot. Gart. Berlin-Dahlem 10: 389–394.
- BURRET, M. 1930. Palmae novae Luetzelburgianae. Notizbl. Bot. Gart. Berlin-Dahlem 10: 1013–1026.
- BURRET, M. 1935. Die Palmengattungen *Mauritia* L.F. und *Mauritiella* Burret nov. gen. Notizbl. Bot. Gart. Berlin-Dahlem 12: 605–611.
- CÁRDENAS LÓPEZ, D. (ed). 2007. Flora del Escudo Guayanés en Inírida (Guainía, Colombia). Instituto Amazónico de Investigaciones Científicas-Sinchi. Bogotá, DC.
- DRANSFIELD, J., N.W. UHL, C.B. ASMUSSEN, W.J. BAKER, M.M. HARLEY AND C.E. LEWIS. 2008. Genera Palmarum. Evolution and Classification of the Palms. Royal Botanic Gardens, Kew.
- DRUDE, O. 1881. Cyclanthaceae et Palmae, Pp. 225–460. In: C. MARTIUS (ed.). Flora Brasiliensis vol. 3. Munich.
- FISHER, J.B. AND S. ZONA. 2006. Unusual branching in *Manicaria*. Palms 50: 99–102.
- GAERTNER, J. 1791. De Fructibus et Seminibus Plantarum. Stuttgart.
- GOVAERTS, R. AND J. DRANSFIELD. 2005. World Checklist of Palms. Royal Botanic Gardens, Kew.
- GRISEBACH, A.H.R. 1864. Flora of the British West Indies. Lovell, Reeve & Co., London.
- GUÁNCHEZ, F. & G. ROMERO. 1995. The flowers and unusual inflorescences of *Leopoldinia*. Principes 39(3): 152–158.
- HENDERSON, A. 1995. The palms of the Amazon. Oxford University Press.
- HENDERSON, A., G. GALEANO AND R. BERNAL. 1995. Field guide to the palms of the Americas. Princeton University Press.
- MARTIUS C.F.P. VON. 1823–1853. Historia Naturalis Palmarum, 3 Vol., Munich.
- PINTAUD J.-C., G. GALEANO, H. BALSLEV, R. BERNAL, F. BORCHSENIUS, E. FERREIRA, J.-J. DE GRANVILLE, K. MEJÍA, B. MILLÁN, M. MORAES, L. NOBLICK, F.W. STAUFFER AND F. KAHN. 2008. Las palmeras de América del Sur: diversidad, distribución e historia evolutiva. Revista Peru. Biol. 15 (supl. 1): 7–29.
- SPRUCE R. 1869. Palmae amazonicae, sive enumeratio palmarum in itinere suo per regiones americae aequatoriales lectarum. J. Proc. Linn. Soc., Bot. 11: 65–175.
- STAUFFER, F. 2000. Taxonomía de las palmas del Estado Amazonas. In: F. Stauffer (ed.). Contribución al estudio de las palmas (Arecaceae) del Estado Amazonas. Venezuela. Sci. Guaianae 10:1–120.
- TRAIL, J. 1876. Descriptions of new species and varieties of palms collected in the valley of the Amazon in north Brazil, in 1874. J. Bot (Hooker) 14: 323–333, 353–359.
- WALLACE, A.R. 1853. Palm trees of the Amazon and their Uses. Van Hoorst, London.
- WESSELS BOER, J.G. 1988. Palmas indigenas de Venezuela. Pittieria 17: 1–332.