

MARATTIACEAE

合囊蕨科 he nang jue ke

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Plants terrestrial (rarely epiphytic, sometimes in streams), evergreen. Rhizomes erect, ascending, or creeping, amyloseous (starchy), polycyclostelic to dictyostelic. Fronds monomorphic and long-lived or dimorphic and fertile ones short-lived (*Danaea*), simple or compound, 1–4-pinnate or (pedate-)palmate (*Christensenia*), small (ca. 20 cm) to very large (up to at least 6 m). Stipes fleshy, with a pair of stipulelike appendages at base, often with conspicuous lenticels. Pulvini at base of fronds, at nodes, at bases of pinnae, and in some species at “naked” nodes (without pinnae) along stipe. Veins free, simple or bifurcate, or reticulate (*Christensenia*), false veins present between true veins or absent. Tissues mucilaginous. Indument of multicellular uniseriate hairs and basifixed or peltate scales. Sori lacking true indusia, usually with paraphyses, superficial, sunken or stalked, elongate along veins, bilateral or radial. Sporangia partially or completely fused into synangia, dehiscing by a slit or pore. Spores trilete or monoete, with bullate, muriform, or stellate ornamentation. Prothalli very large, thalloid, photosynthetic.

Six genera and ca. 100 species: pantropical, *Danaea* Smith, *Eupodium* J. Smith, and *Marattia* Swartz in the Neotropics, *Angiopteris*, *Christensenia*, and *Ptisana* in the Paleotropics; three genera and 30 species (17 endemic) in China.

The delimitation of certain species of *Angiopteris* is unclear.

The following papers are relevant: Christenhusz (Ann. Univ. Turku., A II, 216: 1–134. 2007); Christenhusz and Toivonen (Biol. Invas. 10: 1215–1228. 2008); Murdock (Amer. J. Bot. 95: 626–641. 2008); and Murdock (Taxon 57: 737–755. 2008).

Ching Ren-chang, Fu Shu-hsia, Wang Chu-hao & Shing Gung-hsia. 1959. Angiopteridaceae and Christenseniaceae. In: Ching Ren-chang, ed., Fl. Reipubl. Popularis Sin. 2: 27–66, 330–345; Zhang Xianchun. 2004. Marattiaceae. In: Zhang Xianchun, ed., Fl. Reipubl. Popularis Sin. 6(3): 246–248.

- 1a. Fronds simple, pedately lobed to palmately compound; venation reticulate; synangium radial 2. *Christensenia*
1b. Fronds pinnate (sometimes simple when plants juvenile); venation free, simple or bifurcate; synangium ovate.
2a. Sporangia fully fused into synangia, synangia bivalved 1. *Ptisana*
2b. Sporangia fused basally but free apically, synangia composed of globose sporangia 3. *Angiopteris*

1. PTISANA Murdock, Taxon 57: 744. 2008.

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Plants terrestrial. Rhizomes erect. Stipes with pulvini at base of pinnae and at nodes. Laminae 1–4-pinnate, evenly divided throughout, primary division generally (sub-)opposite, terminal segments usually with a prominent suture at point of attachment; pinna margins usually dentate, occasionally crenulate or entire. Venation free, simple or bifurcate. Scales peltate, often asymmetrical and appearing basifixed, larger scales stalked, scale cells elongate; hairs uniseriate, simple or branching. Sori on veins, marginal to medial. Sporangia fully fused into sessile synangia, outer walls composed of small, rounded cells, mature synangia not sulcate along septa; synangia comprised of 2 opposing rows of sporangia and subtended by rings of paraphyses or uniseriate hairs; synangium opening as a unit, deeply cut, bivalved; sporangia dehiscing by a vertical slit on inner surface of each sporangium valve. Spores monoete (rarely trilete or alete), exospores granular to rugose. $2n = 78, 156$.

About 20–25 species: widely distributed in the Paleotropics with the highest diversity in New Guinea, formerly often referred to the genus *Marattia* (a genus restricted to the Neotropics and Hawaii); one species in China.

1. *Ptisana pellucida* (C. Presl) Murdock, Taxon 57: 747. 2008.

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Marattia pellucida C. Presl, Suppl. Tent. Pterid. 10. 1845; *M. haenkeana* C. Presl; *M. vestita* Christ.

Rhizomes erect, globose, up to 40 cm tall. Fronds up to 2 × 1.5 m. Stipes shorter than laminae, ca. 2 cm in diam., covered with cortical spines and irregularly toothed, narrowly lanceolate

brown scales. Laminae oblong in outline, tripinnate, herbaceous to papery; pinnae up to 60 cm; ultimate pinnules narrowly elliptic, 6–10 × 1–1.5 cm, bases cuneate, margins serrate, apices acuminate; veins free, 1.5–2 mm apart, simple, not forked; costae with small, castaneous, thin scales with bullate bases. Synangia medial or suprasedial, 1–2.2 mm, with up to 8- or 9-cellular uniseriate paraphyses, branched paraphyses rare.

Forests on slopes, very rare. Taiwan (Lan Yu) [Philippines].

2. CHRISTENSENIA Maxon, Proc. Biol. Soc. Washington 18: 239. 1905.

天星蕨属 tian xing jue shu

Kaulfussia Blume, Enum. Pl. Javae 2: 260. 1828, not Dennstedt (1818), nor Nees (1820).

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Plants terrestrial. Rhizomes creeping. Stipes with pulvini at base of segments. Laminae simple (and then usually pedately lobed) to palmately compound, bases rounded to pedate, margins simple to broadly crenate, apices acute to acuminate. Venation reticulate. Stomata large, raised, orbicular, permanently open, densely distributed on abaxial frond surfaces, visible to naked eye. Scales flattened, peltate with lobed margins on short stalks, hairs glandular, mixed with scattered uniseriate simple hairs. Sori \pm in rows on either side of main veins, appearing scattered. Sporangia fully fused into circular, sessile synangia, sporangia dehiscing by a vertical slit on inside of synangium. Spores monolete, ellipsoid, exospore long spinulose, spines simple. $2n = 80, 160$.

One variable species: patchily distributed from NE India and SE Asia to the Solomon Islands.

1. *Christensenia aesculifolia* (Blume) Maxon, Proc. Biol. Soc. Washington 18: 240. 1905.

天星蕨 tian xing jue

Aspidium aesculifolium Blume, Enum. Pl. Javae 2: 143. 1828; *Christensenia assamica* (Griffith) Ching; *C. lobbiana* (de Vriese) Rolleri; *Kaulfussia aesculifolia* (Blume) Blume; *K. assamica* Griffith; *K. korthalsii* de Vriese; *K. lobbiana* de Vriese.

Plants up to 80 cm tall. Rhizomes creeping (to suberect),

short, fleshy, scaly; scales brown with red spots, large, rounded. Stipes up to 36(–50) cm. Laminae simple or pedately lobed to palmate, middle pinna largest, 9–25 \times 3–15 cm, bases cuneate, margins entire to undulate, apices acute to acuminate, distal pinnae (if present) smaller, inequilateral and subrounded at base, margins entire, lobed, or broadly crenate, usually undulate, apices acute to acuminate. Synangia radially arranged, circular, made up of 8–12 sporangia.

On limestone. Yunnan [India, Indonesia, Malaysia, Myanmar, Papua New Guinea (Bismarck Archipelago), Philippines, Vietnam; Pacific islands (Solomon Islands)].

3. **ANGIOPTERIS** Hoffmann, Commentat. Soc. Regiae Sci. Gott. 12: 29. 1796, nom. cons., not Adanson (1763).

莲座蕨属 lian zuo jue shu

Archangiopteris Christ & Giesenhagen; *Clementea* Cavanilles; *Macroglossum* Copeland; *Protangiopteris* Hayata; *Protomarattia* Hayata; *Psilodochea* C. Presl.

Plants terrestrial (sometimes rooted in stream beds). Rhizomes erect, ascending, or creeping. Laminae 1–4-pinnate, usually evenly divided throughout, occasionally with irregular division of some segments (probably a result of stress during lamina development). Pulvini present at bases of segments, at naked nodes on stipe in juvenile fronds, generally absent at maturity, but present at maturity in some species with creeping rhizomes; primary pinnae alternate or subopposite; veins free, simple or bifurcate, false veins absent or present between veins of varying length and extending from margins toward costae; uniseriate simple hairs present, not glandular, scales peltate but generally appearing basifixed due to asymmetry. Sori borne on veins, marginal, submarginal, or medial; sporangia \pm free, fused at base into receptacles, sessile, bilateral, each with 2 opposing rows of sporangia, those opening via a vertical slit on inner surface of each valve, apertures labiate, with distinct patch of specialized thick-walled cells at apex of each sporangium. Spores trilete (rarely monolete or alete), exospores granular to spinulose, spines simple or branched. $2n = 80, 160$.

About 30–40 species (but most are currently poorly defined): widely distributed in the Paleotropics, from Madagascar to the S Pacific islands; introduced and naturalized in Hawaii, Jamaica, and Central America; 28 species (17 endemic) in China.

Species of *Angiopteris* differ chiefly in habit, size, and general appearance; herbarium specimens are therefore often difficult to identify, due to the lack of preserved characters.

The historical variation in species delimitation in *Angiopteris* has made nomenclature in this genus highly unstable. Moreover, the characters distinguishing species of *Angiopteris* are usually difficult to observe on herbarium specimens, which are fragmentary and usually lack information on stipule, stipe, frond size, and general habit. Therefore, many of the published names are difficult to interpret because type specimens are often small frond fragments. The majority of species listed here, therefore, may not be readily identifiable in herbaria. Most species are relatively scarce (or at least rarely collected), and it should, therefore, be noted that the majority of Chinese specimens probably belong to the following taxa: *Angiopteris fokiensis*, *A. lygodifolia*, *A. somae*, and *A. yunnanensis*. The latter is part of the *A. evecta* complex, which needs further investigation. The diversity of this genus in Hainan and Yunnan is far from understood; it is possible that hybridization or allopolyploidy plays a part in the complexity of *Angiopteris*. Molecular work and cultivation experiments are needed to solve the complex taxonomy of this genus, but the morphological diversity is far greater than the known genetic diversity in *Angiopteris*. Chloroplast DNA sequence data suggest that there may be only a small number of species with highly plastic morphology. Even though perhaps not satisfactory, the list of accepted species below should be seen as an approximate consensus.

Angiopteris crassipes Wallich ex C. Presl (Suppl. Tent. Pterid. 23. 1845) and *A. neglecta* Ching & Chu H. Wang (Acta Phytotax. Sin. 8: 159. 1959, described from Hainan), both accepted in the FRPS account, and *A. nanchuanensis* Z. Y. Liu (Bull. Bot. Res., Harbin 4(3): 2. 1984), described since from Sichuan, could not be treated here because no material was seen by the present authors.

Archangiopteris subintegra Hayata (Bot. Gaz. 67: 90. 1919, described from Vietnam near the border with China) has been confused with *Angiopteris subintegra* Ching (here treated as a synonym of *A. caudipinna*). Its taxonomic status and presence within China need investigation.

1a. Rhizomes dorsiventral, long creeping; laminae of mature plants once pinnate, rarely bipinnate; stipes with 1–4(–7) naked pulvini in mature fronds; synangia medial, elongate.

- 2a. Laminae once to twice pinnate, usually with 10–12 pairs of lateral pinnae 1. *A. bipinnata*
- 2b. Laminae once pinnate, pinnae usually with 2–7 pairs of lateral pinnae.
- 3a. Naked pulvini 4 or 5(–7) per stipe; sori 3–4 mm, paraphyses long and dense 2. *A. chingii*
- 3b. Naked pulvini only 1 per stipe; sori shorter than 3 mm; paraphyses short and sparse.
- 4a. Exospore with spinose ornamentation.
- 5a. Fronds ca. 1.5 m, with 9–12 pairs of pinnae; false veins usually present 3. *A. itoi*
- 5b. Fronds 0.5–1.2 m, with 4–6 pairs of pinnae; false veins absent 4. *A. subrotundata*
- 4b. Exospore with rodlike ornamentation.
- 6a. Pinnae subopposite 5. *A. danaeoides*
- 6b. Pinnae clearly alternate, at least in apical part of lamina.
- 7a. Pinna margins acutely dentate 6. *A. tonkinensis*
- 7b. Pinna margins entire, undulate-crenate toward apex.
- 8a. Pinnae lanceolate, margins of pinnules dentate-undulate; laminae herbaceous 7. *A. latipinna*
- 8b. Pinnae oblanceolate, margins of pinnules undulate-crenate; laminae thickly papery 8. *A. somae*
- 1b. Rhizomes erect, subglobose; laminae of mature plants usually bipinnate, rarely once pinnate or tripinnate at base; stipes without naked pulvini in mature fronds; synangia usually restricted to margins.
- 9a. Stipes smooth.
- 10a. Stipes with deep groove on upper surface 9. *A. yunnanensis*
- 10b. Stipes and rachises without groove on upper surface, or stipe bases with shallow groove on upper surface.
- 11a. Veins sparse, lateral veins more than 1 mm apart; pinnules on base of stipe often obviously reduced flabellate, without midvein 10. *A. paucinervis*
- 11b. Veins dense, lateral veins less than 1 mm apart; pinnules on base of stipe not reduced, midveins obvious.
- 12a. False veins absent.
- 13a. Mature laminae very large, 2–4.5 m, bipinnate or tripinnate 11. *A. esculenta*
- 13b. Mature laminae smaller, 0.8–1.2 m, usually bipinnate, sometimes once pinnate 12. *A. sparsisora*
- 12b. False veins present.
- 14a. False veins long, extending over halfway to costa.
- 15a. Mature laminae longer than 2 m, usually reaching 4–5 m in length, false veins nearly reaching costa 13. *A. evecta*
- 15b. Mature laminae 2–3 m, false veins extending ± halfway between margin and costa.
- 16a. Mature laminae up to 3 m; sori at or ca. 0.5 mm from pinnule margins 14. *A. wallichiana*
- 16b. Mature laminae up to 2 m; sori ca. 1 mm from pinnule margins 15. *A. lygodiifolia*
- 14b. False veins short, not extending much beyond synangium.
- 17a. Sori at or 0.3–0.5 mm from pinnule margins 16. *A. hainanensis*
- 17b. Sori 1–3 mm from pinnule margins.
- 18a. Pinnule bases cuneate; veins dense, ca. 20 per cm 17. *A. caudatiformis*
- 18b. Pinnule bases cordate, rounded, or truncate; veins sparse, ca. 10 per cm 18. *A. helferiana*
- 9b. Stipes tuberculate.
- 19a. False veins absent.
- 20a. Mature laminae shorter than 2 m.
- 21a. Veins dense, 20–22 veins per cm 19. *A. confertinervia*
- 21b. Veins normally spaced, 10–19 veins per cm 20. *A. wangii*
- 20b. Mature laminae longer than 2 m.
- 22a. Mature pinnae 1–2 cm wide 21. *A. fokiensis*
- 22b. Mature pinnae 3–4 cm wide 22. *A. hokouensis*
- 19b. False veins present.
- 23a. Pinnules oblanceolate, widest above middle, (sub-)opposite 23. *A. oblanceolata*
- 23b. Pinnules lanceolate to elliptic, widest at or below middle, subopposite to alternate.
- 24a. False veins short, reaching up to 1/3 to costa, often not beyond synangia.
- 25a. Pinnae with more than 15 pinnules; sori less than 1 mm; laminae up to 2.5 m 24. *A. cochinchinensis*
- 25b. Pinnae with less than 15 pinnules; sori 1–6 mm; laminae 2–4 m 25. *A. dianyuecola*
- 24b. False veins long, reaching at least halfway to costa.

- 26a. Pinnule apices long caudate 26. *A. caudipinna*
 26b. Pinnule apices acuminate.
 27a. Pinnule margins sharply dentate 27. *A. acutidentata*
 27b. Pinnule margins entire, undulate 28. *A. remota*

1. *Angiopteris bipinnata* (Ching) J. M. Camus, Proc. Int. Symp. Syst. Pterid. 35. 1989.

二回莲座蕨 er hui lian zuo jue

Archangiopteris bipinnata Ching, Icon. Filic. Sin. 5: t. 203. 1958.

Fronds 50–80 cm; stipes 60–70 cm, with 1 naked pulvinus, and 10–12 pairs of pinnae. Laminae once pinnate to bipinnate; pinnae 16–19 × 6–7 cm; pinnules 0–7 pairs, broadly lanceolate, 7–10 × 2.5–2.8 cm, bases cuneate, margins subentire, undulate, apices caudate. Veins obvious, false veins absent. Sori medial, ca. 4 mm from margin, extending to costule, 1–2 cm, composed of 20–40 sporangia. Exospores with forked rod-like ornamentation.

- Forests; 1100–1300 m. Yunnan (Maguan, Malipo).

2. *Angiopteris chingii* J. M. Camus, Proc. Int. Symp. Syst. Pterid. 35. 1989.

秦氏莲座蕨 qin shi lian zuo jue

Archangiopteris hokouensis Ching, Icon. Filic. Sin. 5: t. 204. 1958, not *Angiopteris hokouensis* Ching (1959).

Fronds 50–85 cm; stipes ca. 50 cm, with 4 or 5(–7) naked pulvini. Laminae once pinnate; pinnae 2 or 3 (sub-)opposite pairs, elliptic, 15–20 × 5–7 cm, bases cuneate, margins serrulate-crenulate, apices caudate. Veins obvious, false veins absent. Sori medial, ca. 1 cm; paraphyses longer than sporangia.

- Forests; 100–500 m. Guangxi, Yunnan.

3. *Angiopteris itoi* (W. C. Shieh) J. M. Camus, Proc. Int. Symp. Syst. Pterid. 35. 1989.

伊藤氏莲座蕨 yi teng shi lian zuo jue

Archangiopteris itoi W. C. Shieh, J. Jap. Bot. 45: 165. 1970.

Fronds ca. 150 cm; stipes 60–100 cm, with 1 naked pulvinus. Laminae once pinnate; pinnae 9–12 pairs, oblong, 25–30 × 3–3.5 cm, bases cuneate, margins undulate, apices caudate. Veins obvious, false veins short (or absent). Sori medial, ca. 1 cm, with 40–90 sporangia; multicellular paraphyses present. Exospores with spinulose ornamentation.

- Extremely rare; 400–600 m. C and N Taiwan (Nantou, Taibei).

According to reviewer Ralf Knapp, the false veins are missing in some plants of C Taiwan.

4. *Angiopteris subrotundata* (Ching) Z. R. He & Christenhusz, **comb. nov.**

圆基莲座蕨 yuan ji lian zuo jue

Basionym: *Archangiopteris subrotundata* Ching, Icon. Filic. Sin. 5: t. 206. 1958.

Fronds 50–120 cm; stipes 18–70 cm, with 1 naked pulvinus. Laminae once pinnate; pinnae 4–6 pairs, alternate, elliptic, 10–30 × 2.5–7.5 cm, bases cuneate, margins entire-undulate, apices caudate. Veins obvious, false veins absent. Sori medial, 0.3–2 cm; paraphyses longer than sporangia. Exospores with spinose ornamentation.

- Yunnan (Maguan, Malipo, Xichou).

5. *Angiopteris danaeoides* Z. R. He & Christenhusz, **nom. nov.**

尾叶莲座蕨 wei ye lian zuo jue

Replaced synonym: *Archangiopteris caudata* Ching, Icon. Filic. Sin. 5: t. 208. 1958, not *Angiopteris caudata* de Vriese, Monogr. Marattiac. 20. 1853.

Fronds 50–85 cm; stipes 20–50 cm, with 1 naked pulvinus. Laminae once pinnate; pinnae 2 or 3 (sub-)opposite pairs, elliptic, 10–30 × 6–11 cm, bases cuneate, margins serrulate-crenulate, apices long caudate. Veins obvious, false veins absent. Sori medial, ca. 1 cm; paraphyses longer than sporangia. Exospores with rodlike ornamentation.

- Guangxi.

6. *Angiopteris tonkinensis* (Hayata) J. M. Camus, Proc. Int. Symp. Syst. Pterid. 34. 1989.

尖叶莲座蕨 jian ye lian zuo jue

Protomarattia tonkinensis Hayata, Bot. Gaz. 67: 88. 1919; *Archangiopteris tamdaoensis* Hayata; *A. tonkinensis* (Hayata) Ching; *Protangiopteris tamdaoensis* (Hayata) Hayata.

Fronds 50–85 cm; stipes 40–45 cm, with 1 naked pulvinus. Laminae once pinnate; pinnae 2–4 alternate pairs, elliptic, 20–25 × 4–5 cm, bases cuneate, margins sharply serrate, apices caudate. Veins obvious, false veins absent. Sori medial, 0.7–1 cm; paraphyses shorter than sporangia. Exospores with rodlike ornamentation.

- Hainan [N Vietnam].

7. *Angiopteris latipinna* (Ching) Z. R. He, W. M. Chu & Christenhusz, **comb. nov.**

阔羽莲座蕨 kuo yu lian zuo jue

Basionym: *Archangiopteris latipinna* Ching, Icon. Filic. Sin. 5: t. 207. 1958; *A. henryi* Christ & Giesenhagen (1899), not *Angiopteris henryi* Hieronymus (1919).

Fronds 40–85 cm; stipes 30–60 cm, with 1 naked pulvinus. Laminae once pinnate; pinnae 2–4, alternate to subopposite, lanceolate, 17–30 × 4.5–6.5 cm, bases cuneate, margins dentate, apices caudate to acuminate. False veins absent. Sori medial, 0.5–2 cm, composed of up to 160 sporangia; paraphyses present, longer than sporangia.

- Forests; 1100–1500 m. Yunnan.

8. *Angiopteris somae* (Hayata) Makino & Nemoto, Fl. Japan, 1563. 1925 [“*somai*”].

相马氏莲座蕨 *xiang ma shi lian zuo jue*

Archangiopteris somae Hayata, Icon. Pl. Formosan. 5: 256. 1915 [“*somai*”]; *A. henryi* Christ & Giesenhagen var. *somae* (Hayata) Tagawa; *Protangiopteris somae* (Hayata) Hayata.

Fronds 50–85 cm; stipes 20–70 cm, with 1(or 2) naked pulvinus. Laminae once pinnate; pinnae 4–6, alternate to subopposite, (ob-)lanceolate, (15–)22–25(–28) × 3–6.5 cm, bases cuneate, margins undulate, crenate to dentate, apices caudate to acuminate. False veins absent. Sori medial, 1–2 cm, composed of up to 170 sporangia; paraphyses present, longer than sporangia.

- Forests. Taiwan.

9. *Angiopteris yunnanensis* Hieronymus, Hedwigia 61(3): 277. 1919.

云南莲座蕨 *yun nan lian zuo jue*

Angiopteris badia Ching; *A. evecta* (G. Forster) Hoffmann var. *alata* Christ; *A. pingpienensis* Ching.

Fronds 2–5 m; stipes with deep groove on upper surface; rachises with narrow wings. Laminae bipinnate; pinnae 60–80 × 20–25 cm, with 15–30 pairs of pinnules; pinnules 7–20 × 1.5–3.5 cm, bases cordate, truncate, or rounded, margins shallowly serrate, apices long acuminate or caudate. Veins obvious, false veins obvious (and longer than sori) or absent. Sori close to margin, composed of 13–15 sporangia. Spores spherical or near spheroidal, trilete, one fissure of spore long, other two fissures short.

Forests, often on limestone soil; 100–1200 m. Guangxi, Yunnan [N Vietnam].

This species belongs to the unresolved complex surrounding the morphologically diverse *Angiopteris evecta*. Further studies are needed to unravel this complex.

10. *Angiopteris paucinervis* W. M. Chu & Z. R. He in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl. II), 3. 2007.

疏脉莲座蕨 *shu mai lian zuo jue*

Fronds 1–2 m; stipes smooth. Laminae bipinnate; pinnae 55–65 × 60–70 cm, with 12–15 pairs of pinnules; pinnules 13–16 × 1–3 cm, often obviously reduced flabellate on basal part of stipe, without midvein, margins crenulate. Veins sparse, lateral veins more than 1 mm apart, false veins absent. Sori ca. 1 mm from margin, 1–2 mm, composed of 8–14 sporangia. Spores trilete.

- Forests; 200–300 m. Guangxi (Luocheng).

The name *Angiopteris paucinervis* was originally published by Chu and He (Acta Bot. Yunnan. 22: 399. 2000) but not validly so because the type was not explicitly indicated (*Melbourne Code*, Art. 40.6). Later, Jin and Chen (loc. cit.) cited “*W. M. Chu et al. ... 18358*. (Typus: PYU),” provided a full and direct reference to He’s Latin description and diagnosis, and ascribed the name to “W. M. Chu et Z. R.

He ex Z. R. He” thereby validly publishing the name, which should be attributed to W. M. Chu & Z. R. He (Art. 46.2 and Note 2).

11. *Angiopteris esculenta* Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 1. 1940.

食用莲座蕨 *shi yong lian zuo jue*

Angiopteris acuta Ching; *A. parvifolia* Ching & Fu.

Fronds 2–4.5 m; stipes smooth. Laminae bipinnate, sometimes tripinnate at base; pinnae 50–60 × ca. 20 cm, with 20–30 pairs of spreading pinnules; pinnules lanceolate, 7–15 × 1–1.8 cm, base cuneate, margins serrate, apices acute. Veins sparse, ca. 10 per cm, false veins absent. Sori almost marginal, with 6–8 sporangia.

- Forests; 1500–2000 m. SE Xizang (Médog), Yunnan.

12. *Angiopteris sparsisora* Ching, Acta Phytotax. Sin. 20: 347. 1982.

发斗莲座蕨 *fa dou lian zuo jue*

Fronds 85–130 × 60–70 cm, with up to 4 pairs of pinnae; stipes smooth. Laminae pinnate to bipinnate; pinnae 45–65 × 18–70 cm, with 7–15 pairs of spreading pinnules; pinnules lanceolate, 7–16 × 1.5–2.5 cm, bases cuneate, margins serrate to crenulate, apices acute. Veins sparse, less than 10 per cm, false veins absent (or obscure). Sori 1–3 mm from margin, 1–2 mm, with 5–16 sporangia.

- Broad-leaved or open forests; 1500–1600 m. Yunnan (Xichou).

It has been suggested that *Angiopteris sparsisora* is of hybrid origin because it putatively is intermediate between *Angiopteris* and the formerly independent *Archangiopteris*, but this has not yet been proven to be the case. This species is, however, one of the reasons why it is difficult to draw a clear morphological distinction between the two genera, and (apart from the molecular evidence provided by Murdock, Amer. J. Bot. 95: 626–641. 2008) it is a further reason to merge *Archangiopteris* with *Angiopteris*.

13. *Angiopteris evecta* (G. Forster) Hoffmann, Commentat. Soc. Regiae Sci. Gott. 12: 29. 1796.

莲座蕨 *lian zuo jue*

Polypodium evectum G. Forster, Fl. Ins. Austr. 81. 1786; *Angiopteris acrocarpa* de Vriese; *A. alata* Nadeaud; *A. commutata* C. Presl; *A. durvilleana* de Vriese; *A. oldhamii* Hieronymus; *A. palmiformis* (Cavanilles) C. Christensen; *Clementea palmiformis* Cavanilles.

Fronds 2–5 m; stipes smooth. Laminae bipinnate; pinnae 65–70 cm, with 15–30 pairs of spreading pinnules; pinnules 7–20 × 0.9–3.5 cm, bases cordate, rounded to cuneate, margins crenulate to serrate, apices acuminate to caudate. Veins obvious, false veins obvious, extending nearly to costule. Sori marginal to ca. 1 mm from margin, ca. 2 mm, with 8–10 sporangia.

Broad-leaved forests, rain forests in valleys, roadsides, slopes, usually on volcanic soils; 100–1200 m. Taiwan (Lan Yu) [New Guinea, Philippines; Australia, S Pacific islands; naturalized in Costa Rica, Hawaii, Jamaica, and possibly elsewhere].

Because this is the first species described in the genus *Angiopteris*, it has found a very broad application in the past. The species is

here treated in its strict sense with a Pacific distribution (see Christenhusz & Toivonen, *Biol. Invas.* 10: 1215–1228. 2008), and it can be recognized by its very obvious false veins and its rather large leaves to 5 m. This remains a species complex, however, and more studies at population level and possibly horticultural experiments will be needed to resolve this.

14. *Angiopteris wallichiana* C. Presl, *Suppl. Tent. Pterid.* 22. 1845.

西藏莲座蕨 xi zang lian zuo jue

Type: Nepal. 1821, *Wallich 187/4* (lectotype, designated here, K! [barcode 000784939]).

Angiopteris fibrillosa Ching & Y. X. Lin; *A. henryi* Hieronymus; *A. lobulata* Ching; *A. medogensis* Ching & Y. X. Lin.

Fronds 1–3 m; stipes smooth, streaked. Laminae bipinnate; pinnae 35–70 × 15–30 cm, with 15–18 pairs of pinnules; pinnules lanceolate, 8–15 × 1–2 cm, bases rounded to cuneate, margins crenulate-entire to serrate, apices acuminate. Veins obvious, sparse, ca. 10 lateral veins per cm; false veins present, usually longer than sori, extending halfway from margin to costule. Sori 0.3–0.5 mm from margin, 1–1.4 mm, with 12–14 sporangia.

Forests along streams; 300–1500 m. SE Xizang (Mêdog), Yunnan (Yingjiang) [N India, Nepal].

This and the next two species (*Angiopteris lygodiiifolia* and *A. hainanensis*) share numerous characters and are often difficult to tell apart. It appears that they form a grade from larger plants (up to 3 m) with submarginal sori in the Himalaya (*A. wallichiana*) to smaller plants with near-medial sori in Taiwan and Japan (*A. lygodiiifolia*). There are intermediate specimens known from Hainan, and, therefore, it may be difficult to maintain these taxa as distinct. They were maintained here because *A. lygodiiifolia* is in common use and would be diverted into synonymy if these species were merged, and they may be separated on the basis of geography. Further studies at the population level are needed to resolve this species complex.

Angiopteris fauriei Hieronymus var. *formosana* Hieronymus (*Hedwigia* 61(3): 274. 1919) was included as a synonym of *A. henryi* in *FRPS* (2: 36. 1959). If correct, this would add Taiwan to the distribution of *A. wallichiana*.

15. *Angiopteris lygodiiifolia* Rosenstock, *Meded. Rijks-Herb.* 31: 2. 1917.

海金沙叶莲座蕨 hai jin sha ye lian zuo jue

Angiopteris formosa Ching; *A. rahaensis* Ching; *A. sakuraii* Hieronymus; *A. taiwanensis* Ching.

Fronds ca. 2 m; stipes green, cylindrical, stipes and rachises without deep groove, smooth, streaked. Laminae bipinnate; pinnae 35–70 cm; pinnules 5–15 cm, usually 1–1.2 cm wide, margins serrate. Veins simple or once forked; false veins obvious, long, extending ± halfway to costule. Sori ca. 1.5 mm, ca. 1 mm from margin.

Ravines, stream banks. Taiwan [Japan].

Angiopteris lygodiiifolia is possibly conspecific with *A. wallichiana* (see comments under the latter species).

16. *Angiopteris hainanensis* Ching, *Acta Phytotax. Sin.* 8: 158. 1959.

海南莲座蕨 hai nan lian zuo jue

Fronds 2–3 m; stipes smooth. Laminae bipinnate; pinnae 50–60 × 15–20 cm, with 16–18 pairs of pinnules; pinnules patent, lanceolate, 10–12 × ca. 2 cm, margins nearly entire. Veins sparse, lateral veins ca. 1 mm apart, false veins extending nearly to sori. Sori near margin or 0.3–0.5 mm from margin, ca. 1 mm, with 12–18 sporangia. Spores subspheroidal, trilete.

• Hainan (Danxian).

Angiopteris hainanensis is possibly conspecific with *A. wallichiana* (see comments under the latter species).

17. *Angiopteris caudatiformis* Hieronymus, *Hedwigia* 61(3): 278. 1919.

披针莲座蕨 pi zhen lian zuo jue

Angiopteris crassifolia Ching (1959), not de Vriese (1852); *A. crassiuscula* Ching; *A. magna* Ching ex C. Christensen & Tardieu; *A. majuscula* Ching; *A. megaphylla* Ching; *A. multijuga* Ching; *A. nuda* Ching; *A. pinnata* Ching; *A. vasta* Ching.

Fronds 2–4 m; stipes smooth. Laminae bipinnate; pinnae 60–110 × 20–40 cm, with 14–18 pairs of pinnules; pinnules 15–25 × 1.5–3 cm, bases cordate, rounded, or truncate, margins usually serrate, apices acute to caudate. Veins dense; false veins present, rarely absent. Sori 1–2 mm from margin, 2–3 mm, composed of 12–18 sporangia.

Rain forests, broad-leaved forests; 100–1200 m. Guangxi, Yunnan [E Myanmar, Vietnam].

18. *Angiopteris helferiana* C. Presl, *Suppl. Tent. Pterid.* 22. 1845.

楔基莲座蕨 xie ji lian zuo jue

Angiopteris latemarginata Ching; *A. subcuneata* Ching.

Fronds 2–3 m; stipes smooth. Laminae bipinnate; pinnae 60–80 × 20–30 cm, with 15–20 pairs of pinnules; pinnules 10–20 × 2–6 cm, bases cuneate, margins serrate to sharply serrate, apices acuminate to caudate. Veins sparse, ca. 10 per cm; false veins present, rarely absent. Sori 2–3 mm from margin, 1.5–3 mm, composed of 14–26 sporangia.

Seasonal rain forests, broad-leaved forests; 900–1400 m. Guangxi, Yunnan [Bhutan, India, Myanmar, Nepal].

19. *Angiopteris confertinervia* Ching ex C. Christensen & Tardieu, *Notul. Syst. (Paris)* 5: 11. 1935.

密脉莲座蕨 mi mai lian zuo jue

Fronds 1.5–2 m; stipes tuberculate. Laminae bipinnate; pinnae ca. 60 × 20–25 cm, with 12–20 pairs of pinnules; pinnules 4–10 × 1.5–3 cm, bases rounded to truncate, margins serrate, apices shortly acuminate. Veins obvious, 20–22 lateral veins per cm, false veins absent. Sori ca. 0.5 mm from margin, composed of 8–12 sporangia.

Forests; 100–200 m. Yunnan (Hekou) [N Vietnam].

20. *Angiopteris wangii* Ching, Fl. Reipubl. Popularis Sin. 2: 338. 1959.

王氏莲座蕨 wang shi lian zuo jue

Fronds dark green, 1–2 m; stipes tuberculate. Laminae bipinnate; pinnae narrowly ovate, 40–60 × 15–18 cm, with 25–27 pairs of pinnules; pinnules 12–15 × 3–5 cm, bases rounded to truncate, margins regularly serrate, apices acuminate, curved acropically. Veins obvious, false veins absent. Sori 1–3 mm from margin, 2–4 mm, composed of 18–20 sporangia.

- Broad-leaved forests; 400–1600 m. Guangxi, Yunnan.

21. *Angiopteris fokiensis* Hieronymus, Hedwigia 61(3): 175. 1919.

福建莲座蕨 fu jian lian zuo jue

Angiopteris angustipinnula Ching; *A. attenuata* Ching (1959), not Brackenridge (1854); *A. jiangxiensis* Ching & J. F. Cheng; *A. kwangsiensis* Ching; *A. lingii* Ching; *A. longipetiolata* Ching; *A. muralis* Ching; *A. officinalis* Ching; *A. omeiensis* Ching; *A. petiolulata* Ching; *A. shanyuanensis* Ching; *A. sinica* Ching; *A. subcordata* Ching; *A. tenera* Ching.

Fronds 2–4 m; stipes tuberculate. Laminae bipinnate; pinnae 50–60 × 20–60 cm, with 35–40 pairs of pinnules; pinnules lanceolate, 7–9 × 1–1.8 cm, bases rounded to truncate, margins regularly serrate, apices acuminate, acropically curved. Veins obvious, false veins absent. Sori 0.5–1 mm from margin, ca. 1 mm, composed of 8–10 sporangia.

- Broad-leaved forests; 400–1600 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang.

22. *Angiopteris hokouensis* Ching, Fl. Reipubl. Popularis Sin. 2: 339. 1959.

河口莲座蕨 he kou lian zuo jue

Angiopteris brevicaudata Ching; *A. cartilaginea* Ching; *A. consimilis* Ching; *A. crassa* Ching; *A. crenata* Ching; *A. fengii* Ching; *A. garbongensis* Ching; *A. grossedentata* Ching [“*grosso-dentata*”]; *A. lateternalis* Ching; *A. latipinnula* Ching; *A. parvipinnula* Ching; *A. taweshanensis* Ching.

Fronds light green, 2–4 m; stipes tuberculate. Laminae bipinnate; pinnae narrowly ovate, ca. 60 × 6–20 cm, with 9–11 pairs of pinnules; pinnules 12–15 × 3–5 cm, bases rounded to truncate, margins regularly serrate, apices acuminate, curved acropically. Veins obvious, false veins absent. Sori 1–3 mm from margin, 2–4 mm, composed of 18–24 sporangia.

- Broad-leaved forests; 400–1600 m. Guangxi, Yunnan [Vietnam].

23. *Angiopteris oblanceolata* Ching & Chu H. Wang, Acta Phytotax. Sin. 8: 159. 1959.

倒披针莲座蕨 dao pi zhen lian zuo jue

Fronds 1–3 m; stipes tuberculate. Laminae bipinnate; pinnae 60–70 cm, up to 30 cm wide, with 12–14 pairs of (sub-) opposite pinnules; pinnules oblanceolate, 12–18 × ca. 2 cm, bases rounded, margins densely shallowly crenate, apices acuminate. Veins obvious abaxially, obscure adaxially; false veins

short, just surpassing sori. Sori 0.3–0.5 mm from margin, 0.5–0.7 mm, composed of 10–12 sporangia.

- Forests. Hainan.

24. *Angiopteris cochinchinensis* de Vriese, Monogr. Marattiac. 23. 1853.

琼越莲座蕨 qiong yue lian zuo jue

Angiopteris howii Ching & Chu H. Wang.

Fronds 1–2.5 m; stipes tuberculate. Laminae bipinnate; pinnae 40–70 × 15–35 cm, with 10–15 pairs of pinnules; pinnules lanceolate, 12–18 × 1.5–2.8 cm, bases rounded to cuneate, margins dentate to shallowly crenate (to nearly entire), apices acute to caudate. Veins usually obvious, sometimes obscure adaxially, 10–15 lateral veins per cm; false veins short, not surpassing sori or up to 1/3 toward costule. Sori 0.3–0.5 mm from margin, 0.5–1.5 mm, composed of 7–15 sporangia.

- Forests; 900–1200 m. Guangxi, Hainan [Vietnam].

Angiopteris cochinchinensis may be expanded in the future to include a few other very similar taxa such as *A. acutidentata*, *A. caudipinna*, and *A. remota*. Further studies are needed to establish if these taxa are phenotypes of a single species or separate species in their own right.

25. *Angiopteris dianyuecola* Z. R. He & W. M. Chu, Fl. Yunnan. 20: 720. 2006.

滇越莲座蕨 dian yue lian zuo jue

Angiopteris repandula de Vriese var. *latemarginata* C. Christensen & Tardieu, Notul. Syst. (Paris) 5: 8. 1935, not *A. latemarginata* Ching (1959).

Fronds 2–4 m; stipes tuberculate. Laminae bipinnate; pinnae ovate-lanceolate, 100–240 × 100–150 cm, with 15–25 pairs of (sub-)opposite pinnules; pinnules oblong, ovate-lanceolate, or oblanceolate, 5–8 × 1–2 cm, bases rounded to cuneate, margins serrate, apices shortly acuminate to caudate. Veins obvious abaxially, false veins present. Sori 2–4 mm from margin, 1–6 mm, composed of 14–20 sporangia.

- Forests; ca. 100 m. Yunnan (Hekou) [Vietnam].

26. *Angiopteris caudipinna* Ching, Acta Phytotax. Sin. 8: 158. 1959.

长尾莲座蕨 chang wei lian zuo jue

Angiopteris subintegra Ching; *A. venulosa* Ching.

Fronds 1–2 m; stipes tuberculate. Laminae bipinnate; pinnae 40–50 × 15–20 cm, with 11 or 12 pairs of pinnules; pinnules 10–13 × 2.5–3.5 cm, bases rounded, margins sharply serrate, apices long caudate. Veins obvious; false veins long, ± halfway from margin to costule. Sori 0.3–0.5 mm from margin, ca. 1 mm, composed of 7–17 sporangia. Exospores with reticulate ornamentation.

- Forests by streams. Hainan.

27. *Angiopteris acutidentata* Ching, Acta Phytotax. Sin. 8: 157. 1959.

尖齿莲座蕨 jian chi lian zuo jue

Fronds 1–2 m; stipes tuberculate. Laminae bipinnate; pinnae 50–60 × 20–25 cm, with 16–18 pairs of pinnules; pinnules 10–20 × 1.5–2 cm, bases asymmetrical, rounded, margins sharply serrate, apices acuminate. Veins obvious, up to 15 lateral veins per cm; false veins long, ± halfway from margin to costule. Sori ca. 0.5 mm from margin, ca. 1 mm, composed of 10–12 sporangia. Exospores with reticulate ornamentation.

- Hainan.

28. *Angiopteris remota* Ching & Chu H. Wang, *Acta Phytotax.* Sin. 8: 159. 1959.

疏叶莲座蕨 shu ye lian zuo jue

Fronds 1–2 m; stipes tuberculate. Laminae bipinnate; pinnae ca. 60 × 15–22 cm, with ca. 15 pairs of pinnules; pinnules 13–15 × 1.5–2 cm, bases rounded, margins nearly entire, slightly undulate, apices acuminate. Veins obvious, up to 15 lateral veins per cm; false veins long, up to ± halfway from margin to costule. Sori ca. 0.5 mm from margin, ca. 1 mm, composed of 10–12 sporangia.

- Hainan.