ARECACEAE (PALMAE)

棕榈科 zong lü ke

Pei Shengji (裴盛基)[1], Chen Sanyang (陈三阳)[1], Guo Lixiu (郭丽秀)[2]; Andrew Henderson[3]

Stems solitary or clustered, short and subterranean, erect, or climbing. Leaves pinnate, palmate, or costapalmate, spirally or rarely distichously arranged, sometimes spiny; sheaths usually open, sometimes closed and forming crownshafts, in climbing plants usually with knees and sometimes with flagella; petioles short or absent to elongate, smooth, spiny, in palmate leaves with a hastula at apex, rarely hastula absent; rachis short to elongate, absent in palmate leaves, sometimes extended into a whiplike climbing organ (cirrus); pinnae in pinnate leaves either regularly or irregularly arranged along rachis, spreading in 1 or several planes, variously shaped, mostly reduplicate, rarely induplicate, sometimes jagged or lobed at apices, rarely gray abaxially; segments in palmate leaves variously arranged, single or multi-fold, split to varying degrees, mostly induplicate, rarely reduplicate. Plants monoecious, sometimes dioecious, iteroparous (pleonanthic) or less often semelparous (hapaxanthic). Inflorescences borne among or below leaves, solitary or rarely multiple at each node; peduncle bearing a prophyll and usually 1 or more peduncular bracts; rachis bearing prominent or much-reduced rachis bracts; rachillae 1 to many, bearing flowers in various arrangements, often solitary, paired, in threes (triads) or more; flowers usually with 3 sepals, 3 petals, 6 stamens, and 3 carpels. Fruits variously shaped and colored, sometimes covered with overlapping scales; endosperm ruminate or homogeneous; germination remote or adjacent; eophylls undivided, bifid, pinnate, or palmate.

About 183 genera and ca. 2,450 species: tropical and subtropical areas in Africa, the Americas, Asia, Madagascar, and the Pacific; 18 genera (two introduced) and 77 species (27 endemic, four introduced, including *Areca catechu*, *Arenga pinnata*, *Cocos nucifera*, and *Phoenix dactylifera*) in China.

A very wide range of palm species is grown as ornamentals in botanical gardens, including those in the humid, tropical parts of China. A few are more widely grown in China and are listed at the end of this account.

See Henderson (Palms S. Asia. 2009).

Pei Shengji, Chen Sanyang & Tong Shaoquan. 1991. Palmae. *In:* Pei Shengji & Chen Sanyang, eds., Fl. Reipubl. Popularis Sin. 13(1): 1–172.

Glossary

Within the definitions, *italics* indicate terms that are defined in this glossary.

Cirrus (plural **cirri**) – a long, narrow extension of the leaf rachis with small, grapnel-like spines, found in climbing palms.

Clustered – a term applied to an individual palm with basal axillary branching giving several stems in the same plant.

Costapalmate – *palmate* but with a short leaf rachis.

Crownshaft – a cylindric structure formed by the base of the leaves, and appearing as an extension of the stem.

Eophyll – the first green, expanded leaf of a seedling.

Flagellum (plural **flagella**) – a modified inflorescence consisting of a long, whiplike organ covered with recurved spines, found in some climbing species of *Calamus*.

Hastula – in *palmate* leaves, a flap of tissue borne at the apex of the petiole, where it joins the blade, usually on the adaxial surface.

Induplicate – of a *pinna* or segment in which the central axis of a fold is abaxial and the margins adaxial (i.e., V-shaped in cross section).

Infrafoliar – of an inflorescence reaching anthesis below the leaves, and free of its subtending leaf.

Interfoliar – of an inflorescence reaching anthesis while still subtended by its leaf. *Interfoliar* inflorescences may become *infrafoliar* in fruit.

Iteroparous (syn. pleonanthic) – the condition of a stem with a relatively long reproductive phase, typically of over 20 years duration, before death.

Knee – in climbing palms, the rattans, a swollen area on the sheath immediately below the petiole.

Ocrea – an extension of the leaf sheath above the point of insertion of the petiole.

Palmate – of a leaf in which the rachis is truncated and the leaf appears fan-shaped.

Peduncular bract – the second (and subsequent) bract(s) on an inflorescence after the *prophyll*.

Pinna (plural **pinnae**) – a single leaflet of a *pinnate* leaf.

Pinnate – of a leaf in which the rachis is elongate and the leaf appears feather-shaped.

Prophyll – the first bract on an axillary branch, usually applying to that of an inflorescence.

Rachilla (plural **rachillae**) – the flower bearing branch(es) of an inflorescence.

Reduplicate – of a *pinna* or segment fold in which the central axis of a fold is adaxial and the margins abaxial (i.e., Λ-shaped in cross section).

Remote germination – germination in which the seedling develops at some distance from the seed, by extension of the cotyledonary petiole.

Semelparous (syn. hapaxanthic) – the condition of a stem with a relatively short reproductive phase, typically of 1–7 years duration, before death.

[1] Kunming Institute of Botany, Chinese Academy of Sciences, 132 Lanhei Road, Heilongtan, Kunming, Yunnan 650204, People's Republic of China. (Chen Sanyang died in March 2008.)
[2] South China Botanical Garden, Chinese Academy of Sciences, Guangzhou, Guangdong 510650, People's Republic of China.
[3] Institute of Systematic Botany, New York Botanical Garden, Bronx, New York 10458-5126, U.S.A.

1a. Leaves palmate or costapalmate.
2a. Hastula absent; petioles deeply channeled ..... 12. *Chuniophoenix*
2b. Hastula present; petioles not deeply channeled.
3a. Petiole margins unarmed.
4a. Segments with 1(or 2) reduplicate folds, green abaxially ..... 9. *Rhapis*
4b. Segments with several induplicate folds, grayish or silvery white abaxially ..... 7. *Guihaia*
3b. Petiole margins armed.
5a. Leaf blades split to their bases into multi-fold, wedge-shaped segments with lobed apices ..... 11. *Licuala*
5b. Leaf blades not or seldom split to their bases, segments single or multi-fold, not wedge-shaped, with pointed or split apices.
6a. Adult leaves markedly costapalmate; petioles with stout spines along margins; fruits globose to ellipsoid, not grooved ..... 10. *Livistona*
6b. Adult leaves palmate; petioles with small, blunt spines along margins; fruits kidney-shaped or oblong, grooved ..... 8. *Trachycarpus*
1b. Leaves pinnate (or pinnately veined if undivided) or bipinnate.
7a. Pinnae induplicate, at base of leaf modified into green, straight spines ..... 6. *Phoenix*
7b. Pinnae reduplicate, at base of leaf not modified into spines.
8a. Stems, leaves, or inflorescences spiny.
9a. Stems stiff and erect, sometimes short and subterranean, not climbing, without flagella and cirri.
10a. Stems always short and subterranean, or creeping; ocrea absent ..... 1. *Salacca*
10b. Stems subterranean or erect; ocrea present, often conspicuous ..... 3. *Calamus*
9b. Stems thin and flexible, climbing, with either flagella or cirri.
11a. Knees on leaf sheaths absent; inflorescences borne simultaneously at apex of stem, their production ending life of stem (semelparous); inflorescence branches covered with prominent, overlapping bracts obscuring flowers ..... 2. *Plectocomia*
11b. Knees on leaf sheaths usually present; inflorescences borne sequentially along stem, their production not ending life of stem (iteroparous); inflorescence branches without prominent, overlapping bracts, flowers visible.
12a. Cirri always present; inflorescences not flagellate, usually shorter than leaves, with boat-shaped bracts splitting their entire length and then either falling off or remaining attached and enclosed by prophyll, without grapnel-like spines ..... 4. *Daemonorops*
12b. Cirri present or absent; inflorescences flagellate or not flagellate, usually longer than leaves, with sheathing, tubular bracts not or only briefly splitting and remaining attached, not enclosed by prophyll, usually with grapnel-like spines ..... 3. *Calamus*
8b. Stems, leaves, and inflorescences not spiny.
13a. Pinnae with pointed apices.
14a. Stems creeping, seldom visible; leaves erect ..... 5. *Nypa*
14b. Stems erect; leaves spreading ..... 16. *Cocos*
13b. Pinnae, at least apical ones, with lobed or jagged apices.
15a. Leaf sheaths closed and forming a crownshaft; inflorescences borne below crownshaft, with only 1 bract (or bract scar); only apical pinnae with lobed margins.
16a. Apical few nodes of stems covered with reddish brown scales; apical part of rachillae not shriveling, male and female flowers borne all along rachillae ..... 18. *Pinanga*
16b. Apical few nodes of stems green, without scales; apical part of rachillae with male flowers only, shriveling after flowers are shed ..... 17. *Areca*
15b. Leaf sheaths open, not forming a crownshaft; inflorescences borne among leaves, with several bracts (or bract scars); all pinnae with lobed or jagged margins.
17a. Leaves bipinnate; pinnae green abaxially ..... 13. *Caryota*
17b. Leaves pinnate; pinnae silvery gray abaxially.
18a. Pinnae strongly asymmetric, scarcely to deeply lobed along margins; sepals of male flowers joined at their bases into a cupule ..... 15. *Wallichia*
18b. Pinnae ± symmetric, notched but usually not lobed along margins; sepals of male flowers free, imbricate ..... 14. *Arenga*

1. SALACCA Reinwardt in Hornschuch, Syll. Pl. Nov. 2: 3. 1825.

蛇皮果属 she pi guo shu

Stems clustered, short and subterranean, mostly obscured by persistent leaf bases. Leaves 6–20 per stem, pinnate, sometimes undivided, spiny; leaf sheaths open, not forming crownshafts, sheaths and petioles elongate, covered with flattened spines often in

short rows or sometimes arranged in whorls completely encircling sheaths and petioles; pinnae sometimes silvery gray on abaxial surfaces, usually sigmoid, less often linear, regularly arranged and spreading in same plane or, more often, irregularly arranged and spreading in different planes, pinnae at apex usually joined in compound terminal pinna, sometimes this absent. Plants dioecious, most iteroparous, some semelparous. Inflorescences borne simultaneously in axils of reduced leaves on a short stem, this dying after flowering, in iteroparous plants inflorescences borne sequentially, emerging from a groove on outside of subtending leaf sheaths, inflorescences branched to 2 orders or sometimes spicate, covered with many persistent, sheathing bracts very short and spicate, short and branched, or very long, branched, and rooting at apex and forming new plants; in male inflorescences flowers borne in densely arranged pairs on short, thick rachillae; in female inflorescences flowers either solitary or borne in pairs with a sterile male flower, also densely arranged on rachillae. Fruits reddish brown, ovoid, obovoid, or pear-shaped, usually 3-seeded, covered with many overlapping scales, tips of scales turned up and giving fruit a spiny appearance; endosperm homogeneous; germination adjacent; eophylls bifid.

Twenty-one species: Borneo, China, NE India, Indonesia (Java, Sumatra), Malaysia (Peninsular), Myanmar, Philippines, Thailand; one species in China.

1. Salacca griffithii A. J. Henderson, Makinoa, n.s., 7: 2. 2008.

滇西蛇皮果 dian xi she pi guo

Stems clustered, short and subterranean. Leaf sheaths and petioles not distinct from one another, to 2.9 m, densely covered abaxially with small, distinct groups of 2–10 light brown spines to 3 cm; rachis to 4.5 m; pinnae 35–42 per side of rachis, lanceolate, regularly arranged and spreading in same plane; middle pinnae 83–125 cm, 4–7 cm in diam. at middle, with spines on margins and veins adaxially. Inflorescences borne together on short stems, their production ending life of stems; each inflorescence subtended by a much reduced leaf or leaf sheath; male inflorescences several per stem, each to 1 m, closely covered with overlapping bracts; rachillae 13–24 cm; flowers borne in dyads; stamens 6; female inflorescences several per stem, contracted, hidden among leaf bases; individual inflorescences 30–40 cm; rachillae 7–10, 8–12 cm, flowers borne in dyads of 1 sterile male and 1 female flower. Fruits obovoid, to 6 × 6–8 cm, 1–3-seeded, densely covered with triangular, flattened, spine-like scales.

Lowland rain forests or more often in disturbed areas; below 1000 m. Yunnan [Myanmar, Thailand].

Material of this species was treated in FRPS (13(1): 57. 1991) as *Salacca secunda* Griffith, which does not occur in China (see Henderson, Palms S. Asia, 164. 2009).

The leaves are commonly used for thatching.

2. PLECTOCOMIA Martius ex Schultes & J. H. Schultes, Syst. Veg. 7: 1333. 1830.

钩叶藤属 gou ye teng shu

Stems usually solitary, sometimes basal shoots developing into new plants after main stem dies. Leaves to 20 or more, pinnate, leaf sheaths without knees, flagella, and ocreas, usually covered with distinctive spines and brownish or whitish hairs; sheath spines arranged in oblique rows of closely spaced spines joined to one another at their bases, resembling combs; rachis terminating in a long cirrus, with grapnel-like spines; pinnae irregularly (rarely regularly) arranged along rachis, usually spreading in different planes, green but more often grayish on abaxial surfaces. Plants dioecious, semelparous. Inflorescences 2–20 at a time at stem apex, produced and flowering together over a short period of time (stem dying after fruiting), usually branched to 2 orders, borne among much-reduced leaves, covered with overlapping bracts; rachillae pendulous, covered with boat-shaped, persistent bracts obscuring flowers; male flowers very fragrant, borne in pairs, densely crowded along short rachillae; female flowers solitary, fewer per flowering branch. Fruits brownish, globose, usually 1-seeded, covered with overlapping scales, tips sometimes recurved, giving fruit a spiny or fuzzy appearance; endosperm homogeneous; germination adjacent; eophylls undivided.

Sixteen species: Bhutan, Borneo, Cambodia, China, India, Indonesia (Java, Sumatra), Laos, Malaysia (Peninsular), Myanmar, Nepal, Philippines, Thailand, Vietnam; three species (one endemic) in China.

1a. Pinnae green on abaxial surfaces, minutely spiny along margins, with elongate, threadlike apices, without prominent submarginal veins ..... 1. *P. himalayana*
1b. Pinnae grayish on abaxial surfaces, not or rarely spiny along margins, without elongate, threadlike apices, with prominent submarginal veins.
2a. Pinnae 10–30 cm ..... 2. *P. microstachys*
2b. Pinnae 20–55 cm ..... 3. *P. pierreana*

1. Plectocomia himalayana Griffith, Calcutta J. Nat. Hist. 5: 100. 1845.

高地钩叶藤 gao di gou ye teng

Plectocomia montana Griffith ex T. Anderson.

Stems clustered, to 20 m, 5–10 cm in diam. Leaf sheaths green, densely covered initially with whitish brown tomentum, with brown, needlelike spines to 2.5 cm borne in rows almost circling sheath; petioles 6–15 cm; rachis to 1.5 m; pinnae to 30 per side of rachis, lanceolate, with an elongate, filiform apex, without prominent mid- and submarginal veins, minutely spiny along margins, irregularly arranged in clusters of 2 or 3 pinnae, spreading in different planes, green abaxially; middle pinnae 25–50 cm, 2–4 cm wide at mid-point; cirri to 1 m. Inflorescences several per stem, branched to 2 orders, with several pen-

dulous primary branches, these 40–80 cm; rachillae subtended by prominent, ± rectangular bracts to 5.5 × 2 cm, densely tomentose adaxially with brown, feltlike scales; male flowers with 6 stamens; female flowers with stigmas to 1 mm. Fruits globose, 1–1.5 cm in diam.; fruit scales fringed, without bristly, erect apices.

Montane rain forests; 1500–2500 m. Yunnan [Bhutan, India, Laos, Nepal, Thailand].

2. Plectocomia microstachys Burret, Notizbl. Bot. Gart. Berlin-Dahlem 15: 731. 1942.

小钩叶藤 xiao gou ye teng

Stems clustered, to 15 m, to 2 cm in diam., thickening at apex to 6 cm in diam. on older plants. Leaf sheaths green, with whitish tomentum initially, with yellowish spines to 1 cm, solitary or usually borne in short rows; petioles absent or to 2 cm; rachis 1–1.5 m; pinnae 25–30 per side of rachis, broadly lanceolate, with prominent mid- and submarginal veins, margins without spines, irregularly arranged in clusters of 2 or 3 pinnae, spreading in different planes, gray abaxially and adaxially initially; middle pinnae 10–30 cm, 3–6.5 cm wide at mid-point; cirri to 1.5 m. Inflorescences several per stem, branched to 2 orders, with several pendulous primary branches, these 0.5–0.7 m; rachillae subtended by prominent, ± diamond-shaped bracts 2.2–2.5 × ca. 1.3 cm, glabrous abaxially; male flowers with 6 stamens; female flowers not seen. Fruits globose to ellipsoid, beaked, to 2 cm in diam.; fruit scales with apices minutely bristly initially, these wearing off with age.

● Lowland rain forests; 300–1000 m. Hainan.

There are no qualitative differences between this species and *Plectocomia pierreana*. However, given the few fragmentary collections in herbaria, it is perhaps better to retain it until more material becomes available.

3. Plectocomia pierreana Beccari, Webbia 3: 236. 1910.

钩叶藤 gou ye teng

Plectocomia barthiana Hodel; *P. cambodiana* Gagnepain; *P. kerriana* Beccari.

Stems clustered, to 35 m, 1–9 cm in diam. Leaf sheaths green with dark brown tomentum initially, with yellowish brown, needlelike spines to 2 cm, solitary or usually borne in short rows; petioles absent or 2–10 cm; rachis to 3 m; pinnae 25–40 per side of rachis, broadly lanceolate, with prominent mid- and submarginal veins, not spiny along margins, rarely with few small spines, irregularly arranged in clusters of 2 or 3 pinnae, spreading in different planes, gray abaxially; middle pinnae 20–55 cm, 1.5–5 cm wide at mid-point; cirri 0.5–1.5 m. Inflorescences to 15 per stem, branched to 2 orders, each inflorescence with to 6 pendulous primary branches, these 75–100 cm; rachillae subtended by prominent, ± rectangular bracts 2.5–5 × 2–2.5 cm, glabrous or with few whitish gray, appressed hairs adaxially; male flowers with 6 stamens; female flowers with stigmas to 6 mm. Fruits globose to ellipsoid, beaked, 2–2.3 cm in diam.; fruit scales fringed only, lacerate apices mostly breaking off except where protected by persistent perianth.

Lowland to montane rain forests; below 1200 m. Guangdong, Guangxi, Yunnan [Cambodia, Laos, Thailand, Vietnam].

Records of *Plectocomia assamica* Griffith from China (e.g., FRPS 13(1): 53. 1991) were probably based on a misidentification of this species.

3. CALAMUS Linnaeus, Sp. Pl. 1: 325. 1753.

省藤属 sheng teng shu

Cornera Furtado; *Palmijuncus* Kuntze; *Rotang* Adanson; *Rotanga* Boehmer; *Schizospatha* Furtado; *Zalaccella* Beccari.

Stems clustered or less often solitary, mostly slender and climbing, occasionally non-climbing and then either short and subterranean or free standing. Leaves 10–60, pinnate, spiny; sheaths closed in climbing stems, open in non-climbers, variously hairy and spiny, hairs of young sheaths soon wearing off; sheath spines scattered or densely arranged (rarely absent), or arranged in rows, occasionally hairy on margins, variously shaped and colored, sometimes arranged in overlapping, interlocking rings and forming chambers; sheath apices usually extended above point of insertion of petiole into an inconspicuous or prominent ocrea; knees present in climbing stems; flagella present in climbers, whiplike and armed with small, grapnel-like spines; cirri present in few species (and then flagella absent, and vice versa); pinnae variously arranged and shaped, occasionally whitish or gray on abaxial surfaces. Plants dioecious. Inflorescences usually elongate, branched to 3 orders, male inflorescences more branched than female ones; branches and rachillae covered with overlapping bracts with clawed spines on outer surfaces in climbers; male flowers borne along opposite sides of rachillae; female flowers borne in pairs with a sterile male flower, along opposite sides of rachillae. Fruits mostly small, variously shaped and colored, usually 1-seeded, sometimes pedicellate, always covered with overlapping scales, these sometimes with a groove down middle; endosperm homogeneous or ruminate; germination adjacent; eophylls bifid or pinnate.

About 385 species: from W Africa, India, and Sri Lanka through S and SE Asia to Australia and the Pacific islands; 28 species (15 endemic) in China.

Calamus palustris Griffith (Calcutta J. Nat. Hist. 5: 60. 1845) has been reported from China, but no reliable fertile material has been seen (Henderson, Palms S. Asia, 80. 2009). *Calamus latifolius* Roxburgh (Hort. Bengal. 73. 1814) has been recorded from China as well (e.g., in Govaerts et al. 2010. World Checklist of Arecaceae. The Board of Trustees of the Royal Botanic Gardens, Kew. Published on the Internet; http://www.kew.org/wcsp/ accessed 6 May 2010); however, the species group to which it belongs is complex and not well understood, so the record is thought to be best excluded.

1a. Stems non-climbing, free standing or short and subterranean; knees, flagella, and cirri usually absent; inflorescence bracts without clawed spines.

2a. Pinnae whitish abaxially.
3a. Pinnae 11–15 per side of rachis, lanceolate to broadly lanceolate, irregularly arranged in distant clusters ..... 1. *C. oxycarpus*
3b. Pinnae 30–45 per side of rachis, linear, regularly arranged but with gaps ..... 2. *C. macrorrhynchus*
2b. Pinnae green abaxially.
4a. Petioles and rachis with whorls of yellow spines ..... 3. *C. erectus*
4b. Petioles and rachis without whorls of yellow spines.
5a. Pinnae regularly arranged and spreading in same plane ..... 4. *C. dianbaiensis*
5b. Pinnae irregularly arranged in remote clusters and spreading in different planes ..... 5. *C. thysanolepis*
1b. Stems climbing; knees, flagella, and/or cirri usually present; inflorescence bracts with clawed spines.
6a. Flagella absent; cirri present.
7a. Pinnae 3–10 per side of rachis.
8a. Pinnae to 5 per side of rachis, regularly arranged; fruits globose to ellipsoid, to 1 × 0.8 cm, not stalked, scales not grooved ..... 6. *C. compsostachys*
8b. Pinnae to 10 per side of rachis, clustered in alternate pairs; fruits ovoid to ellipsoid, to 1.8 × 1.2 cm, stalked, with grooved scales ..... 7. *C. austroguangxiensis*
7b. Pinnae 14–40 per side of rachis.
9a. Stems solitary ..... 8. *C. siphonospathus*
9b. Stems clustered.
10a. Pinnae 18 or 19 per side of rachis; Taiwan ..... 9. *C. formosanus*
10b. Pinnae 14–40 per side of rachis; Hainan, Yunnan.
11a. Pinnae 36–40 per side of rachis; Yunnan ..... 10. *C. nambariensis*
11b. Pinnae 14–22 per side of rachis; Hainan.
12a. Pinnae clustered in alternate groups of 2 or 3 ..... 11. *C. egregius*
12b. Pinnae regularly arranged ..... 12. *C. simplicifolius*
6b. Flagella present; cirri absent.
13a. Pinnae 3–16 per side of rachis, usually irregularly arranged, apical ones inserted close together in a fan shape, apical pair free or joined at their bases.
14a. Pinnae whitish abaxially ..... 13. *C. albidus*
14b. Pinnae green abaxially.
15a. Stems to 5 cm in diam.; petioles very short or absent; ocreas densely bristly; pinnae broadly lanceolate ..... 14. *C. acanthospathus*
15b. Stems to 2 cm in diam.; petioles usually present and well developed; ocreas not or rarely densely bristly; pinnae linear to lanceolate, not broadly lanceolate.
16a. Pinnae regularly arranged but with wide gaps between groups, shiny green, curled over at tips.
17a. Fruits to 2 × 1 cm ..... 15. *C. gracilis*
17b. Fruits to 2.7 × 2 cm ..... 16. *C. hainanensis*
16b. Pinnae regularly arranged or clustered, dull green, not curled over at tips.
18a. Leaf sheath spines subulate, not longer at sheath apices (rarely spines absent) ..... 17. *C. tetradactylus*
18b. Leaf sheath spines needlelike, longer at sheath apices ..... 18. *C. tetradactyloides*
13b. Pinnae 27–70 per side of rachis, apical ones not inserted close together in a fan shape, apical pair not joined at their bases.
19a. Leaf sheath spines arranged in rows.
20a. Leaf sheaths with needlelike spines to 2.5 cm, not longer at sheath apices ..... 19. *C. beccarii*
20b. Leaf sheaths with flattened spines to 4(–10 at sheath apices) cm ..... 20. *C. rhabdocladus*
19b. Leaf sheath spines not in rows.
21a. Pinnae strongly clustered, spreading in different planes.
22a. Fruits black ..... 21. *C. melanochrous*
22b. Fruits brown, whitish, or yellowish.
23a. Ocreas short; knees present; fruits to 1 cm in diam. ..... 22. *C. viminalis*
23b. Ocreas to 35 cm, soon tattered; knees absent; fruits to 2.5 cm in diam. ..... 23. *C. wuliangshanensis*
21b. Pinnae not strongly clustered, spreading in same plane.
24a. Leaf sheath spines upward pointing; ocreas conspicuous, tattering and soon falling; inflorescence bracts not sheathing, split open and flat, brown ..... 24. *C. guruba*
24b. Leaf sheath spines not upward pointing; ocreas short, inconspicuous; inflorescence bracts not split open and flat, not brown.

25a. Leaf sheath spines densely arranged, to 5.5(–10 at sheath apices) cm, interspersed with shorter spines ..... 25. *C. flagellum*
25b. Leaf sheath spines scattered, to 2.5 cm (not longer or to 7 cm at sheath apices), usually not interspersed with shorter spines.
26a. Ocreas densely bristly; leaf sheath spines not longer at sheath apices; inflorescence bracts not tattering ..... 26. *C. walkeri*
26b. Ocreas not densely bristly; leaf sheath spines sometimes longer at sheath apices; inflorescence bracts tattering.
27a. Leaf sheaths with spines to 2 cm (sometimes to 7 cm at sheath apices) ..... 27. *C. henryanus*
27b. Leaf sheaths with spines to 1.5 cm (sometimes to 3 cm at sheath apices) ..... 28. *C. multispicatus*

1. Calamus oxycarpus Beccari, Ann. Roy. Bot. Gard. (Calcutta) 11(1) (Suppl.): 138. 1913.

尖果省藤 jian guo sheng teng

Stems clustered, not climbing, to 3 m tall, to 2 cm in diam. Leaf sheaths not seen; ocreas not seen; knees absent; flagella absent; rachis to 50 cm with to 15 lanceolate to broadly lanceolate pinnae per side, these irregularly arranged in distant clusters, apical few pinnae in a fan shape, apical pair free; middle pinnae 41–42 cm, 3–4 cm wide at mid-point, margins minutely bristly, densely white waxy abaxially and with many minute bristles; cirri absent. Inflorescences not seen in their entirety, not flagellate; inflorescence bracts splitting and tattering longitudinally and disintegrating. Fruits brownish, pear-shaped with a pronounced rostrum, to 3 × 1.7 cm, scales with densely brown tomentose margins.

● Ravines in dense semievergreen forests; 800–1100 m. Guangxi, Guizhou.

2. Calamus macrorrhynchus Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 590. 1937.

大喙省藤 da hui sheng teng

Stems clustered, non-climbing, to 3 m, to 4 cm in diam. Leaf sheaths with brown hairs, densely covered with short rows of yellowish, flattened spines to 2.5 cm; ocreas to 15 cm, spiny as sheath, fibrous, disintegrating; knees absent; flagella absent; rachis to 1 m with 30–45 linear pinnae per side, these regularly arranged but sometimes with gaps; middle pinnae 20–28 cm, 1–1.7 cm wide at mid-point, margins not or scarcely bristly, densely white waxy abaxially and with many minute bristles; cirri absent. Inflorescences to 1 m, erect, not flagellate; inflorescence bracts splitting and tattering longitudinally and eventually disintegrating. Fruits brownish, pear-shaped, with a pronounced rostrum, to 2.7 × 1.5 cm, scales with densely brown tomentose margins.

● Lowland rain forests or bamboo forests in hilly places usually near streams; 400–1400 m. Guangdong, Guangxi.

3. Calamus erectus Roxburgh, Fl. Ind., ed. 1832, 3: 744. 1832.

直立省藤 zhi li sheng teng

Calamus collinus Griffith; *C. erectus* var. *birmanicus* Beccari; *C. erectus* var. *collinus* (Griffith) Beccari; *C. erectus* var. *macrocarpus* (Griffith) Beccari; *C. erectus* var. *schizospathus* (Griffith) Beccari; *C. macrocarpus* Griffith; *C. schizospathus* Griffith; *Palmijuncus collinus* (Griffith) Kuntze; *P. erectus* (Roxburgh) Kuntze; *P. macrocarpus* (Griffith) Kuntze; *P. schizospathus* (Griffith) Kuntze.

Stems clustered, non-climbing, free standing or sometimes leaning, to 6 m, to 5 cm in diam. Leaf sheaths dark green with dark brown hairs, with short rows of brown, flattened spines to 3.5 cm; ocreas present, with rows of short spines, split into 2, soon falling; knees absent; flagella absent; petioles and rachis with whorls of yellow spines; rachis to 3 m with up to 40 lanceolate pinnae per side, these regularly arranged; middle pinnae 60–80 cm, 3.5–5 cm wide at mid-point, adaxial and abaxial veins and margins bristly; cirri absent. Inflorescences to 2 m, not flagellate; inflorescence bracts tubular, tattering at apices. Fruits greenish- or reddish brown, ellipsoid, 3–5 × 2–2.5 cm, scales grooved.

Lowland or montane rain forests or drier forests usually on steep slopes; below 1400 m. Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Thailand].

This species provides a short, thick, non-flexible cane used in construction and furniture-making.

4. Calamus dianbaiensis C. F. Wei, Guihaia 6: 24. 1986.

电白省藤 dian bai sheng teng

Calamus guangxiensis C. F. Wei; *C. yuangchunensis* C. F. Wei.

Stems clustered, non-climbing, free standing or creeping, to 4 m, to 7 cm in diam. Leaf sheaths yellowish brown with brown hairs, with short, oblique rows of yellowish, flattened spines to 3 cm; ocreas present, to 20 cm, fibrous; knees absent; flagella absent; rachis to 3 m with up to 30 linear-lanceolate pinnae per side, these regularly arranged; middle pinnae 50–60 cm, 2.5–4 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 1 m, not flagellate; inflorescence bracts split open and tattering at apices. Fruits brownish, globose to ellipsoid, to 2 × 1.5 cm, scales grooved.

● Lowland rain forests. Guangdong, Guangxi.

5. Calamus thysanolepis Hance, J. Bot. 12: 265. 1874.

毛鳞省藤 mao lin sheng teng

Calamus hoplites Dunn; *C. scutellaris* Beccari; *C. thysanolepis* var. *polylepis* C. F. Wei; *Palmijuncus thysanolepis* (Hance) Kuntze.

Stems clustered, non-climbing, short and subterranean or free standing, to 5 m, to 5 cm in diam. Leaf sheaths greenish brown with brown hairs, with densely arranged, black, needle-

like spines to 2 cm; ocreas to 40 cm, spiny, fibrous and soon disintegrating; knees absent; flagella absent; rachis to 1.5 m with 28–49 lanceolate pinnae per side, these strongly clustered and spreading in different planes; middle pinnae 30–37 cm, 1.5–2 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 1 m, erect, not flagellate; inflorescence bracts split open and tattering. Fruits reddish brown, ovoid or ellipsoid, to 1.5 × 1 cm.

Lowland rain forests; below 800 m. Fujian, Guangdong, Guangxi, Hunan, Jiangxi, Zhejiang [Vietnam].

The fruits are eaten.

6. Calamus compsostachys Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 598. 1937.

短轴省藤 duan zhou sheng teng

Stems clustered, climbing, to 10 m, to 1 cm in diam. Leaf sheaths greenish brown, with scattered, dark brown, needlelike spines to 0.5 cm; ocreas present; knees present; flagella absent; rachis to 0.7 m with 5–10 broadly lanceolate pinnae per side, these remotely clustered, apical pair free at base; middle pinnae to 25 cm, 3–3.5 cm wide at mid-point, adaxial veins and margins bristly; cirri to 0.5 m. Inflorescences to 0.6 m, not flagellate; inflorescence bracts tubular. Fruits yellowish, globose to ellipsoid, to 0.8 cm in diam.

● Lowland rain forests. Guangdong, Guangxi.

7. Calamus austroguangxiensis S. J. Pei & San Y. Chen, Acta Phytotax. Sin. 27: 144. 1989.

桂南省藤 gui nan sheng teng

Calamus distichus Ridley var. *shangsiensis* S. J. Pei & San Y. Chen.

Stems clustered, climbing, to 10 m, to 1.5 cm in diam. Leaf sheaths green with brown hairs, with scattered, yellowish, flattened spines to 1.5 cm; ocreas present, short, spiny; knees present; flagella absent; rachis to 0.9 m with up to 10 broadly lanceolate pinnae per side, these clustered, alternately paired, apical pair not joined at their bases; middle pinnae 12–16.5 cm, 3–3.5 cm wide at mid-point, veins not bristly, margins minutely bristly; cirri to 1 m. Inflorescences to 1 m, not flagellate; inflorescence bracts tubular. Fruits yellowish brown, ovoid to ellipsoid, to 1.8 × 1.2 cm, stalked, scales grooved.

● Lowland rain forests. Guangdong, Guangxi.

The stems are used to make furniture.

8. Calamus siphonospathus Martius, Hist. Nat. Palm. 3: 342. 1853.

管苞省藤 guan bao sheng teng

Calamus siphonospathus var. *sublaevis* Beccari.

Stems solitary, climbing, to 30 m, 2.5–5 cm in diam. Leaf sheaths yellowish brown, sparsely covered with needlelike, yellowish spines to 1 cm; ocreas membranous; knees obscure; flagella absent; rachis to 2 m with 25–50 linear pinnae per side, these regularly arranged and closely spaced; middle pinnae to 32 cm, to 2 cm wide at mid-point, adaxial veins and margins bristly; cirri to 1 m. Inflorescence to 0.6 m, not flagellate; inflorescence bracts open and swollen near apex. Fruits yellowish brown, ellipsoid, to 0.6 × 0.4 cm.

Scrub forests at low elevations. Taiwan (Lan Yu) [Indonesia, Philippines].

9. Calamus formosanus Beccari, Rec. Bot. Surv. India 2: 211. 1902.

台湾省藤 tai wan sheng teng

Calamus orientalis C. E. Chang; *C. quinquesetinervius* Burret.

Stems clustered, climbing, to 20 m, 3–5 cm in diam. Leaf sheaths yellowish brown, densely covered with flattened, yellowish, upward-pointing spines to 2 cm; ocreas short or absent; knees prominent, swollen, spiny; flagella absent; petioles short or absent; rachis to 2 m with 18 or 19 broadly lanceolate pinnae per side, these irregularly arranged (regularly arranged on young plants), distantly spaced; middle pinnae 30–45 cm, 3–5 cm wide at mid-point, adaxial veins and margins bristly; cirri to 1.5 m. Inflorescences to 1.2 m, flagellate; inflorescence bracts tightly sheathing. Fruits yellowish brown, pedicellate, ellipsoid, to 2 × 1 cm.

● Lowland rain forests; below 1000 m. Taiwan.

10. Calamus nambariensis Beccari, Ann. Roy. Bot. Gard. (Calcutta) 11(1): 433. 1908.

南巴省藤 nan ba sheng teng

Calamus banlingensis Cheng Y. Yang, Zheng H. Yang & J. Lu; *C. doriaei* Beccari; *C. giganteus* Beccari var. *robustus* S. J. Pei & San Y. Chen; *C. inermis* T. Anderson; *C. inermis* var. *menghaiensis* San Y. Chen, S. J. Pei & K. L. Wang; *C. khasianus* Beccari; *C. multinervis* Beccari var. *menglaensis* San Y. Chen, S. J. Pei & K. L. Wang; *C. nambariensis* var. *alpinus* S. J. Pei & San Y. Chen; *C. nambariensis* var. *furfuraceus* S. J. Pei & San Y. Chen; *C. nambariensis* var. *menglongensis* S. J. Pei & San Y. Chen; *C. nambariensis* var. *xishuangbannaensis* S. J. Pei & San Y. Chen; *C. nambariensis* var. *yingjiangensis* S. J. Pei & San Y. Chen; *C. obovoideus* S. J. Pei & San Y. Chen; *C. palustris* Griffith var. *longistachys* S. J. Pei & San Y. Chen; *C. platyacanthoides* Merrill; *C. platyacanthus* Warburg; *C. platyacanthus* var. *longicarpus* San Y. Chen & K. L. Wang; *C. platyacanthus* var. *mediostachys* S. J. Pei & San Y. Chen; *C. polydesmus* Beccari; *C. wailong* S. J. Pei & San Y. Chen; *Palmijuncus inermis* (T. Anderson) Kuntze.

Stems clustered, climbing, to 30 m, to 6 cm in diam. Leaf sheaths green with light brown hairs, with scattered to densely arranged, yellowish brown, triangular, flattened, downward-pointing spines to 3.5(–9) cm, often interspersed among shorter spines, or sometimes spines absent; ocreas present; knees prominent; flagella absent; rachis to 4 m with 36–40 lanceolate pinnae per side, these clustered or regularly arranged; middle pinnae 40–55 cm, 2.5–7 cm wide at mid-point, margins bristly; cirri to 2.5 m. Inflorescences to 2 m, not flagellate; inflorescence bracts tubular. Fruits whitish to yellowish brown, globose to ovoid or ellipsoid, to 2.4(–3.4) × 2.5 cm, stalked, scales grooved.

Lowland or montane rain forests; below 2000 m. Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam].

This species provides a high-quality cane used in furniture-making and binding. It has been introduced into other areas for trial plantings.

Calamus nambariensis is very variable and difficult taxonomically, and it represents a species complex. It is morphologically similar to *C. palustris*, which does not occur in China, and the two can be distinguished reliably only by the female inflorescences and fruits. *Calamus nambariensis* has been treated in local floras as consisting of several distinct species. The characters used to separate these species are based mostly on leaf sheath spines or their absence, leaflet arrangement, and fruit size. Here, only one species is recognized, although many local forms are likely to be encountered, and the complex is greatly in need of a modern revision. There are also nomenclatural problems. The widely accepted name used here, *C. nambariensis*, is not the oldest name, which is *C. inermis* T. Anderson (J. Linn. Soc., Bot. 11: 11. 1869). However, Evans et al. (Kew Bull. 57: 53–54. 2002) are followed here, and this name is used pending a revision of the whole complex. The FRPS record (13(1): 98. 1991) of *C. palustris* var. *cochinchinensis* Beccari is probably based on a misidentification of material belonging to this complex.

11. Calamus egregius Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 599. 1937.

短叶省藤 duan ye sheng teng

Stems clustered, climbing, to 50 m, 3–5 cm in diam. Leaf sheaths yellowish green with brown hairs, with scattered, brownish, flattened spines to 2 cm; ocreas to 10 cm, disintegrating; knees conspicuous; flagella absent; rachis to 1.5 m with to 20 lanceolate pinnae per side, these clustered in alternate groups of 2 or 3; middle pinnae 10–17 cm, 2–3 cm wide at mid-point, margins bristly; cirri to 1 m. Inflorescences to 1 m, not flagellate; inflorescence bracts tubular. Fruits brown, ovoid, to 2 × 1.6 cm, stalked, scales grooved.

● Lowland rain forests; below 1000 m. Hainan.

This species provides a high-quality cane for binding and weaving. The palm hearts are eaten.

12. Calamus simplicifolius C. F. Wei, Guihaia 6: 36. 1986.

单叶省藤 dan ye sheng teng

Stems clustered, climbing, to 50 m, 3–6 cm in diam. Leaf sheaths green with brown hairs, with densely arranged, yellowish, flattened, triangular, downward-pointing spines to 4 cm; ocreas absent; knees present; flagella absent; rachis to 2 m with 14–22 broadly lanceolate pinnae per side, these regularly arranged, tending to be irregular on younger leaves; middle pinnae 36–40 cm, 2–5 cm wide at mid-point, margins bristly; cirri to 1.5 m. Inflorescences to 1 m, not flagellate; inflorescence bracts tubular. Fruits yellowish, globose, to 3 × 2.3 cm.

● Lowland rain forests. Hainan.

This species provides a high-quality cane used in furniture-making and binding. It has been introduced into other areas of China for trial plantings.

13. Calamus albidus L. X. Guo & A. J. Henderson, Brittonia 59: 346. 2007.

狭叶省藤 xia ye sheng teng

Calamus oxycarpus Beccari var. *angustifolius* San Y. Chen & K. L. Wang, Acta Bot. Yunnan. 24: 201. 2002.

Stems clustered, climbing, to 6 m, to 3 cm in diam. Leaf sheaths with brown hairs, densely covered with gray or black, flattened spines to 2 cm; ocreas to 10 cm, spiny as sheath, fibrous, disintegrating; knees absent; flagella present; petioles 20–58 cm; rachis to 50 cm with 15 or 16 linear to lanceolate pinnae per side, these irregularly arranged in distant clusters of 2 or 3 pinnae, apical few pinnae in a fan shape, apical pair free; middle pinnae 17–27 cm, 1.5–2 cm wide at mid-point, margins minutely bristly, densely white waxy abaxially and with many minute spines; cirri absent. Inflorescences 1–2 m, flagellate; inflorescence bracts tubular. Fruits brownish, pear-shaped to ovoid, to 2.5 × 1.5 cm, scales with densely brown tomentose margins.

● Broad-leaved forests; 1000–1900 m. Yunnan.

A new epithet had to be given to this taxon when it was raised to species rank because of the existence of the earlier name *Calamus angustifolius* Griffith.

14. Calamus acanthospathus Griffith, Calcutta J. Nat. Hist. 5: 39. 1845.

云南省藤 yun nan sheng teng

Calamus feanus Beccari; *C. feanus* var. *medogensis* S. J. Pei & San Y. Chen; *C. montanus* T. Anderson; *C. yunnanensis* Govaerts; *C. yunnanensis* var. *densiflorus* S. J. Pei & San Y. Chen; *C. yunnanensis* var. *intermedius* S. J. Pei & San Y. Chen; *Palmijuncus acanthospathus* (Griffith) Kuntze; *P. montanus* (T. Anderson) Kuntze.

Stems solitary or weakly clustered, climbing, to 30 m, 1.5–5 cm in diam. Leaf sheaths green with brown hairs, with sparsely to densely arranged, sometimes in short rows, brown, flattened spines to 1 cm, these with sinuous margins, densely hairy initially; ocreas present, densely bristly; knees present; flagella present, to 5.6 m; petioles very short or absent; rachis to 1.4 m with 8–15 broadly lanceolate pinnae per side, these regularly arranged, sometimes somewhat irregularly, especially near base of leaf; middle pinnae 18–30 cm, 3.5–7 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 3 m, flagellate; inflorescence bracts tubular; rachillae short and strongly recurved. Fruits yellowish brown, ovoid to ellipsoid, to 2.5 × 1.5 cm, scales grooved.

Lowland or montane rain forests; 800–2400 m. Xizang, Yunnan [Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam].

This species provides a cane used in basketry and furniture-making.

15. Calamus gracilis Roxburgh, Fl. Ind., ed. 1832, 3: 781. 1832.

细茎省藤 xi jing sheng teng

Palmijuncus gracilis (Roxburgh) Kuntze.

Stems clustered, climbing, to 30 m, to 2 cm in diam. Leaf sheaths green with mottled, dark brown and whitish hairs, without spines or with scattered, black-tipped, conic-based spines to 0.5 cm; ocreas small; knees present; flagella present; petioles

very short; rachis to 0.7 m with 8–15 linear or lanceolate pinnae per side, these regularly arranged but with wide gaps between groups, shiny green, curled over at tips, apical ones inserted close together in a fan shape, apical pair not joined at their bases; middle pinnae 25–35 cm, 1.5–2.5 cm wide at mid-point, adaxial and abaxial veins and margins bristly; cirri absent. Inflorescences to 0.7 m, flagellate; inflorescence bracts tubular. Fruits yellowish or orange, ovoid to ellipsoid, to 2 × 1 cm, stalked, scales grooved.

Lowland or montane rain forests; 800–1500 m. Yunnan [Bangladesh, India, Laos, Myanmar, Vietnam].

16. Calamus hainanensis C. C. Chang & L. G. Xu ex R. H. Miao, Acta Sci. Nat. Univ. Sunyatseni 1981(3): 116. 1981.

海南省藤 hai nan sheng teng

Stems clustered, climbing, to 15 m, to 1 cm in diam. Leaf sheaths green with brown and whitish hairs, without spines or with scattered, conic-based spines to 0.5 cm; ocreas small; knees inconspicuous or absent; flagella present; petioles very short; rachis to 0.4 m with 12–14 linear pinnae per side, these regularly arranged but with wide gaps between groups, shiny green, curled over at tips, apical ones inserted close together in a fan shape, apical pair not joined at their bases; middle pinnae 9–15 cm, 0.7–1 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 0.7 m, flagellate; inflorescence bracts tubular. Fruits yellowish or orange, ellipsoid, to 2.7 × 2 cm, stalked, scales grooved.

● Lowland rain forests; below 1000 m. Hainan.

The validity of this name has been challenged on the basis that no type was designated; however, the protologue listed only a single collection, which thus must be the type collection, and was published before 1990 when the ICBN required the explicit designation of a holotype. Thus, the name is valid.

17. Calamus tetradactylus Hance, J. Bot. 13: 289. 1875.

白藤 bai teng

Calamus bonianus Beccari; *C. cambojensis* Beccari; *C. tetradactylus* var. *bonianus* (Beccari) Conrard; *Palmijuncus tetradactylus* (Hance) Kuntze.

Stems clustered, climbing, to 6 m, to 1.8 cm in diam. Leaf sheaths green, without hairs, with scattered, yellowish brown, triangular spines to 1.5 cm, or spines absent; ocreas prominent, not spiny; knees present; flagella to 1 m; petiole short or absent; rachis to 0.5 m with to 10 clustered, lanceolate pinnae per side, apical few close together in a fan shape, apical pair joined at their bases, margins often with a thin, brown line of hairs; middle pinnae 11–28 cm, 2–6.5 cm wide at mid-point, margins bristly; cirri absent. Inflorescences to 1.8 m, usually flagellate; inflorescence bracts tubular, briefly split at apex. Fruits yellowish, globose, to 0.9 cm in diam., stalked.

Lowland rain forests or scrub forests, or sometimes around villages; below 1000 m. Fujian, Guangdong, Guangxi, Hainan [Cambodia, Laos, Thailand, Vietnam].

18. Calamus tetradactyloides Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 596. 1937.

多刺鸡藤 duo ci ji teng

Calamus pulchellus Burret.

Stems clustered, climbing, to 5 m, to 1 cm in diam. Leaf sheaths greenish brown with brown hairs, with densely arranged, brown, needlelike spines to 1(–2 at sheath apex) cm; ocreas short and densely bristly; knees present; flagella to 1 m; rachis to 0.5 m with 4 or 5(–12) linear-lanceolate to broadly lanceolate pinnae per side; middle pinnae 16–30 cm, 1.5–4 cm wide at mid-point, not bristly; cirri absent. Inflorescences to 0.7 m, flagellate; inflorescence bracts tubular. Fruits whitish, subglobose, to 1.5 × 1 cm.

● Lowland rain forests. Hainan.

19. Calamus beccarii A. J. Henderson, Taiwania 50: 222. 2005.

土藤 tu teng

Stems clustered, climbing, to 50 m, to 4 cm in diam. Leaf sheaths brown, covered with black, needlelike, horizontally spreading spines to 2.5 cm, these arranged in short rows, interspersed with shorter spines to 0.5 cm; ocreas present, densely spiny; knees obscure; flagella present, to 2.5 m; rachis to 0.8 m with 30–62 linear pinnae per side, these regularly arranged and closely spaced; middle pinnae to 40 cm, to 1.5 cm wide at mid-point, adaxial and abaxial veins minutely bristly; cirri absent. Inflorescences to 3 m, flagellate; inflorescence bracts tubular. Fruits yellowish brown, globose-ellipsoid, to 2 (including a short beak) × 1.2 cm, scales fringed.

● Lowland rain forests. Taiwan.

20. Calamus rhabdocladus Burret, Notizbl. Bot. Gart. Berlin-Dahlem 10: 884. 1930.

杖藤 zhang teng

Calamus pseudoscutellaris Conrard; *C. pseudoscutellaris* var. *cylindrocarpus* Conrard; *C. rhabdocladus* var. *globulosus* S. J. Pei & San Y. Chen.

Stems clustered, climbing (sometimes only shortly climbing or erect), to 40 m, 4–6 cm in diam. Leaf sheaths green with reddish brown hairs, with densely arranged, oblique rows of glossy, black or brown, flattened spines to 4(–10 at sheath apices) cm; ocreas present; knees inconspicuous or absent; flagella to 5 m; rachis to 1.5 m with to 60 linear pinnae per side, these regularly arranged (young plants regularly arranged but with gaps); middle pinnae 30–50 cm, 1.8–2 cm wide at mid-point, adaxial and abaxial veins and margins prominently bristly; cirri absent. Inflorescences to 8 m, flagellate; inflorescence bracts tubular. Fruits reddish or yellowish, globose, ellipsoid, or ovoid, to 1.4 × 0.8 cm.

Lowland or montane rain forests; below 1600 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Yunnan [Laos, Vietnam].

This species provides a cane of medium quality for furniture-making, and the palm hearts and fruits are eaten.

21. Calamus melanochrous Burret, Notizbl. Bot. Gart. Berlin-Dahlem 11: 208. 1931.

瑶山省藤 yao shan sheng teng

Stems not known. Leaf sheaths not known; rachis with to 36 linear pinnae per side, these clustered and spreading in different planes; cirri absent. Inflorescence bracts tattering at base. Fruits black, ovoid, to 2.4 × 1.8 cm.

● Lowland rain forests. Guangxi.

22. Calamus viminalis Willdenow, Sp. Pl. 2: 203. 1799.

柳条省藤 liu tiao sheng teng

Calamus extensus Martius; *C. fasciculatus* Roxburgh; *C. litoralis* Blume; *C. pseudorotang* Martius ex Kunth; *C. viminalis* subvar. *andamanicus* Beccari; *C. viminalis* subvar. *bengalensis* Beccari; *C. viminalis* subvar. *cochinchinensis* Beccari; *C. viminalis* var. *fasciculatus* (Roxburgh) Beccari; *C. viminalis* subvar. *pinangianus* Beccari; *Palmijuncus fasciculatus* (Roxburgh) Kuntze; *P. litoralis* (Blume) Kuntze; *P. pseudorotang* (Martius ex Kunth) Kuntze; *P. viminalis* (Willdenow) Kuntze; *Rotang viminalis* (Willdenow) Baillon.

Stems clustered, climbing or often forming thickets, to 35 m, to 4 cm in diam. Leaf sheaths green with dense covering of grayish or brownish hairs, with scattered, greenish or brownish, triangular, flattened spines to 4.5 cm; ocreas present; knees present; flagella to 5 m; rachis to 1.3 m with 32–55 lanceolate pinnae per side, these gray-green, distinctly clustered and spreading in different planes, apical ones usually smaller than others; middle pinnae 15–35 cm, 1–1.5 cm wide at mid-point, adaxial and abaxial main vein prominently bristly; cirri absent. Inflorescences to 3 m, flagellate; inflorescence bracts tubular. Fruits whitish or yellowish, globose, to 1 cm in diam., sometimes borne in pairs.

Lowland rain forests or deciduous forests, persisting in cleared areas and often present near villages, sometimes planted; below 600 m. Yunnan [Bangladesh, Cambodia, India, Indonesia (Bali, Java, Sumatra), Laos, Malaysia (Peninsular), Myanmar, Thailand, Vietnam].

This species provides a widely used cane for basketry and furniture-making, and the palm heart and fruits are eaten.

23. Calamus wuliangshanensis San Y. Chen, K. L. Wang & S. J. Pei, Acta Bot. Yunnan. 24: 199. 2002.

无量山省藤 wu liang shan sheng teng

Calamus wuliangshanensis var. *sphaerocarpus* San Y. Chen & K. L. Wang.

Stems clustered, climbing, to 15 m, to 3.5 cm in diam. Leaf sheaths gray or brown, with gray hairs, with scattered or densely arranged, yellowish brown, flattened spines to 2.5 cm; ocreas present, to 35 cm, soon tattering; knees absent; flagella present; rachis to 2.8 m with 45–70 linear-lanceolate pinnae per side, these in distant clusters and spreading in different planes; middle pinnae to 55 cm, to 1.5 cm wide at mid-point, spiny along margins; cirri absent. Inflorescences to 5 m, flagellate; inflorescence bracts tubular. Fruits brownish, ellipsoid to globose, to 2.7 × 2.5 cm, scale margins densely brown tomentose.

● Montane rain forests; 2000–2400 m. Yunnan.

24. Calamus guruba Buchanan-Hamilton ex Martius, Hist. Nat. Palm. 3: 211 [ed. 2]. 1845.

褐鞘省藤 he qiao sheng teng

Calamus guruba var. *ellipsoideus* San Y. Chen & K. L. Wang; *C. mastersianus* Griffith; *C. multirameus* Ridley; *C. nitidus* Martius; *Daemonorops guruba* (Buchanan-Hamilton ex Martius) Martius; *D. guruba* var. *hamiltoniana* Martius; *D. guruba* var. *mastersiana* (Griffith) Martius; *Palmijuncus guruba* (Buchanan-Hamilton ex Martius) Kuntze; *P. nitidus* (Martius) Kuntze.

Stems clustered, climbing or forming thickets, to 20 m, to 3 cm in diam. Leaf sheaths dull green with rusty brown or light brown hairs, with scattered to densely arranged, dark brown, flattened, upward-pointing spines to 3.5 cm (sometimes to 10 cm at sheath apices); ocreas conspicuous, tattering and soon falling; knees present; flagella to 3 m; rachis to 1.3 m with 30–65 linear-lanceolate pinnae per side, these regularly arranged, apical ones smaller than others; middle pinnae 25–45 cm, 1.7–2.2 cm wide at mid-point, adaxial and abaxial veins bristly; cirri absent. Inflorescences to 3 m, flagellate; inflorescence bracts not sheathing, split open and flat, brown. Fruits yellowish or brown, globose, to 0.8 cm in diam.

Lowland or montane rain forests, scrub forests, dry forests, disturbed areas, especially roadsides; below 1200 m. Yunnan [Bangladesh, Bhutan, Cambodia, India, Laos, Malaysia (Peninsular), Myanmar, Thailand].

25. Calamus flagellum Griffith ex Martius, Hist. Nat. Palm. 3: 333. 1853.

长鞭藤 chang bian teng

Calamus flagellum var. *furvifurfuraceus* S. J. Pei & San Y. Chen; *C. flagellum* var. *karinensis* Beccari; *C. karinensis* (Beccari) S. J. Pei & San Y. Chen; *C. polygamus* Roxburgh; *Palmijuncus flagellum* (Griffith ex Martius) Kuntze; *P. polygamus* (Roxburgh) Kuntze.

Stems clustered, climbing, to 30 m, 4.5–5 cm in diam. Leaf sheaths greenish yellow with dark brown hairs, with densely arranged, black, brownish, or yellowish, flattened spines to 5.5(–10 at sheath apices) cm, interspersed with shorter spines; ocreas fibrous, soon falling; knees inconspicuous; flagella to 7 m; rachis to 3 m with 27–35 linear-lanceolate pinnae per side, these regularly or sometimes irregularly arranged; middle pinnae 60–70 cm, 3.5–4.5 cm wide at mid-point, adaxial and abaxial veins and margins bristly; cirri absent. Inflorescences to 7 m, flagellate; inflorescence bracts tubular, tattering at apices. Fruits yellowish or brownish, ovoid, 2.7–3 × 1.8–2.2 cm, scales grooved.

Lowland or montane rain forests; below 1500 m. Guangxi, Xizang, Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam].

The hearts are eaten.

26. Calamus walkeri Hance, J. Bot. 12: 266. 1874.

多果省藤 duo guo sheng teng

Calamus faberi Beccari; *C. faberi* var. *brevispicatus* (C. F. Wei) S. J. Pei & San Y. Chen; *C. tonkinensis* Beccari; *C. tonkinensis* var. *brevispicatus* C. F. Wei; *Palmijuncus walkeri* (Hance) Kuntze.

Stems clustered, climbing, to 15 m, to 3 cm in diam. Leaf sheaths green with gray-brown hairs, with scattered, yellowish, black-tipped, flattened spines to 2.5 cm; ocreas densely bristly; knees present; flagella to 5 m; rachis to 1.5 m with to 40 linear-lanceolate pinnae per side, these regularly arranged; middle pinnae 30–50 cm, 1.5–2 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 5.5 m, flagellate; inflorescence bracts tubular. Fruits yellowish, ovoid, to 1.2 × 1 cm.

Lowland rain forests. Guangdong, Hainan [Vietnam].

The fruits are eaten.

27. Calamus henryanus Beccari, Rec. Bot. Surv. India 2: 199. 1902.

滇南省藤 dian nan sheng teng

Calamus balansanus Beccari; *C. balansanus* var. *castaneolepis* (C. F. Wei) S. J. Pei & San Y. Chen; *C. henryanus* var. *castaneolepis* C. F. Wei.

Stems clustered, climbing, to 20 m, to 1.8 cm in diam. Leaf sheaths with mottled, reddish brown hairs, with scattered, yellowish, flattened, triangular spines to 2 cm (sometimes a few spines to 7 cm at sheath apices); ocreas very short, sometimes spiny; knees present; flagella to 4 m; rachis to 1.3 m with 30–45 linear pinnae per side, these regularly arranged, or often regularly arranged but with gaps; middle pinnae 15–40 cm, 1.3–2 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 4.5 m, flagellate; inflorescence bracts tattering at apices. Fruits yellowish brown, globose to ellipsoid, 1–1.5 × 0.7–1 cm.

Lowland or montane rain forests or scrub forests; below 1700 m. Guangxi, S Sichuan, Yunnan [Laos, Myanmar, Thailand, Vietnam].

This species provides a cane used in furniture-making.

Records of *Calamus rugosus* Beccari from China (e.g., Chen et al., Acta Bot. Yunnan. 24: 203. 2002) are based on a misidentification of this species.

28. Calamus multispicatus Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 592. 1937.

裂苞省藤 lie bao sheng teng

Stems clustered, climbing, to 5 m, 1–1.5 cm in diam. Leaf sheaths with brown hairs, with scattered, brown, flattened spines to 1.5 cm (sometimes to 3 cm at sheath apices); ocreas short; knees present; flagella to 2 m; rachis to 1.3 m with 33–45 linear pinnae per side, these regularly arranged; middle pinnae 20–25 cm, 1–1.5 cm wide at mid-point, adaxial veins and margins bristly; cirri absent. Inflorescences to 2 m, flagellate; inflorescence bracts tattering. Fruits yellowish brown, globose, to 1 cm in diam.

● Lowland rain forests; below 600 m. Hainan.

This species provides a cane used in furniture-making.

4. DAEMONOROPS Blume in Schultes & J. H Schultes, Syst. Veg. 7: 1333. 1830.

黄藤属 huang teng shu

Stems slender, climbing, clustered or less often solitary, sometimes non-climbing or even short and subterranean. Leaves 13–30, pinnate, spiny; leaf sheaths closed in climbing species, open in non-climbing ones, covered with various hairs and spines, these scattered (rarely absent) to densely arranged, or arranged in rows, variously shaped and colored, rarely spines arranged in overlapping, interlocking rings forming ant chambers; ocreas present, obscure; knees present except in non-climbers; cirri present except in non-climbers; pinnae variously arranged and shaped. Plants dioecious, rarely semelparous. Inflorescences branched to 3 orders, male inflorescences more branched than female ones, both covered with overlapping bracts, these persistent, swollen, and split lengthwise to reveal rachillae, apices of all bracts included within prophyll, in other species bracts falling from elongating inflorescence, and only basal bract persistent; male flowers usually arranged distichously along rachillae; female flowers borne in pairs, each pair consisting of a female flower and a sterile male flower. Fruits variously shaped and colored, usually 1-seeded, covered with overlapping scales, usually borne on short stalks; endosperm ruminate; germination adjacent; eophylls pinnate, rarely palmate.

About 100 species: from NE India through SE Asia to just reaching New Guinea; one species in China.

1. Daemonorops jenkinsiana (Griffith) Martius, Hist. Nat. Palm. 3: 327. 1853 [*"jenkinsianus"*].

黄藤 huang teng

Calamus jenkinsianus Griffith, Calcutta J. Nat. Hist. 5: 81. 1845; *C. margaritae* Hance; *C. nutantiflorus* Griffith; *Daemonorops jenkinsiana* var. *tenasserimica* Beccari; *D. margaritae* (Hance) Beccari; *D. margaritae* var. *palawanica* Beccari; *D. nutantiflora* (Griffith) Martius; *D. pierreana* Beccari; *D. schmidtiana* Beccari; *Palmijuncus jenkinsianus* (Griffith) Kuntze; *P. margaritae* (Hance) Kuntze; *P. nutantiflorus* (Griffith) Kuntze.

Stems clustered, climbing or often forming thickets, to 25 m, to 6 cm in diam. Leaf sheaths yellowish green with gray, brown, or reddish black hairs, with scattered or rows of black, flattened, triangular spines to 4 cm, mixed with some needlelike spines; ocreas obscure; knees conspicuous; rachis to 3 m with 55–100 linear or lanceolate pinnae per side, these regularly arranged; middle pinnae 30–70 cm, 1.5–3.8 cm wide at mid-point, adaxial veins bristly, margins with smaller bristles; cirri to 2 m. Inflorescences to 0.8 m, erect; inflorescence bracts persistent, swollen, splitting lengthwise to reveal rachillae; male inflorescences branched to 4 orders, female to 2 orders. Fruits yellowish brown, globose to ellipsoid, to 2 × 2 cm, with grooved scales.

Lowland rain forests, often persisting in disturbed areas; below 1000 m. Guangdong, Guangxi, Hainan [Bangladesh, Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Thailand, Vietnam].

This species provides a cane used in furniture-making, and the leaves are used for thatching.

5. NYPA Steck, Sagu, 15. 1757.

水椰属 shui ye shu

Nipa Thunberg.

Stems creeping, seldom visible above mud in which they grow, rooting from abaxial surface, branching dichotomously, forming large colonies. Leaves 3–15, pinnate, stiff and erect; leaf sheaths open and relatively short; petioles elongate and stout; pinnae many, regularly arranged and spreading in same plane, with conspicuous, brown ramenta on abaxial surface along midveins. Inflorescences branched to 5 or 6 orders, borne on a stout stalk arising from center of leaves; flowers borne in dense heads; male flowers densely arranged along short rachillae, closely covered with light brown bracts; female flowers borne in dense, central heads. Fruits densely arranged in head-shaped clusters of many fruits, large, irregularly globose, flattened and angled, usually 1-seeded; endosperm homogeneous; eophylls bifid.

One species: from Sri Lanka through SE Asia to Japan (Ryukyu Islands), the Pacific islands (Solomon Islands), and just reaching Australia.

1. Nypa fruticans Wurmb, Verh. Batav. Genootsch. Kunst. 1: 349. 1779.

水椰 shui ye

Cocos nypa Loureiro; *Nipa arborescens* Wurmb ex H. Wendland; *N. fruticans* (Wurmb) Thunberg; *N. litoralis* Blanco.

Stems creeping, not visible, dividing equally, to 60 cm in diam., forming large colonies. Leaves stiffly erect; blades to 9 m with 57–100 pinnae per side, these regularly arranged and spreading in same plane. Inflorescences erect, to 2 m. Fruits brown, densely packed in a head-shaped infructescence, each obovoid, angled, to 15 × 10 cm.

Low-lying estuarine tidally flooded areas, or sometimes in wet areas near the sea. Hainan [Bangladesh, Cambodia, India (including Andaman and Nicobar Islands), Indonesia, Japan (Ryukyu Islands), Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Australia, Pacific islands (Solomon Islands)].

The leaves are commonly used as thatch, and the inflorescences are tapped for sugar and alcohol. There are many other minor uses.

6. PHOENIX Linnaeus, Sp. Pl. 2: 1188. 1753.

刺葵属 ci kui shu

Stems solitary or clustered, short and subterranean to large and aerial, usually rough with very close nodes, often covered with persistent leaf bases. Leaves 8–50, pinnate; leaf sheaths open; pinnae induplicate, regularly or irregularly arranged and then spreading in different planes, at base of leaf modified into short, stout, sharp spines (acanthophylls). Plants dioecious. Inflorescences usually branched to 1 order, borne among leaves; peduncle bearing a prophyll, other bracts much reduced; rachillae often borne in groups or spirals along inflorescence rachis; flowers small, simple, unisexual; male flowers with 6(–9) stamens. Fruits variously colored black or brown, obovoid, oblong, or ellipsoid, usually 1-seeded; mesocarp fleshy, thick and sweet tasting in date palm but thin and bitter in other species; endosperm homogeneous, rarely ruminate; germination remote; eophylls undivided.

Fourteen species: from the Canary Islands across Africa, the Mediterranean, and SW Asia to just reaching the Philippines; three species (one introduced) in China.

In addition to species no. 1 below, *Phoenix canariensis* Chabaud (Prov. Agric. Hort. Ill. 19: 293. 1882; 加拿利海枣 jia na li hai zao) is cultivated in China. It is native to the Canary Islands.

Records of *Phoenix sylvestris* (Linnaeus) Roxburgh from China (e.g., FRPS 13(1): 8. 1991) were presumably based on misidentifications.

1a. Pinnae regularly arranged and spreading in same plane; pinnae with persistent scales on abaxial surface of midrib ..... 3. *P. roebelenii*
1b. Pinnae irregularly arranged and spreading in different planes; pinnae without persistent scales on abaxial surface of midrib.
2a. Stems short and subterranean or to 5 m tall ..... 2. *P. loureiroi*
2b. Stems tall and aerial, to 30 m tall ..... 1. *P. dactylifera*

1. Phoenix dactylifera Linnaeus, Sp. Pl. 2: 1188. 1753.

海枣 hai zao

Stems solitary or clustered and then with few shoots, to 30 m tall, to 50 cm in diam., rough with persistent, diamond-shaped leaf bases. Leaves 3–5 m; sheath and petiole to 1 m; rachis 1–2 m; acanthophylls many per side of rachis; pinnae to 200 per side of rachis, linear, irregularly arranged and spreading in different planes; middle pinnae to 40 × 2 cm. Male inflorescences erect, to 1 m, with many rachillae, these ca. 30 cm; female inflorescences erect, becoming pendulous, to 2 m, with to 150 rachillae, these to 40 cm. Fruits variable in shape, usually oblong, to 7 × 3 cm, brown or black; endosperm homogeneous.

Cultivated. Fujian, Guangdong, Guangxi, Yunnan [widely cultivated throughout N Africa, SW Asia, and parts of S Asia].

2. Phoenix loureiroi Kunth, Enum. Pl. 3: 257. 1841 [*"loureirii"*].

刺葵 ci kui

Phoenix pusilla Loureiro, Fl. Cochinch. 2: 614. 1790, not Gaertner (1788); *P. hanceana* Naudin; *P. hanceana* var. *formosana* Beccari; *P. hanceana* var. *philippinensis* Beccari; *P. humilis* Royle ex Beccari (1890), not (Linnaeus) Cavanilles (1793); *P. humilis* var. *hanceana* (Naudin) Beccari; *P. humilis* var. *loureiroi* (Kunth) Beccari; *P. humilis* var. *pedunculata* (Griffith) Beccari; *P. humilis* var. *robusta* Beccari; *P. loureiroi* var. *humilis* S. Barrow; *P. loureiroi* var. *pedunculata* (Griffith) Govaerts; *P. ouseleyana* Griffith; *P. pedunculata* Griffith; *P. pygmaea* Raeuschel; *P. robusta* (Beccari) J. D. Hooker.

Stems solitary or clustered, 1–6 m tall, 20–40 cm in diam., sometimes short and subterranean, rough with persistent, diamond-shaped leaf bases. Leaves to 2 m; sheath and petiole to 40 cm; rachis 1–2 m; acanthophylls ca. 15 per side of rachis; pinnae 40–130 per side of rachis, linear, irregularly arranged and spreading in different planes; middle pinnae 20–50 × 1–4 cm. Male inflorescences erect, to 65 cm, with to 30 rachillae, these ca. 10 cm; female inflorescences erect, becoming arched, to 2 m, with to 40 rachillae, these to 40 cm. Fruits black, blue-black, or dark purple, ovoid to obovoid, to 1.8 × 0.9 cm; endosperm homogeneous.

Open forests, *Pinus* forests, open grassy areas, dunes, often on steep slopes, persisting in disturbed areas and in places subject to burning; below 1700 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Bangladesh, Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam].

The leaves are woven into various domestic items, especially mats and brooms, or used for thatching.

Two varieties are sometimes recognized. The one occurring in China, *Phoenix loureiroi* var. *loureiroi*, has pinnae with a thin brown line along the margins, which is lacking in *P. loureiroi* var. *pedunculata*, restricted to the Indian subcontinent. The FRPS record (13(1): 7. 1991) of *Phoenix acaulis* Roxburgh from China was probably based on a misidentification of *P. loureiroi*.

3. Phoenix roebelenii O'Brien, Gard. Chron., ser. 3, 6: 475. 1889.

江边刺葵 jiang bian ci kui

Stems clustered (solitary in cultivated plants), 1–3 m tall, to 10 cm in diam., straight or twisted, rough with persistent, diamond-shaped leaf bases. Leaves to 2 m; sheath and petiole to 50 cm; rachis 1–2 m; acanthophylls ca. 12 per side of rachis; pinnae 25–50 per side of rachis, linear, regularly arranged and spreading in same plane, with persistent scales on abaxial surface of midrib; middle pinnae 20–40 × ca. 1.5 cm. Male inflorescences pendulous, 30–60 cm, with to 20 rachillae, these 7–20 cm; female inflorescences erect, to 35 cm, with to 50 rachillae. Fruits orange-brown or purple-brown, obovoid, to 1.8 × 0.7 cm; endosperm homogeneous.

Scattered localities on rocky riverbanks or cliffs, sometimes with stems submerged, especially along the Lancang Jiang and Nu Jiang, at low elevations. Yunnan [Laos, Myanmar, Thailand, Vietnam].

This species is widely planted as an ornamental.

7. GUIHAIA J. Dransfield, S. K. Lee & F. N. Wei, Principes 29: 7. 1985.

石山棕属 shi shan zong shu

Stems short or subterranean, clustered, sometimes creeping, forming small clumps. Leaves 6–14, palmate, forming an open crown; leaf sheaths open, with coarse, black or brown fibers, these either free and spinelike or remaining joined at their apices and then forming a distinct point; petioles with smooth, sharp margins; hastula present; blades ± silvery white abaxially, divided to 3/4 or more their length into many segments, reduplicate, rarely blade undivided; margins of leaves with minute sawlike teeth. Plants dioecious. Inflorescences branched to 4 orders, borne among leaves; bracts 2; flowers very small, arranged spirally along rachillae. Fruits bluish black, small, globose to almost ellipsoid, 1-seeded; endosperm homogeneous with an irregular intrusion of seed coat; germination remote, eophyll not known.

Two species: S China, N Vietnam; two species in China.

1a. Leaf sheath fibers stiff, erect, separating and becoming spinelike; leaf blades densely silvery white abaxially; stems to 0.5 m tall and to 5 cm in diam. ..... 1. *G. argyrata*

1b. Leaf sheath fibers curved, remaining joined, not separating into stiff spines; leaf blades scarcely silvery white abaxially; stems to 2.5 m tall and to 8 cm in diam. ..... 2. *G. grossifibrosa*

1. Guihaia argyrata (S. K. Lee & F. N. Wei) S. K. Lee, F. N. Wei & J. Dransfield, Principes 29: 9. 1985.

石山棕 shi shan zong

Trachycarpus argyratus S. K. Lee & F. N. Wei, Guihaia 2: 131. 1982.

Stems clustered, to 0.5 m tall, 3–5 cm in diam., erect or creeping, densely covered with persistent leaf bases. Leaf sheath fibers dark brown, stiff, erect, separating and becoming spinelike; petioles to 1 m, smooth along margins; blades to 1 m wide, divided for up to 3/4 their length into 14–34 segments, these to 50 × 5 cm, densely silvery white abaxially. Inflorescences interfoliar, to 0.8 m, with 2–5 partial inflorescences; rachillae many, to 50 cm; flowers unisexual; male flowers to 1.5 mm, with 6 stamens; female flowers to 1.5 mm. Fruits bluish black, almost globose, to 0.6 cm in diam.

Seasonal forests on steep slopes of karst limestone hills; below 1000 m. Guangdong, Guangxi, Guizhou [Vietnam].

2. Guihaia grossifibrosa (Gagnepain) J. Dransfield, S. K. Lee & F. N. Wei, Principes 29: 12. 1985.

两广石山棕 liang guang shi shan zong

Rhapis grossifibrosa Gagnepain, Notul. Syst. (Paris) 6: 159. 1937; *R. filiformis* Burret.

Stems solitary or clustered, to 2.5 m tall, 2–8 cm in diam., erect or leaning, densely covered with persistent leaf bases. Leaf sheath fibers stout, black or dark brown, curved, remaining joined, not separating into stiff spines, forming a distinct point opposite petiole; petioles 0.4–1 m, smooth along margins; blades 35–85 cm wide, sometimes undivided, usually divided into 2–21 segments, these to 45 × 1.5–6 cm, scarcely silvery white abaxially. Inflorescences interfoliar, to 0.8 m, with 2–5 partial inflorescences; rachillae many, to 10 cm; flowers unisexual; male flowers to 2.5 mm, with 6 stamens; female flowers to 2.2 mm. Fruits blue-black, ellipsoid to ovoid, to 1 × 1 cm.

Seasonal forests on steep slopes of karst limestone hills; 500–1100 m. Guangdong, Guangxi [Vietnam].

8. TRACHYCARPUS H. Wendland, Bull. Soc. Bot. France 8: 429. 1862.

棕榈属 zong lü shu

Stem solitary, tall and aerial or rarely short and subterranean, usually covered with persistent, fibrous leaf sheaths, stems of older plants losing this covering, leaving a bare, ringed trunk. Leaves 6–25, palmate, usually forming a dense crown; leaf sheaths open, fibrous, old sheaths forming a mass of interwoven fibers, fibers at apex of sheath on younger leaves forming a prominent ocrea; petioles elongate, often bearing small, blunt teeth along margins; hastula present, small or prominent; blades green, gray-green, or bright white waxy on abaxial surfaces, divided into many stiff segments, these shortly split at their apices, rarely 2 or 3 segments fused together. Plants dioecious or polygamous. Inflorescences branched to 4 orders, borne among leaves, covered with many sheathing bracts, usually yellowish at flowering time. Fruits yellowish brown to purple-black, often with a whitish "bloom," kidney-shaped or oblong, grooved, 1-seeded; endosperm ruminate; germination remote; eophylls undivided, lanceolate.

Eight species: Bhutan, China, India, Myanmar, Nepal, N Thailand, Vietnam; three species (two endemic) in China.

It has not been possible to confirm the Kew World Checklist record of *Trachycarpus martianus* (Wallich ex Martius) H. Wendland for China.

1a. Stem short and subterranean; segments 20–30 per leaf ..... 1. *T. nanus*
1b. Stem tall and aerial; segments 40–70 per leaf.
2a. Leaf blade bright white waxy on abaxial surface ..... 2. *T. princeps*
2b. Leaf blade green or gray-green on abaxial surface ..... 3. *T. fortunei*

1. Trachycarpus nanus Beccari, Webbia 3: 187. 1910 [*"nana"*].

龙棕 long zong

Chamaerops nana (Beccari) Chabaud; *Trachycarpus dracocephalus* Ching & Y. C. Hsu.

Stem solitary, short and subterranean, to 5 cm in diam. Leaf sheaths not known; petioles 12–25 cm, margins with very small teeth; blades semicircular in outline, ca. 0.5 m wide, green or grayish on abaxial surface, divided to more than 2/3 their length into 20–30 stiff segments, transverse veinlets barely visible; middle segments ca. 2 cm wide. Inflorescences to 0.5 m, erect; male inflorescences branched to 2 or more orders; rachillae ca. 10 cm; female inflorescences branched to 2 or more orders; rachillae ca. 10 cm. Fruits yellowish to brown, with a thin waxy bloom, kidney-shaped, to 0.9 × 1.3 cm.

● Dry forests or open areas on mountains; 1800–2300 m. Yunnan.

Brushes are made from bundles of the leaves.

2. Trachycarpus princeps Gibbons, Spanner & San Y. Chen, Principes 39: 73. 1995.

贡山棕榈 gong shan zong lü

Stem solitary, to 10 m tall, 13–16 cm in diam. Leaf sheath fibers coarse, forming an ocrea to 10 cm; petioles to 0.8 m, margins with very small teeth; blades semicircular to almost circular in outline, 0.9–1.2 m wide, bright white waxy on abaxial surface, divided to ca. 1/2 their length into 45–48 stiff segments, transverse veinlets barely visible; middle segments 3–3.5 cm wide. Inflorescences to 0.8 m, erect; male inflorescences branched to 4 orders; rachillae 1–3 cm; female inflorescences branched to 3 orders; rachillae 2–10 cm. Fruits black with a waxy bloom, kidney-shaped, to 0.8 × 1 cm.

● Steep limestone cliffs on banks of Nu Jiang; 1500–1900 m. Yunnan.

3. Trachycarpus fortunei (Hooker) H. Wendland, Bull. Soc. Bot. France 8: 429. 1862.

棕榈 zong lü

Chamaerops fortunei Hooker, Bot. Mag. 86: t. 5221. 1860; *C. excelsa* Thunberg; *Trachycarpus caespitosus* Beccari; *T. wagnerianus* Beccari.

Stem solitary, to 12 m tall, to 15 cm in diam. Leaf sheath fibers persistent, forming an ocrea more than 25 cm; petioles to 60 m, margins with very fine teeth; blades semicircular in outline, to 1.2 m wide, green on abaxial surface, divided to ca. 3/4 their length into 40–50 stiff segments, transverse veinlets barely visible; middle segments to 3 cm wide. Inflorescences 0.7–0.9 m, erect; male inflorescences branched to 4 orders; rachillae 1–3 cm; female inflorescences branched to 3 orders; rachillae 3–15 cm. Fruits black with a waxy bloom, kidney-shaped, to 0.9 × 1.4 cm.

Commonly cultivated, rarely found in forests; 100–2400 m. S of Qin Ling and Chang Jiang [Bhutan, India, Myanmar, Nepal, Vietnam].

Fibers are collected from the leaf bases and made into coats and other items (brooms, brushes, doormats); wax is collected from the fruits; and a hemostatic drug is extracted from the seeds. This species is widely cultivated as an ornamental, especially in cooler climates.

9. RHAPIS Linnaeus f. ex Aiton, Hortus Kew. 3: 473. 1789.

棕竹属 zong zhu shu

Stems slender, clustered, spreading by rhizomes to form small to large clumps, covered, especially in upper part, with fibrous, persistent leaf bases, otherwise green. Leaves 12–22, palmate; leaf sheaths fibrous, consisting of 2 layers of fibers, forming a square or diagonal mesh, with fibrous ligules at apices; hastula present; segments few to many, split to 1/2 or more their length, with minute spines along margins. Plants dioecious. Inflorescences branched to 3 orders, borne among leaves, covered with persistent bracts, these closely or loosely sheathing, bearing either all male or all female flowers, occasionally bisexual; flowers simple in structure, borne singly, male flowers with 6 stamens. Fruits variously colored, small, globose to ellipsoid or ovoid, usually 1-seeded, sometimes borne on short stalks; endosperm homogeneous; germination remote; eophylls undivided.

Eleven species: China, Indonesia (Sumatra), Laos, Thailand, Vietnam; five species (two endemic) in China.

1a. Leaf blade segments with ± straight sides and jagged apices ..... 1. *R. excelsa*
1b. Leaf blade segments with curved sides and ± pointed apices.
2a. Leaf blades split to base, or at least some segments split to base ..... 2. *R. gracilis*
2b. Leaf blades not split to base.
3a. Leaf blades divided into 3–6 segments ..... 3. *R. robusta*
3b. Leaf blades divided into 5–23 segments.
4a. Leaf sheaths with coarse, black or brown fibers producing a diagonal mesh; fruits borne on short (ca. 5 mm) stalks ..... 4. *R. multifida*
4b. Leaf sheaths with narrow, brown fibers producing a square mesh; fruits not borne on short stalks ..... 5. *R. humilis*

1. Rhapis excelsa (Thunberg) A. Henry in Rehder, J. Arnold Arbor. 11: 153. 1930.

棕竹 zong zhu

Chamaerops excelsa Thunberg in Murray, Syst. Veg., ed. 14, 984. 1784; *Rhapis aspera* W. H. Baxter; *R. cordata* W. H. Baxter; *R. divaricata* Gagnepain; *R. flabelliformis* L'Héritier; *R. kwamwonzick* Siebold ex Rodigas; *R. major* Blume; *Trachycarpus excelsus* (Thunberg) H. Wendland.

Stems clustered, rhizomatous, forming large, loose colonies, to 3 m tall, to 1.5 cm in diam., covered with persistent, fibrous leaf sheaths. Leaf sheaths with coarse, black fibers producing a square mesh; ligules not persistent; blades not split to base, divided into 2–13 segments, these with ± straight sides and jagged apices, to 40 × 7 cm, outermost narrowest. Inflorescences borne among leaves, branched to 2 or 3 orders; bracts tubular, sheathing; rachis to 26 cm; rachillae to 11 cm, glabrous; male flowers to 6 mm; sepals united into a tubular, 3-lobed calyx; petals united into a tubular corolla with a 3-lobed, valvate apex; stamens 6, borne in 2 series; filaments keeled adaxially; female flowers similar to but shorter than male. Fruits developing from 1 carpel, yellow, globose to ellipsoid, to 1 × 0.8 cm.

Scattered localities in lowland forests or dry forests, on slopes; below 1000 m. Fujian, Guangdong, Guizhou, Hainan, Yunnan [Thailand (?introduced), Vietnam].

The stems are used for chopsticks and walking sticks. This species is widely planted as an ornamental and has been introduced in Japan.

2. Rhapis gracilis Burret, Notizbl. Bot. Gart. Berlin-Dahlem 10: 883. 1930.

细棕竹 xi zong zhu

Stems clustered, rhizomatous, forming colonies, to 2 m tall, to 0.5 cm in diam., covered with persistent, fibrous leaf sheaths. Leaf sheaths with fine, black or brown fibers producing a square mesh; ligules persistent; blades split to base, divided into 2–4 segments, these with curved sides and ± pointed apices, to 20 × 3.5 cm. Inflorescences borne among leaves, branched to 2 orders; bracts tubular, sheathing; rachis to 20 cm; rachillae 2–3 cm, ± glabrous; male flowers to 4 mm; sepals united into a tubular, 3-lobed calyx; petals united into a tubular corolla with a 3-lobed, valvate apex; stamens 6, borne in 2 series; filaments not keeled adaxially; female flowers similar to but shorter than male. Fruits developing from 1 carpel, blue-green, globose, to 0.8 cm in diam., borne on a short stalk.

Lowland forests on limestone slopes; below 900 m. Guangdong, Guangxi, Hainan [Vietnam].

3. Rhapis robusta Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 587. 1937.

粗棕竹 cu zong zhu

Stems clustered, rhizomatous, forming colonies, to 1.5 m tall, to 0.6 cm in diam., covered with persistent, fibrous leaf sheaths. Leaf sheaths with coarse, black or brown fibers producing a diagonal mesh; ligules persistent; blades not split to base, divided into 3–6 segments, these with curved sides and ± pointed apices, to 22 × 2–3 cm. Inflorescences borne among leaves, branched to 2 orders; bracts tubular, sheathing, not or scarcely overlapping; rachis to 22 cm; rachillae 2.5–5 cm, ± glabrous; male flowers not known; female flowers ca. 2 mm. Fruits developing from 1 carpel, color not known, ellipsoid, to 0.5 cm in diam., borne on short stalks.

Lowland forests on slopes of limestone mountains; 300–1000 m. Guangxi [Vietnam].

4. Rhapis multifida Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 588. 1937.

多裂棕竹 duo lie zong zhu

Stems clustered, rhizomatous, forming colonies, to 2.5 m tall, to 2.5 cm in diam., covered with persistent, fibrous leaf sheaths. Leaf sheaths with coarse, black or brown fibers producing a diagonal mesh; ligules persistent; blades not split to base, divided into 14–23 linear segments, these with curved sides and ± pointed apices, to 45 × 2 cm. Inflorescences borne among leaves, branched to 3 orders; bracts tubular, sheathing; rachis to 56 cm; rachillae 3.5–10 cm, hairy; male flowers not seen; female flowers to 4.5 mm. Fruits developing from 1 carpel, yellow, globose, to 0.8 cm in diam., borne on ca. 5 mm stalks.

● Lowland and montane forests on rocky slopes; below 1500 m. Guangxi, E Yunnan [?Vietnam].

This species is planted as an ornamental.

5. Rhapis humilis Blume, Rumphia 2: 54. 1838–1839.

矮棕竹 ai zong zhu

Chamaerops excelsa Thunberg var. *humilior* Thunberg; *C. sirotsik* H. Wendland; *Licuala waraguh* Blume; *L. wixu* Blume; *Rhapis javanica* Blume; *R. sirotsik* H. Wendland.

Stems clustered, rhizomatous, forming large, loose colonies, to 6 m tall, to 3 cm in diam., covered with persistent, fibrous leaf sheaths. Leaf sheaths with narrow, brown fibers producing a square mesh; ligules persistent; blades not split to base, divided into 7–20 segments, these with curved sides and ± pointed apices, to 45 × 2 cm, outermost narrowest. Inflorescences borne among leaves, branched to 3 orders; bracts tubular, sheathing; rachis to 40 cm; rachillae to 17 cm, brown tomentose; male flowers to 7 mm; sepals united into a tubular, 3-lobed calyx; petals united into a tubular corolla with a 3-lobed, valvate apex; stamens 6, borne in 2 series; filaments not keeled adaxially; female flowers similar to but shorter than male. Fruits ovoid, to 0.7 cm in diam. Seeds ovoid, to 4.5 mm.

● Lowland dry forests on slopes; below 1000 m. Guangxi, Guizhou.

This species is widely planted as an ornamental and has been introduced in Indonesia (Java) and Japan. One of us (Henderson) suggests that *Rhapis humilis* might prove to be just a cultivar of *R. excelsa*.

10. LIVISTONA R. Brown, Prodr. 267. 1810.

蒲葵属 pu kui shu

Saribus Blume; *Wissmannia* Burret.

Stems solitary, often large and stout, usually rough with persistent leaf bases. Leaves 10–60, palmate or costapalmate, usually forming a dense crown; dead leaves often persisting as a skirt below crown; leaf sheaths open and often very fibrous, forming a mass of reddish brown, interwoven fibers; petioles spiny on margins, younger plants with more spines than older ones; hastula present; blades green or variously waxy or dull green, divided to ca. 1/2 their length or almost to base into many segments, these again split and sometimes pendulous at apices. Inflorescences borne among leaves, branched up to 5 orders, rarely an inflorescence consisting of 3 separate but equal branches arising from same prophyll; inflorescences covered with many sheathing bracts; flowers usually borne in small groups, bisexual with 6 stamens and 3 carpels; rarely plants functionally dioecious. Fruits bluish or variously colored, globose to ellipsoid, 1-seeded, usually borne on short stalks; endosperm homogeneous, with an irregular intrusion of seed coat; germination remote; eophylls undivided and lanceolate.

Thirty-three species: from NE Africa and India to Australia, New Guinea, the Pacific islands (Solomon Islands), north to the Philippines, China, and Japan; three species in China.

1a. Leaf blade segments stiff at apices ..... 1. *L. jenkinsiana*
1b. Leaf blade segments pendulous at apices.
2a. Leaf blades deeply and irregularly divided almost to base into groups of segments ..... 2. *L. saribus*
2b. Leaf blades regularly divided ca. halfway, segments not in groups ..... 3. *L. chinensis*

1. Livistona jenkinsiana Griffith, Calcutta J. Nat. Hist. 5: 334. 1845.

美丽蒲葵 mei li pu kui

Latania jenkinsiana (Griffith) Devansaye; *Livistona fengkaiensis* X. W. Wei & M. Y. Xiao; *L. moluccana* H. Wendland; *L. speciosa* Kurz; *Saribus jenkinsianus* (Griffith) Kuntze [*"jenkensii"*]; *S. speciosus* (Kurz) Kuntze.

Stems to 25 m tall, to 30 cm in diam., rough with leaf scars. Leaves palmate; petioles 1.3–2 m, with brown recurved spines along margins, decreasing in density toward distal end; hastula to 3 cm; blades almost circular in outline, 1.5–2 m wide, grayish green abaxially, green adaxially, regularly divided to ca. halfway or more into 70–100 segments, these briefly split and erect at apices. Inflorescences to 2 m, branched to 3 orders, with 3–6 partial inflorescences; rachillae 10–30 cm; flowers bisexual, solitary or borne in clusters of 2–6, yellowish, 2.5–4 mm. Fruits bluish, globose to ellipsoid or pear-shaped, to 3.5 × 2.5 cm.

Forests and open areas, commonly planted in villages or other disturbed areas; 100–2500 m. Hainan, Yunnan [Bangladesh, Bhutan, India, Malaysia (Peninsular), Myanmar, Thailand].

The leaves are commonly used for thatching and making hats, and small plantations are maintained for leaf harvesting. The seeds are eaten as a substitute for betel nut, and in Hainan the fruits are used medicinally.

2. Livistona saribus (Loureiro) Merrill ex Chevalier, Bull. Econ. Indochine, n.s., 21: 501. 1919.

大叶蒲葵 da ye pu kui

Corypha saribus Loureiro, Fl. Cochinch. 1: 212. 1790; *Chamaerops cochinchinensis* Loureiro; *Livistona cochinchinensis* (Loureiro) Martius; *L. diepenhorstii* Hasskarl; *L. hasseltii* (Hasskarl) Hasskarl; *L. hoogendorpii* Teijsmann & Binnendijk; *L. inaequisecta* Beccari; *L. spectabilis* Griffith; *L. tonkinensis* Magalon; *L. vogamii* Beccari; *Pholidocarpus diepenhorstii* (Hasskarl) Burret; *Rhapis cochinchinensis* (Loureiro) Martius; *Sabal hoogendorpii* (Teijsmann & Binnendijk) Kuntze; *Saribus cochinchinensis* (Loureiro) Blume; *S. hasseltii* Hasskarl; *S. hoogendorpii* (Teijsmann & Binnendijk) Kuntze.

Stems to 40 m tall, to 65 cm in diam., rough with leaf scars. Leaves palmate; petioles 1–2 m, with green to brown, recurved spines along margins, spines denser proximally, fewer distally on petioles; blades almost circular in outline, 1.5–1.7 m wide, green adaxially and abaxially, irregularly divided for up to 1/2 their length into 80–90 segments, segments in groups, each group separated by a split almost to base of leaf, segments deeply split and pendulous at apices. Inflorescences to 2.3 m, branched to 3 orders, with 4–9 partial inflorescences; rachillae 15–45 cm; flowers borne in clusters of 3–5, yellowish, to 2 mm. Fruits blue or blue-gray, globose to ellipsoid, to 2.5 × 2 cm.

Lowland rain forests or dry forests, often in periodically inundated habitats; below 600–1100 m. Guangdong, Yunnan [Borneo, Cambodia, Indonesia (Java, Sumatra), Laos, Malaysia (Peninsular), Philippines, Thailand, Vietnam].

The leaves are used for thatching and fishing; the fruits are eaten locally.

3. Livistona chinensis (Jacquin) R. Brown ex Martius, Hist. Nat. Palm. 3: 240. 1838.

蒲葵 pu kui

Latania chinensis Jacquin, Fragm. Bot. 1: 16. 1800; *Chamaerops biroo* Siebold; *Livistona boninensis* (Beccari) Nakai; *L. chinensis* var. *boninensis* Beccari; *L. chinensis* var. *subglobosa* (Hasskarl) Beccari; *L. japonica* Nakai; *L. oliviformis* (Hasskarl) Martius; *L. sinensis* Griffith; *L. subglobosa* (Hasskarl) Martius; *Saribus chinensis* (Jacquin) Blume; *S. oliviformis* Hasskarl; *S. subglobosus* Hasskarl.

Stems to 15 m tall, 20–30 cm in diam., rough with leaf scars. Leaves palmate; petioles to 1.8 m, with green or black, recurved spines along margins, spines denser proximally, fewer distally on petioles; hastula to 3 cm; blades almost circular in outline, 1.2–1.8 m wide, green on both surfaces, regularly divided to ca. 1/2 their length into 50–90 segments, these split and pendulous at apices. Inflorescences 1–1.2 m, branched to 3 orders, with 6 or 7 partial inflorescences; rachillae 10–18 cm; flowers hermaphroditic, borne in clusters of 4–7, white or yellow, 2–2.5 mm. Fruits green or blue-green, globose to ellipsoid or pear-shaped, 1.5–2.6 × 0.9–1.8 cm.

Coastal forests, often on sandy soils. Guangdong, Hainan, Taiwan [S Japan].

This species is widely planted as an ornamental throughout tropical and subtropical areas of the world.

The leaves are used for making hats, fans, brooms, and raincoats in Guangdong.

11. LICUALA Wurmb, Verh. Batav. Genootsch. Kunst. 2: 473. 1780.

轴榈属 zhou lü shu

Stems solitary or clustered, usually rather small, sometimes short and subterranean. Leaves 5–28, palmate; leaf sheaths open and fibrous on margins; ocreas often present at sheath apex, rarely elongate and conspicuous; petioles normally spiny along margins, sometimes less so or unarmed; hastula present; blades usually strongly folded, circular in outline, split to base into several multi-fold, wedge-shaped segments or rarely undivided; apices of segments truncate, shallowly to deeply lobed, lobes longer on lateral segments; central segment occasionally bifid, central 1–3 segments sometimes borne on petiolules. Plants monoecious or rarely dioecious. Inflorescences borne among leaves and partly covered with swollen, tubular rachis bracts; first order branches 1 to several, each spicate or more often branched to 1 or 2 orders; flowers bisexual with 6 stamens and 3 carpels, stamens or carpels vestigial in dioecious species. Fruits variously colored, usually quite small, globose to ovoid, 1-seeded; endosperm homogeneous; germination remote; eophylls undivided, lanceolate.

About 150 species: from Bhutan and NE India through SE Asia to the W Pacific (Vanuatu); three species (two endemic) in China.

1a. Leaf blades split into 5–13 segments, mottled light and dark green ..... 1. *L. dasyantha*
1b. Leaf blades split into 12–22 segments, uniformly green on both surfaces.
2a. Stems short and subterranean; partial inflorescences spicate or with 2 or 3 rachillae ..... 2. *L. fordiana*
2b. Stems aerial; partial inflorescences branched with 9–16 rachillae ..... 3. *L. hainanensis*

1. Licuala dasyantha Burret, Notizbl. Bot. Gart. Berlin-Dahlem 15: 334. 1941.

毛花轴榈 mao hua zhou lü

Stems solitary or clustered, to 1.5 m tall, to 6 cm in diam., sometimes short and subterranean. Leaf sheaths 12–20 cm, extended above petioles into 6–15 cm ocreas; petioles 15–100 cm, unarmed or proximal ca. half with widely spaced, recurved, brown spines to 0.5 cm; blades 30–107 cm wide, split into 5–8(–13) segments, mottled light and dark green, with straight sides; middle segment wider than others, deeply split into 2 lobes, these 16–58 cm, 13–30 cm wide at apices, costa terminating in a glandlike structure abaxially at base of split. Plants dioecious. Inflorescences 40–70 cm, erect at first, later pendu-

lous below crown; rachis 0–12 cm, with 1 (rarely 2) partial inflorescences, these branched to 1 order; male rachillae 2–7, 9–14 cm; female rachillae 1–4, 8–24 cm; male flowers borne in clusters, female flowers solitary. Fruits ovoid-globose, slightly 3-sided, 0.9–1.5 × 0.7–1.1 cm, red at maturity, with reflexed perianth.

Lowland rain forests on steep mountain slopes of granite or quartzite rocks; 100–1000 m. Guangxi, Yunnan [Vietnam].

2. Licuala fordiana Beccari, Malesia 3: 198. 1889.

穗花轴榈 sui hua zhou lü

Stems clustered, short and subterranean. Leaf sheaths and ocreas not seen; petioles to 1 m, unarmed or proximal ca. half with widely spaced, recurved, brown spines to 1 cm; blades to 1 m wide, split into 15–22 segments, green on both surfaces, with slightly curved sides; middle segment slightly wider than others, not split, 25–52 cm, 2–6 cm wide at apex. Plants monoecious. Inflorescences shorter than leaves, to 1.5 m, erect among leaves; rachis to 75 cm, with 3–7 first order branches, these spicate, rarely with 2 or 3 rachillae; rachilla 1(–3), 15–20 cm, densely hairy; flowers borne in clusters. Fruits globose, 0.7–0.8 cm in diam., with clasping perianth, red at maturity, borne on short stalks.

● Lowland rain forests; below 500 m. Guangdong, Hainan.

The leaves are used to make raincoats.

3. Licuala hainanensis A. J. Henderson, L. X. Guo & Barfod, Syst. Bot. 32: 718. 2007.

海南轴榈 hai nan zhou lü

Stems clustered, to 4 m tall, 2–3 cm in diam. Leaf sheaths ca. 40 cm, extended above petioles into short ocreas; petioles 50–160 cm, basal part with regularly spaced, recurved, brown spines to 0.5 cm; blades to 1.2 m wide, split into 12–17 segments, green on both surfaces; middle segment only slightly wider than others, split, 36–41 cm, 7–8 cm wide at apex, costa terminating in a glandlike structure abaxially at base of split. Plants dioecious. Inflorescences up to 1 m, erect among leaves; rachis ca. 50 cm, with 3–5 partial inflorescences, these branched to 2 orders; male and female rachillae 9–16 on each partial inflorescence, 8–17 cm; male flowers solitary or loosely grouped in 2–4, female flowers solitary. Fruits globose, 0.7–0.9 cm in diam., orange or red at maturity, with reflexed perianth.

● Lowland rain forests; below 600 m. Hainan.

Material of this species was treated as *Licuala spinosa* Wurmb in FRPS (13(1): 30. 1991).

12. CHUNIOPHOENIX Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 583. 1937.

琼棕属 qiong zong shu

Stems small to moderate, clustered. Leaves 15–20, induplicate, briefly costapalmate; petioles slender, elongate, smooth margined, deeply channeled; leaf sheaths open, in one species with an additional triangular cleft at base of petiole; hastula absent; blades irregularly divided almost to base into few to many segments of varying widths, with acute apices, green on both surfaces. Inflorescences spicate or branched to 3 orders, borne among leaves; bracts persistent, tubular, covering peduncle, rachis, and rachillae; flowers bisexual, solitary or borne in small groups, pedicellate, partly covered by tubular bracts; calyx shallowly 3-lobed; corolla deeply 3-lobed, lobes reflexed at anthesis; stamens 6. Fruits red, orange, or purple, small, globose, obovoid, or pear-shaped, 1-seeded; endosperm ruminate; germination remote; eophylls undivided.

Three species: S China, N Vietnam; two species (both endemic) in China.

1a. Stems to 5 m tall, to 10 cm in diam.; leaf blades divided into 36–45 segments; inflorescences with many rachillae ..... 1. *C. hainanensis*
1b. Stems to 2 m tall, to 2 cm in diam.; leaf blades divided into 4–7 segments; inflorescences with 1–4 rachillae ..... 2. *C. humilis*

1. Chuniophoenix hainanensis Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13: 583. 1937.

琼棕 qiong zong

Stems clustered, to 5 m tall, to 10 cm in diam., bare with deciduous leaf sheaths. Leaf sheaths open, swollen, in older plants with additional triangular cleft at base of petiole; petioles to 90 cm, white-waxy tomentose initially; blades divided into 36–45 segments, these to 50 × 1.8–2.5 cm. Inflorescences to 2 m, arching below leaves; rachillae many, 10–20 cm; flowers mostly solitary; petals purple. Fruits red, orange, or purple, obovoid to pear-shaped, to 2.5 × 2.2 cm, borne on short stalks.

● Lowland rain forests. Hainan.

2. Chuniophoenix humilis C. Z. Tang & T. L. Wu, Acta Phytotax. Sin. 15(2): 111. 1977.

矮琼棕 ai qiong zong

Stems clustered, to 2 m tall, 1–2 cm in diam., covered with persistent leaf sheaths. Leaf sheaths open, not split at bases; petioles 25–40 cm; blades divided into 4–7 segments, these 25–35 × 3–7 cm, broad and hooded. Inflorescences to 0.4 m, erect among leaves, becoming pendulous in fruit; rachillae 1–4, 15–20 cm; flowers borne in small groups; petals yellowish. Fruits red, globose, to 1.6 cm in diam.

● Lowland rain forests. Hainan.

Material from Vietnam previously included here is now treated as the distinct species *Chuniophoenix nana* Burret (see Henderson, Palms S. Asia, 98. 2009). It differs by the narrower, unhooded leaflets.

13. CARYOTA Linnaeus, Sp. Pl. 2: 1189. 1753.

鱼尾葵属 yu wei kui shu

Thuessinkia Korthals.

Stems small to very large, solitary or clustered, columnar or swollen, usually ringed with conspicuous leaf scars. Leaves 4–20, spread out along stem, or borne in a compact crown at top of stem; leaf sheaths closed, not forming crownshafts; petioles short or elongate and then rounded in cross section, covered with whitish or brownish hairs, sometimes striped; leaves bipinnate, each primary pinna made up of several secondary pinnae borne on a secondary rachis terminated by a pinna; individual secondary pinnae triangular, with jagged outer margins, often spreading in different planes. Plants monoecious, semelparous, flowering proceeding from top of stem downward (basipetal). Inflorescences usually branched to 1 order, rarely spicate, borne either among or below leaves, covered with many persistent bracts; peduncle bearing a prophyll and several peduncular bracts; rachillae usually many, long and pendulous; flowers unisexual, borne in threes of 1 central female and 2 lateral male; male petals either yellow or purplish; stamens 6–150. Fruits orange, red, or purple, medium sized, usually ± globose, 1- or 2-seeded; mesocarp filled with irritant needle-shaped crystals; endosperm ruminate (homogeneous in one species); germination remote; eophylls bifid [pinnate in one species] with jagged margins.

Thirteen species: from India through SE Asia to the W Pacific; four species in China.

Records of *Caryota no* Beccari ex J. Dransfield from China are based on misidentifications.

1a. Moderate-sized palms, with clustered stems; rachillae less than 80 per inflorescence; flowers purple to maroon; fruits purple, purple-black, or brownish purple.
2a. Inflorescences with to 60 rachillae ..... 1. *C. mitis*
2b. Inflorescences with 1–3 rachillae ..... 2. *C. monostachya*
1b. Massive, solitary palms; rachillae more than 80 per inflorescence; flowers yellowish, rarely reddish brown to purple; fruits reddish, orange, or rarely purple.
3a. Leaves borne along upper half of stem; primary pinnae pendulous; fruits strictly 1-seeded ..... 3. *C. maxima*
3b. Leaves borne in a compact crown at top of stem; primary pinnae spreading; fruits often 2-seeded ..... 4. *C. obtusa*

1. Caryota mitis Loureiro, Fl. Cochinch. 2: 697. 1790.

短穗鱼尾葵 duan sui yu wei kui

Caryota furfuracea Blume; *C. griffithii* Beccari; *C. griffithii* var. *selebica* Beccari; *C. javanica* Zippelius ex Miquel; *C. minor* Wallich; *C. nana* Linden; *C. propinqua* Blume; *C. sobolifera* Wallich; *C. speciosa* Linden; *Drymophloeus zippellii* Hasskarl; *Thuessinkia speciosa* Korthals.

Stems clustered, to 10 m tall, 8–20 cm in diam., columnar. Leaves borne along upper half of stem; petioles 80–200 cm; rachis 2–2.8 m; primary pinnae 9–23 per side of rachis; secondary pinnae 10–20 per side of secondary rachis, with jagged margins and elongate apices. Inflorescences borne among or below leaves, to 85 cm; rachillae 20–60, 25–65 cm; male flowers to 10 mm; sepals ca. 3 mm; petals purple to maroon, 12–15 mm; stamens 12–24; female flowers to 5 mm; sepals ca. 3 mm; petals 4–5 mm. Fruits purple-black or reddish, globose, to 2 cm in diam.

Lowland rain forests, secondary forests, disturbed areas, and often cultivated; below 1000 m. Guangdong, Guangxi, Hainan [Borneo, Cambodia, India, Indonesia (Java, Sulawesi, Sumatra), Laos, Malaysia (Peninsular), Myanmar, Philippines, Singapore, Thailand, Vietnam].

This species is widely planted as an ornamental.

2. Caryota monostachya Beccari, Webbia 3: 196. 1910.

单穗鱼尾葵 dan sui yu wei kui

Stems clustered, with few stems per cluster, to 3 m tall, 2–4 cm in diam. Leaves borne almost all along stem; petioles 80–150 cm; rachis 1–2.5 m; primary pinnae 4–9 per side of rachis; secondary pinnae 5 or 6 per side of secondary rachis, with scarcely jagged margins and short apices. Inflorescences borne among leaves, to 1 m; rachillae 1–3, 30–40 cm; male flowers to 17 mm; sepals 3–5 mm; petals purple to maroon, ca. 17 mm; stamens 60–75; female flowers to 8 mm; sepals 3–5 mm; petals 5–8 mm. Fruits brownish purple, globose, to 3.5 cm in diam.

Lowland to montane rain forests, often on limestone soils; below 1400 m. Guangxi, Guizhou, Yunnan [Vietnam].

3. Caryota maxima Blume ex Martius, Hist. Nat. Palm. 3: 195. 1838.

鱼尾葵 yu wei kui

Caryota aequatorialis (Beccari) Ridley; *C. bacsonensis* Magalon; *C. furfuracea* Blume var. *caudata* Blume; *C. furfuracea* var. *furcata* Blume; *C. macrantha* Burret; *C. obtusa* Griffith var. *aequatorialis* Beccari; *C. ochlandra* Hance; *C. rumphiana* Martius var. *javanica* Beccari; *C. rumphiana* var. *oxydonta* Beccari; *C. rumphiana* var. *philippinensis* Beccari.

Stems solitary, to 30 m tall, 25–64 cm in diam., columnar. Leaves borne along upper half of stem; petioles 8–30 cm; rachis 2.7–4.2 m; primary pinnae to 27 per side of rachis, pendulous; secondary pinnae 12–27 per side of secondary rachis, with deeply jagged margins. Inflorescences borne among leaves, to 3.5 m; rachillae 80–170, 1.5–2.1 m; male flowers to 15 mm; sepals ca. 5 mm; petals yellowish, 12–15 mm; stamens 80–100; female flowers to 10 mm; sepals ca. 5 mm; petals 6–8 mm. Fruits dull reddish or orange, globose, to 2.5 cm in diam., 1-seeded.

Lowland to montane rain forests or disturbed areas, often planted

or naturalized; 200–1800 m. Guangdong, Guangxi, Hainan, Yunnan [Bhutan, India, Indonesia (Java, Sumatra), Laos, Malaysia (Peninsular), Myanmar, Thailand, Vietnam].

The palm heart is eaten; the stems are used to make implements; and the sheath fibers are used for tinder.

4. Caryota obtusa Griffith, Calcutta J. Nat. Hist. 5: 480. 1845.

董棕 dong zong

Caryota gigas Hahn; *C. obtusidentata* Griffith; *C. rumphiana* Martius var. *indica* Beccari.

Stems solitary, to 40 m tall, 50–90 cm in diam., often swollen. Leaves borne in a compact crown at top of stem; petioles 1–2 m; rachis 4–5.5 m; primary pinnae 19–22 per side of rachis; secondary pinnae 20–27 per side of secondary rachis, with scarcely jagged margins and blunt apices. Inflorescences borne among leaves, to 6 m; rachillae to 200, 2–2.9 m; male flowers to 15 mm; sepals 5–7 mm; petals yellowish, ca. 14 mm; stamens ca. 80; female flowers to 10 mm; sepals ca. 5 mm; petals ca. 8 mm. Fruits reddish, globose, to 3.5 cm in diam., often 2-seeded.

Scattered localities in montane rain forests, usually on limestone soils; 1400–1800 m. Yunnan [India, Laos, Myanmar, Thailand, Vietnam].

Material of this species was previously misidentified as *Caryota urens* Linnaeus (FRPS 13(1): 116. 1991).

The palm heart is rich with starch and eaten locally.

14. ARENGA Labillardière, Bull. Sci. Soc. Philom. Paris 2: 162. 1800, nom. cons.

桄榔属 guang lang shu

Blancoa Blume (1843), not Lindley (1840); *Didymosperma* H. Wendland & Drude; *Gomutus* Corrêa; *Saguerus* Steck.

Understory shrubs to large trees. Stems clustered, sometimes spreading by stolons, less often solitary, usually covered with persistent, fibrous leaf bases. Leaves 5–30, pinnate, seldom undivided; leaf sheaths open, fibrous, commonly persisting on stems; petioles usually covered with distinctive scales; pinnae linear to rhomboid, sometimes lobed on margins, always jagged at apices, bases sometimes with an ear-shaped projection overlapping rachis; pinnae regularly or irregularly arranged, basal few borne in clusters, silvery gray abaxially. Plants usually semelparous; flowering proceeding from top of stem downward (basipetal), rarely in opposite direction (acropetal). Inflorescences branched to 2 orders, rarely spicate, borne among leaves, usually unisexual by suppression of either female or male flowers, solitary or rarely several at a node, covered with several persistent bracts, female inflorescences commonly produced first at apex of stem, and male ones later, below; rachillae 1–100 or more; flowers borne in triads with a central female flower and 2 lateral male flowers. Fruits red, yellowish, or purplish, large, ellipsoid, globose, ovoid, or oblong, 1–3-seeded; mesocarp with irritant crystals of calcium oxalate; endosperm homogeneous; germination remote; eophylls undivided or bifid with jagged margins.

Twenty-one species: from India through SE Asia reaching to New Guinea and Australia; six species (two endemic, one introduced) in China.

1a. Pinnae fewer, to 10 per side of rachis, variously shaped, often rhomboid or lobed, less often linear, without ears at bases.
  2a. Inflorescences with 2–8 rachillae ..... 5. *A. longicarpa*
  2b. Inflorescences with 1(–3) rachillae ..... 6. *A. caudata*
1b. Pinnae many, to 150 per side of rachis, linear, usually with ears at bases.
  3a. Stems clustered ..... 1. *A. engleri*
  3b. Stems solitary.
    4a. Stems to 20 m tall; pinnae irregularly arranged and spreading in different planes; cultivated ..... 2. *A. pinnata*
    4b. Stems to 12 m tall; pinnae regularly arranged and spreading in same plane; naturally occurring.
      5a. Stems to 12 m tall (lowland forests, usually below 600 m) ..... 3. *A. westerhoutii*
      5b. Stems to 8 m tall (montane forests, 1400–2200 m) ..... 4. *A. micrantha*

1. Arenga engleri Beccari, Malesia 3: 184. 1889.

山棕 shan zong

Didymosperma engleri (Beccari) Warburg.

Stems clustered, to 4 m tall, 10–15 cm in diam. Leaf petioles to 1.8 m; rachis to 3 m; pinnae 38–41 per side of rachis, linear, very briefly lobed along margins, without ears at bases, regularly arranged and spreading in same plane except for basal few pinnae; middle pinnae 43–49 cm, ca. 2 cm wide at midpoint. Inflorescences to 60 cm; male rachillae many, 9–27 cm; male flowers 8–14 mm; sepals 2–3 mm; petals 9–14 mm; stamens 25–37; female rachillae many, 27–32 cm; female flowers ca. 3 mm; sepals ca. 2.5 mm; petals ca. 3 mm. Fruits orange or red, globose, ca. 1.5 cm in diam.

● Open places or lowland rain forests; below 900 m. Taiwan; cultivated in other areas.

2. Arenga pinnata (Wurmb) Merrill, Interpr. Herb. Amboin. 119. 1917.

砂糖椰子 sha tang ye zi

Saguerus pinnatus Wurmb, Verh. Batav. Genootsch. Kunst. 1: 351. 1779; *Arenga gamuto* Merrill; *A. griffithii* Seemann ex H. Wendland; *A. saccharifera* Labillardière; *Borassus gomutus* Loureiro; *Caryota onusta* Blanco; *Gomutus rumphii* Corrêa; *G. saccharifer* (Labillardière) Sprengel; *G. vulgaris* Oken; *S.*

gamuto Houttuyn; *S. rumphii* (Corrêa) Roxburgh; *S. saccharifer* (Labillardière) Blume; *Sagus gomutus* (Loureiro) Perrottet.

Stems solitary, to 20 m tall, 40–60 cm in diam. Leaf petioles to 1.5 m; rachis to 5 m; pinnae to 150 per side of rachis, linear, with ears at bases, irregularly arranged and spreading in different planes; middle pinnae 120–160 cm, 5–9 cm wide at mid-point. Inflorescences to 2.5 m; male rachillae 40–50, to 40 cm; male flowers 12–15 mm; sepals ca. 5 mm; petals ca. 12 mm; stamens 60–120; female rachillae 40–50, ca. 30 cm; female flowers 10 mm; sepals ca. 2 mm; petals ca. 4 mm. Fruits greenish, yellowish, or orangish, globose to ovoid, to 7 × 6 cm.

Cultivated near villages or in towns. Fujian (Xiamen), Guangdong (Guangzhou), Hainan, Yunnan [native to NE India (Assam), Indonesia, Malaysia, Myanmar, Philippines, and Thailand; introduced elsewhere].

Arenga pinnata, the "sugar palm," was formerly an important source of sugar derived from tapping the inflorescences, especially in Malaysia and Indonesia. Tapping is still carried out on a local scale. There are many other minor uses. It is relatively rare in China and only occasionally planted.

3. Arenga westerhoutii Griffith, Calcutta J. Nat. Hist. 5: 474. 1845.

桄榔 guang lang

Saguerus westerhoutii (Griffith) H. Wendland & Drude.

Stems solitary, to 12 m tall, 40–60 cm in diam. Leaf petioles 1–1.8 m; rachis 3–4 m; pinnae 80–150 per side of rachis, linear, with ears at bases, regularly arranged and spreading in same plane except for basal few pinnae; middle pinnae to 130 cm, to 9.5 cm wide at mid-point. Inflorescences to 3 m; male rachillae 60–70, to 60 cm; male flowers 20–25 mm; sepals 4–6 mm; petals 20–25 mm; stamens 200–300; female rachillae ca. 40, 80–120 cm; female flowers to 10 mm; sepals ca. 5 mm; petals ca. 10 mm. Fruits greenish black, globose, to 7 cm in diam.

Lowland rain forests; below 600(–1400) m. Guangxi, Hainan, Yunnan [Cambodia, Laos, Malaysia (Peninsular), Myanmar, Thailand, Vietnam].

Arenga westerhoutii is quite common in Yunnan, where it can be easily identified by its large size and regularly arranged leaflets. The leaves are used for thatching, and the palm heart is occasionally eaten.

4. Arenga micrantha C. F. Wei, Acta Phytotax. Sin. 26: 404. 1988.

小花桄榔 xiao hua guang lang

Stems solitary, 2–8 m tall, to 15 cm in diam. Leaf petioles to 1 m; rachis to 2 m; pinnae many per side of rachis, linear-lanceolate, very briefly lobed along margins, with ears at bases, regularly arranged and spreading in same plane except for basal few pinnae; middle pinnae 30–36 cm, 3–4 cm wide at mid-point. Inflorescences 80–100 cm; male rachillae to 100, to 17 cm; male flowers 4–5.5 mm; sepals ca. 2 mm; petals ca. 5.5 mm; stamens 9–23; female inflorescences not known. Fruits not known.

Montane rain forests; 1400–2200 m. Xizang [Bhutan, India].

5. Arenga longicarpa C. F. Wei, Acta Bot. Austro Sin. 4: 7. 1989.

长果桄榔 chang guo guang lang

Stems clustered, 2–3 m tall, to 7 cm in diam. Leaf petioles 2–2.5 m; rachis to 2 m; pinnae few per side of rachis, rhomboid, lobed along distal margins, without ears at bases, regularly arranged and spreading in same plane except for basal few pinnae; middle pinnae to 40 cm, to 5 cm wide at mid-point. Inflorescences to 50 cm; male rachillae 2–8, to 20 cm; male flowers 8–9 mm; sepals to 3 mm; petals ca. 15 mm; stamens 6–20; female rachillae 2–8, to 35 cm; female flowers not known. Fruits red to purple, ovoid to oblong, curved, ca. 1.8 × 1 cm.

● Lowland rain forests or secondary forests; below 800 m. Guangdong.

6. Arenga caudata (Loureiro) H. E. Moore, Principes 4: 114. 1960.

双籽棕 shuang zi zong

Borassus caudatus Loureiro, Fl. Cochinch. 2: 619. 1790 [*"caudata"*]; *Arenga hookeriana* (Beccari) Whitmore; *Blancoa caudata* (Loureiro) Kuntze; *Didymosperma caudatum* (Loureiro) H. Wendland & Drude; *D. caudatum* var. *stenophyllum* Beccari; *D. caudatum* var. *tonkinense* Beccari; *D. hookerianum* Beccari; *D. tonkinense* (Beccari) Beccari ex Gagnepain; *Wallichia caudata* (Loureiro) Martius.

Stems clustered, to 1.5 m tall, 1–2 cm in diam. Leaf petioles to 0.4 m; rachis to 0.5 m; pinnae to 10 per side of rachis, linear to rhomboid (rarely blade undivided), briefly lobed along margins and with elongate apices, without ears at bases, regularly arranged and spreading in same plane except for basal few pinnae; middle pinnae to 20 cm, to 7 cm wide at mid-point. Inflorescences to 50 cm; male rachillae 1(–3), 16–20 cm; male flowers 5–8 mm; sepals ca. 1 mm; petals 5–8 mm; stamens 13–15; female rachilla 1, to 30 cm; female flowers ca. 5 mm; sepals ca. 1 mm; petals 2–3 mm. Fruits red, ellipsoid to oblong, ca. 1.5 × 0.8 cm.

Lowland rain forests or deciduous forests, sometimes on limestone outcrops; below 700 m. Guangxi, Hainan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

The leaves are used to weave hats.

15. WALLICHIA Roxburgh, Pl. Coromandel 3: 91. 1820.

瓦理棕属 wa li zong shu

Asraoa J. Joseph; *Harina* Buchanan-Hamilton; *Wrightea* Roxburgh.

Stems clustered or rarely solitary, covered with persistent, fibrous leaf sheaths. Leaves spirally or distichously arranged; sheaths with prominent, fibrous ocreas; petioles rounded in cross section, brown tomentose; rachis tomentose as petiole; pinnae induplicate,

narrowed at base, lanceolate, broadly lanceolate, or oblong, deeply to shallowly lobed, with smooth to serrate, undulate margins, blunt at apex, several apical pinnae joined into compound, broad terminal pinna, silvery gray with small, brown dots abaxially, with broad lines of brown tomentum parallel with veins, with 1 prominent main vein and minor veins diverging from base. Plants semelparous; flowering proceeding from top of stem downward (basipetal), rarely in opposite direction (acropetal). Inflorescences pendulous or erect, branched to 1 order, rarely spicate, usually unisexual by suppression of either female or male flowers; peduncular bracts many, persistent, sheathing or not sheathing peduncle, densely brown or black tomentose adaxially; male flowers borne in spirally arranged pairs, or sometimes triads of 2 male flowers flanking a non-functional female flower, subtended by a very small bract; sepals cupular, lobed or not lobed, sometimes lobes briefly imbricate; petals free, valvate; stamens 3–19, linear, basifixed, pistillode absent; female flowers borne singly and spirally, surrounded by 1 small outer bract and 2 inner, broad, imbricate bracts; sepals united into a low, cupular calyx; petals united into a 3-lobed corolla, lobes valvate distally initially, free and spreading after anthesis; staminodes absent. Fruits variously colored, ovoid to ellipsoid or oblong, with apical stigmatic residue; germination remote; eophylls simple.

Eight species: Bhutan, China, NE India, Laos, Myanmar, Nepal, Thailand, Vietnam; five species in China.

The name *Harina wallichia* Steudel (Nomencl. Bot., ed. 2, 1: 722. 1840), sometimes treated as a synonym of *Wallichia caryotoides*, is of uncertain application.

1a. Stems solitary; leaves arranged in 1 or a few planes; pinnae from middle of leaf irregularly arranged in clusters of 3–8 ..... 1. *W. disticha*
1b. Stems clustered; leaves arranged spirally; pinnae from middle of leaf regularly arranged.
2a. Stems short and subterranean or to 1 m tall, to 40 cm in diam.; pinnae 16 or 17 per side of rachis, ± oblong ..... 2. *W. oblongifolia*
2b. Stems aerial, to 4 m tall, 1.5–10 cm in diam.; pinnae 3–19 per side of rachis, lanceolate or broadly lanceolate.
3a. Stamens 3 ..... 3. *W. triandra*
3b. Stamens 6–19.
4a. Pinnae 5–7 per side of rachis; male rachillae 0.5–1.5 cm; female rachillae to 6 cm; stamens 6 or 7 ..... 4. *W. gracilis*
4b. Pinnae 8–12 per side of rachis; male rachillae 12.5–20.5 cm; female rachillae 10–20 cm; stamens 11–16 ..... 5. *W. caryotoides*

1. Wallichia disticha T. Anderson, J. Linn. Soc., Bot. 11: 6. 1869.

二列瓦理棕 er lie wa li zong

Didymosperma distichum (T. Anderson) J. D. Hooker; *Wallichia yomae* Kurz.

Stems solitary, to 9 m tall, 15–25 cm in diam. Leaves arranged in 1 or a few planes; petioles 0.5–1.5 m; rachis 1.8–3.5 m; pinnae 45–73 per side of rachis, linear or linear-lanceolate, shallowly lobed, irregularly arranged in clusters of 3–8 pinnae, spreading in different planes; middle pinnae 56–80 × 5–8 cm. Inflorescences unisexual, male and female borne on same stem, female terminal and male lateral; male inflorescences to 1.2 m, pendulous; rachillae to over 1000, to 30 cm; male flowers to 10 mm; stamens 8–15; female inflorescences to 1 m, pendulous; rachillae 40–50, 30–60 cm. Fruits reddish brown, ellipsoid, to 2.2 × 1.5 cm.

Lowland to montane rain forests, especially in rocky places on steep slopes, often in disturbed areas; below 1200 m. Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, Thailand].

The sago extracted from the pith of the stems is eaten in times of famine.

2. Wallichia oblongifolia Griffith, Calcutta J. Nat. Hist. 5: 486. 1845.

密花瓦理棕 mi hua wa li zong

Harina densiflora (Martius) Walpers; *H. oblongifolia* (Griffith) Griffith; *Wallichia densiflora* Martius.

Stems clustered, short and subterranean or to 1 m tall, to 40 cm in diam. Leaves spirally arranged; petioles to 2 m; rachis 1.5–2.5 m; pinnae 16 or 17 per side of rachis, ± oblong, with several lobes, regularly and alternately arranged, spreading in same plane, proximal 2 or 3 pinnae in a cluster, smallest erect; middle pinnae 45–56 × 7–12 cm, widest near apex. Inflorescences unisexual, male and female borne on separate stems; male inflorescences pendulous, not seen in their entirety; rachillae many, at least to 12 cm; male flowers 7–10 mm; stamens 6; female inflorescences to 1 m, horizontally spreading; rachillae 16–32, to 35 cm; female flowers to 6 mm. Fruits greenish brown to reddish, ovoid to ellipsoid, to 1.5 × 0.8 cm.

Lowland or montane rain forests, especially in rocky places on steep slopes; 200–1200 m. Yunnan [Bangladesh, Bhutan, India, Myanmar, Nepal].

The leaves are used for thatching and making brooms.

3. Wallichia triandra (J. Joseph) S. K. Basu, Principes 20: 120. 1976.

三药瓦理棕 san yao wa li zong

Asraoa triandra J. Joseph, Bull. Bot. Surv. India 14: 144. 1975.

Stems clustered, to 3 m tall, 3–5 cm in diam. Leaves spirally arranged; petioles not seen; rachis to 2 m; pinnae 11–19 per side of rachis, lanceolate, with 2 pronounced lobes, regularly arranged, spreading in same plane; middle pinnae to 40 × 10 cm. Inflorescences unisexual, female terminal and male lateral; male inflorescences to 35 cm, erect; rachillae to 16 cm;

male flowers to 8 mm; stamens 3; female inflorescences to 35 cm, erect; rachillae 20–30 cm; female flowers ca. 4 mm. Fruits red, oblong, to 1.3 × 0.7 cm.

Montane rain forests on steep slopes; 900–2000 m. Xizang [NE India].

4. Wallichia gracilis Beccari, Webbia 3: 211. 1910.

瓦理棕 wa li zong

Wallichia chinensis Burret.

Stems clustered, to 1.5 m tall, 2–2.5 cm in diam. Leaves spirally arranged; petioles 1–1.7 m; rachis 0.45–1.2 m; pinnae 5–7 per side of rachis, lanceolate, with 2 lobes, regularly arranged, spreading in same plane; middle pinnae 30–40 × 6–9 cm. Inflorescences unisexual, subtended by smaller leaves, male or female terminal; male inflorescences 12–25 cm, pendulous; rachillae many, 0.5–1.5 cm, short and crowded on rachis; male flowers to 5 mm; stamens 6 or 7; female inflorescences to 35 cm, pendulous; rachillae many, to 6 cm; female flowers ca. 2 mm. Fruits yellow, ovoid to ellipsoid, to 1.5 × 1 cm.

Lowland rain forests; 200–1000 m. Guangxi [Vietnam].

5. Wallichia caryotoides Roxburgh, Pl. Coromandel 3: 91. 1820.

琴叶瓦理棕 qin ye wa li zong

Harina caryotoides (Roxburgh) Buchanan-Hamilton; *Wallichia mooreana* S. K. Basu; *W. siamensis* Beccari; *Wrightea caryotoides* (Roxburgh) Roxburgh.

Stems clustered, to 3 m tall, 2–10 cm in diam. Leaves spirally arranged; petioles 0.8–1.5 m; rachis 0.9–1.5 m; pinnae 8–12 per side of rachis, lanceolate, with 2 pronounced lobes, regularly and alternately arranged except for clustered proximal 2 or 3 pinnae, spreading in same plane; middle pinnae 25–49 × 5–11 cm. Inflorescences unisexual, subtended by smaller leaves, male and female borne on same or separate stems, female terminal, male lateral; male inflorescences 40–50 cm, erect; rachillae 21–30, 12.5–20.5 cm; male flowers 5–6 mm; stamens 11–16; female inflorescences 40–50 cm, erect; rachillae 7–17, 10–20 cm; female flowers to 2.5 mm at anthesis. Fruits red, ovoid to ellipsoid, to 1.7 × 0.8 cm.

Lowland to montane rain forests, especially in rocky places on steep slopes; below 1800 m. Yunnan [Bangladesh, Myanmar, Thailand].

16. COCOS Linnaeus, Sp. Pl. 2: 1188. 1753.

椰子属 ye zi shu

Stems large, solitary, gray, often leaning. Leaves 25–30, pinnate; leaf sheaths open, fibrous; pinnae linear, 1-veined, numerous, regularly arranged along rachis, spreading in same plane. Inflorescences branched to 1 order, borne among leaves, covered by a prophyll and woody, persistent peduncular bract; flowers unisexual, borne in triads at bases of rachillae, male only toward apices. Fruit large, 1-seeded; germination adjacent; eophylls undivided.

One species: widely introduced and cultivated throughout tropical areas of the world, especially along sandy coasts.

1. Cocos nucifera Linnaeus, Sp. Pl. 2: 1188. 1753.

椰子 ye zi

Cocos indica Royle; *C. nana* Griffith.

Stems to 20 m tall, 30 cm or more in diam. Pinnae to 100 per side of rachis, regularly arranged and stiffly spreading in same plane. Inflorescences borne among leaves. Fruits greenish to reddish brown, ovoid to irregularly globose, to 30 × 20 cm.

Commonly planted at low elevations, occasionally to 1000 m. Guangdong, Hainan (especially common), Taiwan, Yunnan [coastal areas throughout the tropics].

The coconut is an important commercial crop, producing coconut oil, coir, and toddy. Coconut oil is obtained from the dried endosperm (known as copra) and has been used in the manufacture of soap and margarine. Coir is obtained from the fibrous mesocarp and is used to weave mats and rugs. Toddy is sugar-containing sap, which is tapped from unopened inflorescences and often fermented into an alcoholic drink. Apart from these major uses, the coconut has a host of minor uses, especially as an ornamental plant. In Hainan, coconut milk from unripe fruits is sold both fresh and tinned.

17. ARECA Linnaeus, Sp. Pl. 2: 1189. 1753.

槟榔属 bin lang shu

Stems solitary or clustered, tall to short or subterranean, ringed with conspicuous leaf scars. Leaves 4–12, pinnate or occasionally undivided; leaf sheaths closed, forming a distinct, green or yellowish crownshaft, rarely sheaths open and not forming crownshafts; rachis sometimes strongly recurved, mostly spreading horizontally; pinnae usually regularly arranged, spreading in same plane, those at apex joined with only short splits at apices, giving compound pinnae with lobed apices. Inflorescences branched to 3 orders, borne below crownshaft; prophyll present, peduncular bract absent; flowers unisexual, borne in triads of a central large female flower and 2 lateral much smaller male flowers, usually triads only at bases of rachillae, above male flowers only. Fruits usually bright red, small to moderate, ellipsoid to globose or spindle-shaped, commonly beaked, 1-seeded; endosperm ruminate; germination adjacent; eophylls bifid.

About 48 species: from Sri Lanka and NE India through SE Asia to as far east as New Guinea and the Solomon Islands; one species (introduced) in China.

Areca triandra Roxburgh ex Buchanan-Hamilton (三药槟榔 san yao bin lang) is cultivated in Guangdong, Taiwan, and Yunnan. It differs from *Areca catechu* by the smaller, clustered stems, to 4 m high, and is native to India, Peninsular Malaysia, and Indochina.

1. Areca catechu Linnaeus, Sp. Pl. 2: 1189. 1753.

槟榔 bin lang

Areca faufel Gaertner; *A. himalayana* Griffith ex H. Wendland; *A. hortensis* Loureiro; *A. nigra* Giseke ex H. Wendland; *Sublimia areca* Commerson ex Martius.

Stems solitary, erect, to 20 m tall, 10–20 cm in diam., gray with conspicuous nodes. Leaf sheaths closed and forming green, slightly swollen crownshafts to 1 m; petioles no more than 5 cm; rachis recurved, to 2 m; pinnae 20–30 per side of rachis, regularly and closely arranged, stiffly erect; middle pinnae 30–60 cm, 3–7 cm wide at mid-point. Inflorescences infrafoliar, branched to 3 orders, erect; rachillae many, flexuose, yellowish green, to 25 cm; male flowers solitary, alternate and distichous on rachillae; stamens 6; female flowers at bases of rachillae only, larger than male flowers. Fruits yellow, orange, or red, ovoid, to 8 × 6 cm.

Cultivated and commonly seen around houses. Guangxi, Hainan, Taiwan, Yunnan [origin probably C Malesia; widely cultivated throughout tropical Asia].

Areca catechu is an important cultivated species. The sliced seed (betel nut) is chewed as a mild narcotic. The plant also has great ornamental value and many other minor uses.

18. PINANGA Blume, Bull. Sci. Phys. Nat. Néerlande 1: 65. 1838.

山槟榔属 shan bin lang shu

Pseudopinanga Burret.

Stems clustered or less often solitary, ringed with prominent leaf scars, tall to short or subterranean. Leaves 5–11, pinnate or occasionally undivided; leaf sheaths closed, forming a prominent, yellowish to reddish green crownshaft (rarely open and not forming crownshafts), usually covered with variously colored scales; pinnae regularly arranged along rachis, spreading in same plane, linear to sigmoid, 1- to several veined, at leaf apex pinnae joined with only a short split at tip, giving pinnae a lobed appearance. Inflorescences branched to 1 order, with a few rachillae, sometimes spicate, borne below crownshaft, rarely among leaves, covered initially with prophyll; rachillae becoming pendulous, seldom remaining erect, usually smooth, sometimes hairy; flowers unisexual, borne throughout in triads of 1 female flower flanked by 2 male flowers, these arranged distichously along rachillae, or less often tristichously or spirally. Fruits red, orange, or black, small, ellipsoid to globose or spindle-shaped, commonly beaked, 1-seeded, ripening through a series of colors, commonly from green to pink to red to black; endosperm ruminate, rarely homogeneous; germination adjacent; eophylls bifid.

About 137 species: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Papua New Guinea, Thailand, Vietnam; five species (one endemic) in China.

The record in FRPS (13(1): 140. 1991) of *Pinanga hexasticha* (Kurz) Scheffer is probably based on a misidentification. *Pinanga hexasticha* is restricted to Myanmar.

1a. Inflorescences with 1 rachilla; flower triads and fruits spirally or tristichously arranged along rachilla.
  2a. Rachilla triangular in cross section; flowers and fruits tristichously arranged along rachilla ..... 1. *P. gracilis*
  2b. Rachilla rounded in cross section; flowers and fruits spirally arranged along rachilla ..... 2. *P. acuminata*
1b. Inflorescences with more than 1 rachilla, rarely with 1 rachilla; flower triads and fruits distichously arranged along rachillae.
  3a. Rachillae ca. 30 ..... 3. *P. tashiroi*
  3b. Rachillae 1–8.
    4a. Pinnae 10–28 per side of rachis; rachillae 3–8 ..... 4. *P. sylvestris*
    4b. Pinnae 3–6 per side of rachis, or rarely leaf undivided; rachillae 1–4 ..... 5. *P. baviensis*

1. Pinanga gracilis Blume, Rumphia 2: 77. 1839.

纤细山槟榔 xian xi shan bin lang

Areca gracilis Roxburgh, Fl. Ind., ed. 1832, 3: 619. 1832, not Buchanan-Hamilton (1826); *Nenga gracilis* (Blume) Beccari; *Pinanga patula* Blume var. *gracilis* (Blume) Scheff; *Seaforthia gracilis* (Blume) Martius.

Stems clustered, to 4 m tall, ca. 1.5 cm in diam., reddish brown. Leaves pinnate, rarely undivided; sheaths closed and forming crownshafts, 21–34 cm, green with reddish brown scales; petioles 9–13 cm; rachis 40–60 cm; pinnae (1–)3–8 per side of rachis, green abaxially, sigmoid, regularly arranged, distantly spaced; middle pinnae to 55 × 3–10 cm. Inflorescences spicate, pendulous; peduncles 1.4–4 × 0.5–0.6 cm; rachis absent; rachilla 1, 12–17 cm, straight, triangular in cross section, glabrous; triads tristichously arranged, superficial on rachilla; male flowers to 8 mm, deciduous; sepals to 1 mm, connate at base into a 3-lobed cupule; petals to 8 mm, valvate; stamens ca. 35; female flowers to 2.5 mm; sepals to 2.5 mm, rounded at apex, ciliate; petals to 2.5 mm, ciliate. Fruits red, ellipsoid, to 1.8 × 1 cm.

Lowland to montane rain forests; below 1200 m. Xizang [Bangladesh, Bhutan, India, Myanmar, Nepal].

2. Pinanga acuminata A. J. Henderson, Makinoa, n.s., 6: 2. 2007.

滇缅山槟榔 dian mian shan bin lang

Stems clustered, to 5 m tall, 1.5–2 cm in diam., yellowish. Leaves pinnate; sheaths closed and forming crownshafts, to 25 cm, yellowish green with reddish brown scales; petioles to 30 cm; rachis 45–65 cm; pinnae 6–9 per side of rachis, green

abaxially, sigmoid, multi-veined, regularly arranged, distantly spaced; middle pinnae 30–39 × 2.5–4 cm. Inflorescences spicate, pendulous or rarely erect; peduncles 1.5–2 × 0.4–0.5 cm; rachis absent; rachilla 1, 11–19 cm, straight, rounded in cross section, glabrous; triads spirally arranged, sunken in rachilla; male flowers to 6 mm, semipersistent; sepals to 1.5 mm, connate at base into a 3-lobed cupule; petals to 6 mm, triangular, valvate; stamens not seen; female flowers ca. 3 mm; sepals ca. 3 mm, acuminate, scarcely ciliate; petals ca. 3 mm, ciliate. Fruits red, ellipsoid, to 1.8 × 1 cm.

Lowland rain forests; below 1000 m. Yunnan [Myanmar].

3. Pinanga tashiroi Hayata, Icon. Pl. Formosan. 3: 196. 1913.

兰屿山槟榔 lan yu shan bin lang

Pseudopinanga tashiroi (Hayata) Burret.

Stems clustered or solitary, to 5 m tall, to 5 cm or more in diam., swollen at bases. Leaves pinnate; sheaths closed and forming crownshafts, to 1 m, green with reddish brown scales; petioles to 60 cm; rachis to 1.5 m; pinnae many per side of rachis, green abaxially, linear, multi-veined, regularly arranged; middle pinnae to 60 × 2–2.5 cm. Inflorescences branched, pendulous; peduncles not seen; rachis not seen; rachillae ca. 30, to 21 cm, glabrous; triads distichously arranged, superficial on rachillae; male flowers 10–11 mm, deciduous; sepals connate into a 3-lobed calyx; petals to 10 mm; stamens 36–42; female flowers ca. 5 mm; sepals ca. 3 mm, rounded at apex, ciliate; petals ca. 3 mm, ciliate. Fruits red, ovoid to globose, to 1.8 × 1.2 cm.

● Lowland rain forests; below 500 m. Taiwan (Lan Yu).

The seeds are chewed as a substitute for betel nut.

4. Pinanga sylvestris (Loureiro) Hodel, Palm J. 139: 55. 1998.

华山竹 hua shan zhu

Areca sylvestris Loureiro, Fl. Cochinch. 2: 568. 1790; *Pinanga chinensis* Beccari; *P. macroclada* Burret; *Ptychosperma sylvestre* (Loureiro) Miquel; *Seaforthia sylvestris* (Loureiro) Blume ex Martius.

Stems clustered, to 6 m tall, 1.5–3.5 cm in diam., reddish brown. Leaves pinnate; sheaths closed and forming crownshafts, 17–45 cm, green or yellowish with reddish scales; petioles 10–25 cm; rachis 1–1.3 m; pinnae 10–28 per side of rachis, green abaxially, linear, distantly spaced, regularly arranged; middle pinnae 39–60 × 2–5 cm. Inflorescences branched, pendulous, occasionally erect; peduncles 2.5–6 × ca. 0.7 cm; rachis 0.5–2.5 cm; rachillae 3–8, 9–26 cm, zigzag, triangular in cross section, glabrous; triads distichously arranged, superficial on rachillae; male flowers not seen; female flowers to 3 mm; sepals to 3 mm, rounded at apex, ciliate; petals to 3 mm, ciliate. Fruits red, ellipsoid, 1.4–1.8 × 0.5–0.7 cm.

Lowland and montane rain forests; 100–1700 m. Yunnan [Cambodia, Laos, Myanmar, Thailand].

5. Pinanga baviensis Beccari, Webbia 3: 193. 1910.

变色山槟榔 bian se shan bin lang

Pinanga discolor Burret; *P. sinii* Burret; *P. viridis* Burret.

Stems clustered, to 5 m tall, 0.8–2.5 cm in diam., reddish brown. Leaves pinnate, rarely undivided; sheaths closed and forming crownshafts, 18–34 cm, green or yellowish green, with brown scales; petioles 7–33 cm; rachis 32–100 cm; pinnae (1–)3–12 per side of rachis, gray-green abaxially, falcate, not contracted at bases, multi-veined, regularly arranged, closely spaced; middle pinnae 30–39 × 3–7 cm. Inflorescences branched, pendulous; peduncles 2–3 cm, ca. 0.4 cm wide; rachis 0–0.5 cm; rachillae (1 or)2–5, 10–15 cm, zigzag, rectangular in cross section, glabrous; triads distichously arranged, superficial on rachillae; male flowers to 13 mm, deciduous; sepals to 3.5 mm, connate into a 3-lobed, flat, membranous calyx; petals to 12 mm, unequal, triangular, fleshy, acute; stamens 20 or 21; female flowers to 3 mm; sepals to 3 mm, imbricate, rounded at apices or briefly acuminate, smooth or ciliate; petals to 3 mm, smooth or ciliate. Fruits red, ellipsoid, to 2.5 × 0.8–1 cm.

Lowland rain forests. Fujian, Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

Cultivated taxa

Archontophoenix H. Wendland & Drude (假槟榔属 jia bin lang shu). One species is cultivated in tropical and subtropical areas of Fujian, Guangdong, Guangxi, Hainan, Taiwan, and Yunnan: *A. alexandrae* (F. Mueller) H. Wendland & Drude (Linnaea 39: 212. 1875; *Ptychosperma alexandrae* F. Mueller, Fragm. 5(33): 47. 1865; 假槟榔 jia bin lang), native to Australia.

Borassus Linnaeus (糖棕属 tang zong shu). One species is cultivated in S Yunnan (Xishuangbanna): *B. flabellifer* Linnaeus (Sp. Pl. 2: 1187. 1753; 糖棕 tang zong), native to Bangladesh, Cambodia, India, Indonesia, Laos, Myanmar, Sri Lanka, Thailand, and Vietnam.

Butia (Beccari) Beccari (布迪椰子属 bu di ye zi shu). One species is cultivated as an ornamental: *B. capitata* (Martius) Beccari (Agric. Colon. 10: 507. 1916; *Cocos capitata* Martius, Hist. Nat. Palm. 2: 114. 1826; 布迪椰子 bu di ye zi), native to Brazil and Uruguay.

Corypha Linnaeus (贝叶棕属 bei ye zong shu). One species is cultivated in S Yunnan (Xishuangbanna): *C. umbraculifera* Linnaeus (Sp. Pl. 2: 1187. 1753; 贝叶棕 bei ye zong), native to India and Sri Lanka.

Dypsis Noronha ex Martius (散尾葵属 san wei kui shu). One species is cultivated in S China: *D. lutescens* (H. Wendland) Beentje & J. Dransfield (Palms Madagascar, 212. 1995; *Chrysalidocarpus lutescens* H. Wendland, Bot. Zeitung 36: 117. 1878; 散尾葵 san wei kui), native to Madagascar.

Elaeis Jacquin (油棕属 you zong shu). One species is cultivated in Hainan, Taiwan, and Yunnan: *E. guineensis* Jacquin (Select. Stirp. Amer. Hist. 280. 1763; 油棕 you zong), native to W Africa but now very widely grown for its oil-rich fruits.

Hyophorbe Gaertner (酒瓶椰子属 jiu ping ye zi shu). One species is becoming a common street tree in Hainan: *H. lagenicaulis* (L. H. Bailey) H. E. Moore (Principes 20: 119. 1976; *Mascarena lagenicaulis* L. H. Bailey, Gentes Herb. 6: 74. 1942; 酒瓶椰子 jiu ping ye zi), native to Round Island, Mauritius.

Raphia P. Beauvois (酒椰属 jiu ye shu). One species is recorded as cultivated in China: *R. vinifera* P. Beauvois (Fl. Oware 1: 77. 1806; 酒椰 jiu ye), native to W Africa.

Roystonea O. F. Cook (王棕属 wang zong shu). Two species are recorded as cultivated in China: *R. oleracea* (Jacquin) O. F. Cook (Bull. Torrey Bot. Club 28: 554. 1901; *Areca oleracea* Jacquin, Select. Stirp. Amer. Hist. 278. 1763; 菜王棕 cai wang zong) and *R. regia* (Kunth) O. F. Cook (Science, n.s., 12: 479. 1900; *Oreodoxa regia* Kunth in Humboldt et al., Nov. Gen. Sp. 1, ed. 4°: 305. 1816; 大王椰子 da wang ye zi), both native to the Caribbean region.

Sabal Adanson (箬棕属 ruo zong shu). Two species are recorded as cultivated in China: *S. minor* (Jacquin) Persoon (Syn. Pl. 1: 399. 1805; *Corypha minor* Jacquin, Hort. Bot. Vindob. 3: 8. 1776; *Chamaerops acaulis* Michaux; 小箬棕 xiao ruo zong) and *S. palmetto* (Walter) Loddiges ex Schultes & J. H. Schultes (Syst. Veg. 7: 1487. 1830; *Corypha palmetto* Walter, Fl. Carol. 119. 1788; 箬棕 ruo zong), both native to SE United States.

Syagrus Martius (金山葵属 jin shan kui shu). One species is cultivated in S China: *S. romanzoffiana* (Chamisso) Glassman (Fieldiana, Bot. 31: 382. 1968; *Cocos romanzoffiana* Chamisso, Choris. Voy. Pittor. 5. 1822; 皇后葵 huang hou kui), native to Brazil.

Washingtonia Rafinesque (华盛顿棕属 hua sheng dun zong shu). One species is cultivated in Fujian, Guangdong, Taiwan, and Yunnan: *W. filifera* (Linden ex André) H. Wendland (Bot. Zeitung (Berlin) 37: lxi, 68. 1880; *Pritchardia filifera* Linden ex André, Ill. Hort. 24: 32. 1877; 毛华盛顿棕 mao hua sheng dun zong), native to Mexico (Baja California) and the United States (Arizona, California); and one species is cultivated in S China: *W. robusta* H. Wendland (Gart.-Zeitung (Berling) 2: 198. 1883; 华盛顿棕 hua sheng dun zong), native to Mexico (Baja California, Sonora).

There are many newly introduced palm species cultivated in China as ornamental and indoor plants.