

Identification of Amazonian Palm Genera from Vegetative Characters

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ABSTRACT

Two keys for identification of thirty-eight Amazonian palm genera based on vegetative characters applied to seedling, juvenile, and adult plants are provided. They treat palms with accessible leaves (less than 10 m in height), and those with inaccessible leaves (over 10 m in height), respectively.

The first key which deals with all palms, the leaves of which are accessible, i.e., palms less than 10 m in height, can be used successfully to identify seedlings, juveniles, and sterile palms at the genus level. The key starts with the morphology of the blade (Fig. 1): 1) palmate or "fan-like" (*Chelyocarpus*, *Copernicia*, *Itaya*, *Lepidocaryum*, *Mauritiella*, *Trithrinax*), or costapalmate, i.e., with a short, curved rachis in the blade (*Mauritia*), 2) blade entire and bifid, or having only two segments or pinnae (seedlings of many genera and some adults of *Bactris*, *Chamaedorea*, *Geonoma*, *Wendlandiella*), 3) blade entire, not bifid (seedlings of several genera and adult form of *Manicaria*), and 4) leaf pinnate, or "featherlike" (seedlings, juveniles, and adults of most genera).

The form of the entire or bifid blade and of leaflets (Fig. 2) is treated next in the key. For instance, the presence of pinnae, which are pointed at the tip or truncate and broad apically (wedge-shaped), allows the separation of *Aiphanes* and the *Iriarteeae* (*Catoblastus*, *Iriartea*, *Iriartella*, *Socratea*, and *Wettinia*) from other genera. The presence or absence of spines is also used, together with four other characters: 1) the color of the underside (abaxial) of the blade (white in *Astrocaryum*

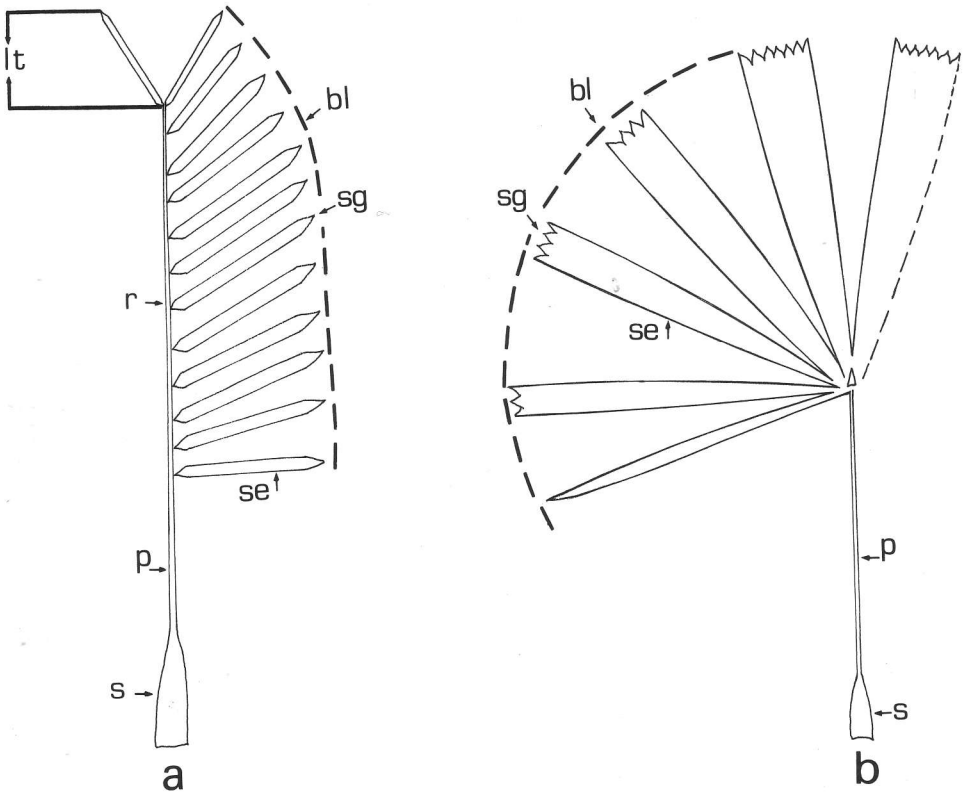
and *Jessenia*, glaucous in *Acrocomia* and *Oenocarpus*, green in most genera, or green with brownish longitudinal stripes in *Attalea*, *Maximiliana*, *Orbignya*, and *Scheelea*); 2) the form of the pinnae (linear, lanceolate, or S-shaped); 3) the tip of the pinnae, either symmetric (acute or slightly bifid) or asymmetric (obliquely notched); and 4) the ribs (main nerves) prominent above and/or below. Other characters, such as the sheath tubular or split, and the arrangement of the pinnae either in one plane or oriented in several directions, are then considered. In several cases, complementary characters are given to make the choice easier at the key dichotomy.

The second key deals with tall palms, the leaves of which are inaccessible. Characters of the leaves, of the trunk, of the roots, and physiognomy of the crown are used.

The Scope of the Keys

These keys are to be used in primary and secondary forests in all ecosystems of the Amazon valley. They were first developed from studies conducted in Brazil and Peru. They can be used, however, in the peripheral Andean region of Bolivia, Colombia, Ecuador, Venezuela, and in the Guianas. Thirty-eight genera are treated. Characters used to separate them refer to Amazonian native species, except for *Cocos* (*C. nucifera*) and two species of *Elaeis* (a native species, *E. oleifera*, and the introduced African oil palm, *E. guineensis*).

Most of the genera included occur



1. a, pinnate leaf; b, palmate leaf (the same terms are used for costapalmate leaf). Details: bl, blade; lf, leaf tip; p, petiole; r, rachis; sg, pinna (a) or segment (b); se, edge of pinna or segment; s, sheath.

throughout the Amazon basin: *Astrocaryum*, *Attalea*, *Bactris*, *Desmoncus*, *Elaeis*, *Euterpe*, *Geonoma*, *Hyospathe*, *Jessenia*, *Mauritia*, *Mauritiella*, *Maximiliana*, *Orbignya*, *Scheelea*, *Socratea*, *Syagrus*, and *Cocos*. Many genera are also located in western Amazonia: *Aiphanes*, *Catoblastus*, *Chamaedorea*, *Chelyocarpus*, *Dictyocaryum*, *Iriartea*, *Itaya*, *Pholidostachys*, *Phytelephas*, *Prestoea*, *Wendlandiella*, and *Wettinia*. Some reach central Amazonia: *Iriartella* and *Lepidocaryum*; a few display limited distributions in central Amazonia: *Barcella* and *Leopoldinia*; and others occur in central and eastern Amazonia: *Acrocomia* and *Manicaria*. *Raphia* is found only in the eastern part, while *Copernicia* and *Trithrinax* are

found in the southern part of the Amazon basin.

It was impossible to separate the seedlings and juveniles of the *Attalea-Maximiliana-Orbignya-Scheelea* complex. Furthermore, some adult genera such as the related *Geonoma* and *Pholidostachys* cannot be clearly distinguished on vegetative characters. A slight confusion also occurs between the seedlings of *Chelyocarpus* and *Itaya*, but the value of the key is not much reduced because these two genera are infrequent and limited to western Amazonia, as is also *Pholidostachys*. The genus *Asterogyne* is only known from a very small area of French Guyana and may be confused with *Geonoma*.

Key 1

Leaves accessible
(palms less than 10 m in height)

- 1a. Leaves palmate (fan-shaped) or costapalmate (with a short, curved rachis in the blade), 3 segments or more. 2
- b. Leaves with only 2 segments or pinnae, or blade entire and bifid. 13
- c. Leaves with blade entire; pointed, not bifid. 35
- d. Leaves pinnate (featherlike). 43
- 2a. Leaves costapalmate; sheath diameter more than 30 cm. *Mauritia*
- b. Leaves palmate; sheath diameter less than 30 cm. 3
- 3a. Blade divided into segments multi-pointed, several-folded (Fig. 2a) with several ribs, white beneath. 4
- b. Blade divided into segments one-pointed (Fig. 2b), connate or not basally, each with one or several ribs, white, green, or glaucous beneath. 5
- 4a. Petiole split basally in the sheath; this splitting opposite the petiole (see old leaves). *Itaya*
- b. Petiole not split basally in the leaf sheath; this closed. *Chelyocarpus*
- 5a. With spines on the upper surface of the rib(s) (select the youngest leaves). 6
- b. Without spines on the upper surface of the rib(s). 8
- 6a. Blade white beneath; spines on the stem. *Mauritiella*
- b. Blade green beneath; without spines on the stem. 7
- 7a. Segments one-ribbed, connate at base forming two groups separated by a central division at the base; blade often in a horizontal plane, but the youngest leaf usually with segments \pm erect; spines on midrib above. *Mauritia*
- b. Segments many-ribbed, not oriented in a marked horizontal plane; spines present on the upper surface of the ribs and on blade edges (select the youngest leaves). *Lepidocaryum*
- 8a. Blade white beneath. 9
- b. Blade green beneath. 10
- c. Blade hazy glaucous beneath, with 3-4 leaflets, each usually with two bright green margins beneath. ...
..... *Oenocarpus*
- 9a. Rib(s) prominent beneath; lower surface of the blade usually covered with a continuous layer of thin, white, membranous scales which rub off on contact; 3-4 segments, not markedly erect.
..... *Chelyocarpus, Itaya*
- b. Rib(s) not prominent beneath; blade dusty white beneath, petiole of the youngest leaves also dusty white; segments of the youngest leaf markedly erect. *Mauritiella*
- 10a. With triangular, laterally flattened spines, curved toward the apex as well as toward the base of the leaf. *Copernicia*
- b. Without spines on the edge of the petiole. 11
- 11a. Fibers of the sheath joined in a spiny expansion. *Trithrinax*
- b. Fibers of the sheath not joined in a spiny expansion, or sheath not fibrous. 12
- 12a. Midrib prominent above. *Mauritia*
- b. Midrib of each one-pointed segment prominent beneath. *Chelyocarpus*
- 13a. Leaflets or halves of bifid blade with tips pointed (Fig. 2c,d,e,f). 14
- b. Leaflets or halves of bifid blade clearly truncate, denticulate or multi-pointed (Fig. 2g,h,i). 30
- 14a. 2 leaflets connate at base, far longer than wide, or blade bifid. 15
- b. 2 leaflets not connate at base, wide, length about two to four times the width, usually light green, soft, flexible, not rigid. *Desmoncus*
- 15a. With spines, at times sparse, on outer edge of leaflets or halves of bifid blade, and, in some cases, on blade above and on sheath. 16
- b. Without spines on edge of leaflets or halves of bifid blade, or on other leaf parts. 19
- 16a. Blade white beneath. *Astrocaryum*
- b. Blade green or glaucous beneath. 17
- 17a. Blade glaucous beneath, light green above; reddish, shiny spines on sheath, rachis and blade.
..... *Acrocomia*
- b. Blade green beneath. 18
- 18a. Spines short, broad basally, up to 3-4 mm long, generally whitish, sometimes with brown tips, located on upper surface of ribs and on leaflet edges. *Lepidocaryum*
- b. Spines or spiny hairs, slender, never swollen at base, often dark, grouped on the outer edge near the



2. a, segment multi-pointed, several folded; b, segment or pinna one-pointed; c, 2 pinnae in a closed-V shape; d, 2 pinnae in an open-V shape, each twisted outwards; e, blade entire and bifid, each half with straight margins; f, blade entire and bifid, each half S-shaped; g, pinna or half of bifid blade regularly multi-pointed toward the tip; h, blade bifid and divided for less than half its length, each half truncate or irregularly toothed; i, blade bifid and divided for more than half its length, each half truncate or irregularly toothed; j, blade entire, not bifid, far longer than wide, with tip pointed; k, blade entire not bifid, far longer than wide, with tip truncate or denticulate, not sharply pointed; l, blade entire, not bifid, margins rounded, with tip pointed; m, blade entire, not bifid, margins rounded, with tip not pointed; n, pinna straight, linear-lanceolate; o, p, pinna S-shaped; q, r, tip of pinna asymmetric, obliquely notched; s, pinna truncate, with broad tip, usually with spines; t, u, pinna wedge-shaped or like a fish fin, without spines; v, blade entire not longitudinally divided pinnae slightly erect, tip drooping; w, upper parts of longitudinally divided pinnae shorter than the lower parts, tip not drooping; x, upper parts of longitudinally divided pinnae not shorter than the lower parts, tip not drooping (v, w, x, leaf viewed in cross section).

- tip of each half of bifid blade, occasionally on blade above; usually longer spines on sheath, petiole and rachis below, these brown or black, rarely whitish then flattened. *Bactris*
- 19a. Leaflets white beneath. 20
- b. Leaflets or half of bifid blade green beneath. 22
- c. Leaflets hazy glaucous with 1-2 bright green margins beneath. *Oenocarpus*
- d. Halves of bifid blade green beneath with greyish or brownish stripes along the ribs and the margins; outer margins denticulate toward the tip. *Attalea, Maximiliana, Orbignya, Scheelea*
- 20a. Two leaflets in closed-V shape, connate at base for 3 cm or more, rachis short but well-marked (Fig. 2c). *Jessenia*
- b. Two segments in open-V shape, connate at base for less than 3 cm long, without rachis; each leaflet slightly twisted outwards (Fig. 2d). 21
- 21a. Ribs prominent beneath; segments with layer of white membranous scales beneath which rub off on contact. *Chelyocarpus, Itaya*
- b. Ribs not prominent beneath; segments dusty white beneath; petiole usually dusty white. *Mauritiella*
- 22a. Petiole and rachis yellow, or very light-green, or whitish; in cultivated areas. *Cocos*
- b. Petiole and rachis green. 23
- 23a. Pinnae linear-lanceolate, or halves of bifid blade with margins straight (Fig. 2c,e). 24
- b. Pinnae or halves of bifid blade S-shaped (Fig. 2f). 27
- 24a. Pinnae or halves of bifid blade rather wide (more than 2 cm), one or several ribs. 25
- b. Pinnae narrow (less than 2 cm), several ribs. 26
- 25a. With 2 pinnae; and a distinct, long petiole between the sheath and the rachis. *Euterpe*
- b. With blade entire and bifid; and a short petiole, or without petiole, then the sheath continues into the rachis. *Elaeis*
- 26a. Ribs (3) prominent above and beneath; sheath tubular, shorter opposite the petiole (obliquely open). *Wendlandiella*
- b. Several ribs prominent above; sheath split opposite the petiole (select old, green leaves). *Geonoma*
- 27a. Sheath split opposite the petiole (select old, green leaves). *Geonoma, Pholidostachys*
- b. Sheath not split opposite the petiole, tubular in young as well as in old leaves. 28
- 28a. Ribs prominent above and beneath on pinnae. 29
- b. Ribs prominent above on pinnae, not beneath. *Hyospathe*
- 29a. Outer margins of blade emarginate (or wavy). *Chamaedorea*
- b. Outer margins of blade regularly linear and curved, not emarginate. *Wendlandiella*
- 30a. Tip of pinnae or of halves of bifid blade regularly multi-pointed (Fig. 2g). 31
- b. Tip of pinnae or of halves of bifid blade irregularly toothed, not regularly multi-pointed (Fig. 2h,i). 32
- 31a. With brownish or greyish stripes on the blade below; blade length less than 1 m. *Attalea, Maximiliana, Orbignya, Scheelea*
- b. Without brownish or greyish stripes on the blade beneath; blade length up to several meters. *Manicaria*
- 32a. Pinnae one-ribbed, with the two margins straight; with spines on sheath, petiole, rachis, and/or blade. *Aiphanes*
- b. Pinnae or halves of bifid blade many-ribbed, with the inner (or upper) margin straight, and the outer (or lower) margin wavy, irregularly toothed; without spines. 33
- 33a. Blade divided for less than half its length (Fig. 2h); sheath, petiole, and blade pilose. *Iriartella*
- b. Blade divided for more than half its length (Fig. 2i); leaf not pilose. 34
- 34a. Blade white beneath. *Dictyocaryum*
- b. Blade green beneath. *Socratea*
- 35a. Leaf length less than 2.5 m. 36
- b. Leaf length more than 2.5 m, blade often torn along the nerves (leaf tip usually slightly bifid). *Manicaria*
- 36a. Blade far longer than wide, linear-lanceolate (Fig. 2j,k). 37
- b. Blade round, or with length about two or three times the width (Fig. 2l,m). 40
- 37a. Tip of blade pointed, prolonged by a narrow apex (Fig. 2j); petiole short or not distinct between sheath and blade. *Elaeis*
- b. Tip of blade not sharply pointed, or roundly blunt (Fig. 2k), or regularly denticulate. 38
- 38a. Blade white beneath, usually with small, slender spines on edge, and on sheath and petiole. *Astrocaryum*
- b. Blade green beneath with longitudinal brownish or greyish stripes; without spines. *Attalea, Maximiliana, Orbignya, Scheelea*
- c. Blade green beneath, without brownish or greyish stripes; without spines. 39
- 39a. Tip of blade roundly truncate, pilose; blade length less than 0.3 m. *Iriartella*

- b. Tip of blade neither rounded nor sharply pointed, not pilose, blade length up to 2.5 m. *Syagrus*
 c. Tip of blade regularly denticulate. *Manicaria*
 40a. Tip of blade pointed (Fig. 2l). 41
 b. Tip of blade not pointed (Fig. 2m). 42
 41a. Blade pilose beneath (not always obvious, then can be confused with *Wettinia*; difference can be made in identifying adult palms if present; stem no more than 5 cm in diameter, and leaf with less than 17 pairs of pinnae). *Catoblastus*
 b. Blade not pilose beneath (adult stem more than 6 cm in diameter, and leaf with more than 17 pairs of pinnae). *Wettinia*
 42a. Blade petiole and sheath strongly pilose. *Iriartella*
 b. Blade petiole and sheath not strongly pilose. *Iriartea*
 43a. Pinnae pointed at tip, linear-lanceolate or S-shaped (Fig. 2n,o,p). 44
 b. Pinnae (or part when divided longitudinally) truncate at tip, lanceolate to wedge-shaped or like a fish fin (Fig. 2s,t,u). 66
 44a. Pinnae much longer than wide. 45
 b. Pinnae wide, narrow basally, with length about two to four times the width, sub-opposite, 2-4 pairs per leaf blade usually light green, soft, flexible, not rigid; rarely armed with small hooks or spines on the rachis and sheath. *Desmoncus*
 45a. With spines on pinna edges. 46
 b. Without spines on pinna edges. 48
 46a. Pinnae white beneath; spines strongly flattened, usually black, sometimes whitish. *Astrocaryum*
 b. Pinnae glaucous beneath; spines not strongly flattened, often reddish brown. *Acrocomia*
 c. Pinnae green beneath. 47
 47a. Spines or spiny hairs grouped at the edges near the tip or disposed regularly along pinna edge, sometimes on the blade above, black or dark brown, slender, no more than 1 cm long, often shorter, usually longer on sheath, petiole and rachis (absent in some small species), dark, not flattened, sometimes whitish with brown tip when strongly flattened. *Bactris*
 b. Spines whitish or brownish, 2-4 mm long, swollen basally, regularly disposed on the edges along the pinnae, and on the midrib above. *Raphia*
 48a. Pinnae lanceolate (Fig. 2n); (if 3-4 ribs prominent above and below on a few narrow pinnae, 2-3 pairs per leaf, see 65b). 49
 b. Pinnae S-shaped (Fig. 2o,p). 62
 49a. Rachis continuing into a cirrus with strong hooks in a V-shape; pinnae sub-opposite to opposite; sheath and petiole often with prickles basally swollen or with slender spines. *Desmoncus*
 b. Rachis not continuing into a cirrus with hooks. 50
 50a. Tip of pinnae symmetric on both sides on the midrib (select pinnae from several leaves, Fig. 2b). 51
 b. Tips of pinnae asymmetric, obliquely notched, with acute or rounded tip (Fig. 2q,r) (see also 60a). 57
 51a. Pinnae green beneath. 52
 b. Pinnae white beneath (select the youngest leaves), wide (more than 6 cm), serrate in cross section, normally arranged in one plane; sheath with erect, knitting-needlelike, black projections, 20 cm and more long. *Jessenia*
 c. Pinnae hazy glaucous beneath, generally less than 6 cm wide, normally oriented in the same plane, or in groups of 2-6 in different directions; the rachis and petiole of youngest leaves dusty red (the youngest leaf often with red blade); sheath fibrous at margins, sometimes forming a muff around the stem, often reddish brown, without knitting-needlelike projections. *Oenocarpus*
 52a. With hooks on the petiole margins. *Elaeis*
 b. Without hooks on the petiole margins. 53
 53a. Pinnae arranged in one plane. 54
 b. Pinnae oriented in several directions perpendicular to the rachis; leaves finely pinnate. *Syagrus*
 54a. Pinnae obviously serrate (like a saw) in cross section (see the basal parts); petiole triangular in cross section; fibers at leaf bases. *Barcella*
 b. Pinnae not obviously serrate in cross section; petiole round basally, not strongly triangular in cross section. 55
 55a. Sheath split, yellow to whitish as petiole, rachis and midrib. *Cocos*
 b. Sheath not split, tubular, yellow, orange, or green. 56
 56a. Pinna tip flat; sheath yellowish to orange, covered by sheath remnants of dead leaves in juvenile plants. *Euterpe*
 b. Pinna tip carinate, sometimes flat in seedlings (confusion with *Euterpe* possible); sheath greenish. Genus limited to the western Amazonia and on the Andean piedmont. *Prestoea*
 57a. Pinnae green beneath. 58
 b. Pinnae hazy glaucous beneath. *Oenocarpus*

- c. Pinnae green with longer tips brownish or greyish below (see pinnae of several leaves). *Attalea, Maximiliana, Orbignya, Scheelea*
- d. Pinnae white beneath. *Jessenia*
- 58a. With hooks on petiole margins. *Elaeis*
- b. Without hooks on petiole margins. 59
- 59a. Pinnae oriented in several directions; segment edge rough (like a small hack-saw); rachis often continuing into only one slender pinna. *Syagrus*
- b. Pinnae arranged in one plane; pinna edges smooth. 60
- 60a. Midrib prominent on both upper and lower surfaces on pinnae, parallel nerves prominent below; midrib with orange or brownish scales beneath; pinnae sub-opposite forming an upward V-shape toward the tip and a downward V-shape toward the base; rachis continuing into a short and narrow pinna (these characters are obvious; sometimes pinna tips are not strongly asymmetric). *Phytelephas*
- b. Midrib prominent above, not below on pinnae. 61
- 61a. Pinna tip slightly bifid, sometimes symmetric, several nerves parallel to the midrib and more prominent on pinna above than below; sheaths of dead leaves persistent and forming a muff of fibers around the stem. *Leopoldinia*
- b. Pinna tip not bifid, carinate; several nerves parallel to the midrib and prominent below; without a persistent fibrous muff around the stem, this with well-marked internodes. *Prestoea*
- 62a. Leaf tip bifid with tip of each half one-pointed. 63
- b. Leaf tip bifid with tip of each half multi-pointed. *Manicaria*
- 63a. Sheath split opposite the petiole (select old green leaves). *Geonoma, Pholidostachys*
- b. Sheath tubular, never split opposite the petiole. 64
- 64a. Ribs prominent above and beneath on pinnae. 65
- b. Ribs prominent above, not beneath on pinnae. *Hyospathe*
- 65a. Pinnae generally more than 2 cm wide, markedly S-shaped, with asymmetric tip, the lower part shorter than the upper; internodes like a truncate inverted cone; stem diameter more than 1 cm. *Chamaedorea*
- b. Pinnae narrow (no more than 2 cm wide), not markedly S-shaped, with symmetric tips, usually with 3-4 prominent ribs; 2-3 pairs of pinnae; internodes cylindrical; internodes cylindrical; stem diameter less than 1 cm. *Wendlandiella*
- 66a. With spines on the sheath, petiole, rachis, and on the stem; pinna tip truncate and broad (Fig. 2s). *Aiphanes*
- b. Without spines; pinna wedge-shaped or like a fish fin (Fig. 2t,u). 67
- 67a. With irritant hairs on the sheath. *Iriartella*
- b. Without irritant hairs on the sheath. 68
- 68a. Pinnae undivided and arranged in one plane. 69
- b. Pinnae longitudinally divided, parts oriented in several directions. 73
- 69a. Leaf tip bifid. 70
- b. Leaf tip not bifid. 71
- 70a. Pinnae green beneath. *Socratea*
- b. Pinnae white beneath. *Dictyocaryum*
- 71a. Leaf tip pointed. 72
- b. Leaf tip not pointed. *Iriartea*
- 72a. Blade pilose beneath (not always obvious, then could be confused with *Wettinia*; consider adult palms if present; stem no more than 5 cm diam., and leaf with less than 17 pairs of pinnae). *Catoblastus*
- b. Blade not pilose below (adult stem more than 6 cm diam., and leaf with more than 17 pairs of pinnae). *Wettinia*
- 73a. Upper parts of divided pinnae slightly erect but with drooping tips (leaf viewed in cross section) (Fig. 2v), green beneath. *Socratea*
- b. Upper parts of divided pinnae straight and slightly erect (leaf viewed in cross section). 74
- 74a. Upper parts shorter than the lower (leaf viewed in cross section) (Fig. 2v), green beneath. *Iriartea*
- b. Upper parts not shorter than the lower (leaf viewed in cross section) (Fig. 2x), white beneath. *Dictyocaryum*

Key 2

Leaves inaccessible
(palm height more than 10-12 m)
(Binoculars helpful)

- 1a. Leaves palmate (fan-shaped) or costapalmate (with a short, curved rachis in the blade). 2
- b. Leaves pinnate (featherlike). 4

- 2a. With spines on the trunk; most often multi-stemmed palms; leaf palmate. *Mauritiella*
 b. Without spines on the trunk; single-stemmed palms; leaf costapalmate or palmate. 3
- 3a. Leaf costapalmate, without spines on the petiole. *Mauritia*
 b. Leaf palmate with triangular, laterally flattened spines on the petiole. *Copernicia*
- 4a. Pinnæ lanceolate with tip pointed. 5
 b. Pinnæ with truncate tip, narrow and long to wedge-shaped. 19
- 5a. Prickly palms (if no spines on the trunk, see sheath, petiole, or rachis—for tall palms, look at dead fallen leaves). 6
 b. Unarmed palms. 9
- 6a. Pinnæ oriented in several directions (leaves ragged). 7
 b. Pinnæ regularly arranged in one plane. *Astrocaryum*
- 7a. Extremity of basal leaves lower than their point of insertion; with spines on the trunk, except in old palms, these not strongly flattened; upper pinnæ slightly erect with drooping tips. 8
 b. Extremity of basal leaves well above their point of insertion (crown funnellike); spines on the trunk most often strongly flattened; pinnæ straight, tips not drooping. *Astrocaryum*
- 8a. Trunk diameter more than 20 cm; numerous leaves radiating out to form a spherical crown.
 *Acrocomia*
 b. Trunk diameter under 20 cm; basal leaves markedly arching. *Bactris*
- 9a. Pinnæ oriented in several planes or directions (ragged leaves). 10
 b. Pinnæ arranged in one plane. 13
 c. Pinnæ of each side drooping in two parallel, vertical planes; sheath yellowish to orange; often with red roots from trunk base, those bearing small, white, spiny roots. *Euterpe*
- 10a. Sheath and basal part of petiole of dead leaves persistent under the crown for more than one meter. 11
 b. Sheaths of dead leaves not persistent under the crown. 12
- 11a. Leaves in crown arranged in 4–6 vertical series (see the vertical superposition of petioles from beneath).
 *Maximiliana*
 b. Leaves many, not arranged in obvious vertical series. *Scheelea*
- 12a. Leaf sheaths dark green, brown to reddish, fibrous, forming a prominent net below the crown; pinnæ glaucous beneath. *Oenocarpus*
 b. Leaf sheaths greyish, not forming a prominent net below the crown; pinnæ green beneath, oriented in several directions perpendicular to the rachis making the leaf bottle-brushlike. *Syagrus*
- 13a. Sheath and petiole base of dead leaves persistent under the crown; leaves ascending to suberect, large (8–10 m long) with numerous pinnæ (200 pairs and more), the tip of the leaf curving in the manner of a cock's tail feather. *Attalea*, *Orbignya*, *Scheelea*
 b. Sheath of dead leaves not persistent under the crown. 14
- 14a. Large leaves, more than 4 m long; trunk diameter more than 20 cm. 15
 b. Medium-sized leaves, less than 4 m long; trunk diameter less than 20 cm. 17
- 15a. With hooks on the margin of the petiole. *Elaeis*
 b. Without hooks on the margin of the petiole. 16
- 16a. Extremities of basal leaves above their point of insertion or at the same level, rarely below (crownlike an open funnel); pinnæ tend to hang at an acute angle from the rachis. *Jessenia*
 b. Extremities of basal leaves lower than their point of insertion; numerous leaves radiating out to form a spherical crown, often with a slightly free space between an upper and a lower group of leaves; sheath, petiole, rachis, and midrib yellowish to whitish. *Cocos*
- 17a. Sheath tubular. 18
 b. Sheath not tubular, usually fibrous at margins. *Oenocarpus*
- 18a. Internodes well-marked. *Prestoea*
 b. Internodes not distinctly marked. *Euterpe*
- 19a. Pinnæ undivided, arranged in one plane; medium-sized palms. 20
 b. Pinnæ longitudinally divided to the base, parts oriented in several directions; tall palms. 21
- 20a. Leaf tips entire (select the youngest leaves). *Wettinia*
 b. Leaf tips bifid. *Socratea*
- 21a. Upper parts of divided pinnæ slightly erect with drooping tips (Fig. 2v), green below; numerous stilt roots regularly spaced forming a rather open cone up to 3 m in height, each stilt root light-brown bearing small, white, hornlike, sharp, spinelike roots; root cap small at the apex of growing roots. *Socratea*
 b. Upper parts of divided pinnæ slightly erect with tips straight, not drooping. 22
- 22a. Upper parts of divided pinnæ shorter than the lower parts (Fig. 2w), green below; stilt roots at a very acute angle with the trunk forming a rather closed cone up to 2 m in height, each stilt root dark-brown, bearing white, spinelike roots; large cap covering root apex in growing stilt roots; stem usually with conspicuous swelling in low western Amazonia; stem without swelling in the Andean piedmont. ... *Iriartea*

- b. Upper parts of divided pinnae not shorter than the lower parts (Fig. 2x), white below; stilt roots at a rather obtuse angle with the trunk forming an open cone up to 1 m in height, each stilt root light-brown, bearing white, spinelike roots. *Dictyocaryum*

Acknowledgments

These two keys are the result of ten years work with palms in the Brazilian and Peruvian Amazonia in projects supported by international agreements: ORSTOM-France/CNPq-Brazil, ORSTOM/IIAP, and ORSTOM/Museo de Historial Natural

(UNMSM)-Peru. I would like to thank F. Halle who urged me to write them, as well as all my colleagues and students who tested them in the field. I am indebted to C. Peters and to H. Clark for their helpful assistance with the English manuscript.

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