

## ATHYRIACEAE

蹄盖蕨科 ti gai jue ke

Wang Zhongren (王中仁)<sup>1</sup>, He Zhaorong (和兆荣)<sup>2</sup>; Masahiro Kato<sup>3</sup>

Plants terrestrial or epilithic, small to medium-sized, sometimes large. Rhizome long or shortly creeping, ascending or erect, rarely short treelike, dictyostelic, scaly; scales entire or toothed, tooth consisting of 2 adjacent upturned ends of marginal cells, basifixed, rarely pseudopeltate. Stipe supplied by 2 vascular strands with xylem seahorse-shaped in cross section and upward united into U-shaped strand, scaly, also hairy or glabrate, hairs unicellular or multicellular, glandular or eglandular. Rachis, costae, and costules grooved adaxially, grooves of costae and costules confluent to those of lower order frond axes or interrupted by ridges between grooves, scaly, hairy, or glabrate; hairs unicellular or multicellular, glandular or eglandular; spines continued from ridges, or short fleshy projections in grooves, at base of costae, costules, and midribs adaxially, or spines and projections absent. Lamina variously dissected, simple to 3-pinnate, pinnatifid or with terminal pinna similar to lateral pinnae, apex narrowed. Veins free or anastomosing with polygonal areoles or with successive veins from adjacent midribs united to excurrent veins between 2 rows of rhomboid areoles. Sori various, linear, J-shaped, horseshoe-shaped, orbicular-reniform, or orbicular, indusiate or exindusiate; indusia inferior entirely or proximally to receptacle, or lateral, various in shape, sack-shaped, cup-shaped, saucer-shaped, platelike, elongate, J-shaped, horseshoe-shaped, or orbicular-reniform. Spores bilateral, ellipsoid, covered by perispore.

Five genera and ca. 600 species: worldwide from tropical to frigid zones of both hemispheres; five genera and 278 species (135 endemic) in China.

Of the genera recognized in FRPS (3(2): 32–504. 1999), *Rhachidosorus* and *Diplaziopsis* were recently segregated as families Rhachidosoraceae and Diplaziopsidaceae, respectively. Athyriaceae s.s. or subfamily Athyrioideae comprise *Anisocampium* (including *Kuniwatsukia*), *Athyrium* (including *Pseudocystopteris*), *Cornopteris* (including *Neoathyrium*), *Deparia* (including *Athyriopsis*, *Dictyodroma*, *Dryoathyrium*, and *Lunathyrium*), and *Diplazium* (including *Allantodia*, *Callipteris*, and *Monomelangium*). Subfamily Cystopteridoideae was raised to family Cystopteridoaceae.

Wang Zhong-ren, Chu Wei-ming, He Zhao-rong & Hsieh Yin-tang. 1999. Athyriaceae (excluding *Acystopteris*, *Cystoathyrium*, *Cystopteris*, *Diplaziopsis*, *Gymnocarpium*, and *Rhachidosorus*). In: Chu Wei-ming, ed., *Fl. Reipubl. Popularis Sin.* 3(2): 32–511.

- 1a. Grooves on adaxial side of costae interrupted at base of costa, not confluent to groove of rachis (if lamina simple then rhizome long creeping); stipe, rachis, costae, and veins with multicellular hairs or subglabrate ..... 1. *Deparia*
- 1b. Grooves on adaxial side of costae confluent to groove of rachis; fronds without multicellular hairs.
  - 2a. Base of costa and costule corniculate on adaxial side; sori exindusiate ..... 2. *Cornopteris* (including *Neoathyrium*)
  - 2b. Base of costa and costule not corniculate; sori mostly indusiate.
    - 3a. Veins anastomosing; sori small, orbicular-reniform ..... 3. *Anisocampium*
    - 3b. Veins free; sori prominent, elongate, horseshoe-shaped.
      - 4a. Stipe bases on ascending to erect rhizomes swollen with pneumatophores, frond axes V-shaped in cross section, acroscopic basal pinnules larger than others, laminar margin cartilaginous or not, spines present adaxially at junction of costules or not; sori horseshoe-shaped, J-shaped, or linear; scales entire ..... 4. *Athyrium*
      - 4b. Stipe bases neither swollen nor bearing pneumatophores, frond axes U-shaped with a flat base in most species, acroscopic basal pinnules equal or smaller, laminar margin not cartilaginous, spines absent; sori linear; scales toothed or entire ..... 5. *Diplazium*

### 1. DEPARIA Hooker & Greville, *Icon. Filic.* 2: t. 154. 1829.

对囊蕨属 dui nang jue shu

He Zhaorong (和兆荣), Wang Zhongren (王中仁); Masahiro Kato

*Athyriopsis* Ching; *Dictyodroma* Ching; *Dryoathyrium* Ching; *Lunathyrium* Koidzumi; *Parathyrium* Holttum; *Triblemma* Ching.

Plants terrestrial, medium-sized. Rhizomes moderately stout, long creeping, ascending or suberect, with black or brown, lanceolate, entire or subentire scales. Fronds distant or approximate; stipe long, with brown, ovate to lanceolate scales at base; lamina pinnate or 2-pinnate, lanceolate, linear-lanceolate, oblong, or ovate-oblong, acuminate; ultimate pinnules pinnatifid; pinnae or pinnules alternate, sessile, equilateral, rounded-cuneate at base, pinnatifid to pinnatifid, segments oblong or rectangular, pinnules or

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segments adnate to costae or costules by narrow wings; rachis, costae, and costules grooved adaxially, grooves of costae or costules interrupted and not merging into grooves of rachis or costae; usually with brown or dark brown, vermiculate glandular hairs consisting of 1–3 (or 4) rows of cells on costae, costules, and midribs. Veins free, lateral veins simple or forked. Lamina herbaceous, papery, or subleathery when dried. Sori orbicular, oblong, J-shaped, or horseshoe-shaped, abaxial or lateral, medial; indusia same in shape, membranous, entire, erose, lacerate, or ciliate, persistent. Spores bilateral, perispore with folds or spines, baculate ornamentation.  $x = 40$ .

About 70 species: tropical and temperate zones of Asia, tropical Africa, and Madagascar, extending to Japan, Korea, E Russia, and to NW Himalaya; 53 species (31 endemic) in China.

The following regions comprise the center of distribution in China: Qin Ling, W Hubei, Sichuan, and NE Yunnan.

The following taxon is excluded from the present treatment, pending further research: *Lunathyrium ebeneostipes* Ching & Z. Y. Liu (Bull. Bot. Res., Harbin 3(4): 14. 1983), described from Sichuan (Nanchuan).

- 1a. Stipe base not swollen, without pneumatophore.
  - 2a. Veins anastomosing.
    - 3a. Free fertile pinnae repand or pinnatilobate at margin; lateral veins obvious, costae with sparse hairs.
      - 4a. Free pinnae of fertile frond 1–5 pairs, margin usually repand, occasionally crenate or pinnatilobate; pinna lobes flat, broad, blunt, oval, symmetrical ..... 33. *D. heterophlebia*
      - 4b. Free pinnae of fertile frond 6–8 pairs, margin shallowly lobed; pinna lobes deltoid-oblong, asymmetrical, subfalcate, apex obtuse ..... 34. *D. yunnanensis*
    - 3b. Free fertile pinnae entire, undulate, or shallowly lobed; lateral veins not obvious, costae subglabrous.
      - 5a. Fertile lamina deeply pinnatilobate or 1-pinnate with 1 or 2 (or 3) free basal pairs of pinnae; pinnae oblong-lanceolate, base rounded ..... 35. *D. formosana*
      - 5b. Fertile lamina 1-pinnate with 3–6 pairs of free lateral pinnae; lower pinnae usually broadly lanceolate, sometimes oblong-lanceolate, base subcordate ..... 36. *D. hainanensis*
  - 2b. Veins free.
    - 6a. Lamina simple or pinnatilobate; rachis glabrous, costa abaxially glabrous; sori elongate.
      - 7a. Lamina simple, margin entire or repand ..... 37. *D. lancea*
      - 7b. Lamina pinnatilobate ..... 38. *D. tomitaroana*
    - 6b. Lamina 1–3-pinnate; rachis hairy, costa abaxially hairy; sori variable (elongate, horseshoe-shaped, J-shaped, or orbicular-reniform).
      - 8a. Rhizome ascending or erect; fronds caespitose.
        - 9a. Rhizome erect; indusia lacerate, ciliate at margin, perispore surface with sparse auriculate and aculeate projections ..... 39. *D. omeiensis*
        - 9b. Rhizome ascending; indusia subentire, slightly denticulate, or erose.
          - 10a. Lamina ovate-oblong; indusia erose at margin; perispore surface with dense unevenly long aculeate projections ..... 40. *D. concinna*
          - 10b. Lamina narrowly ovate or ovate; indusia subentire or slightly denticulate; perispore surface with dense clavate and thickly aculeate projections ..... 41. *D. dickasonii*
      - 8b. Rhizome slender, creeping; fronds distant to approximate.
        - 11a. Lamina narrowly lanceolate, lanceolate, broadly lanceolate, or narrowly deltoid; pinnae rounded and acute at apex.
          - 12a. Lamina herbaceous, rachis and costae with often many curly long nodose hairs on both surfaces; free pinnae 1 or 2 (or 3) pairs; indusia with short, nodose hairs or glabrous, margin lacerate, ciliate, usually flat, rarely incurved; perispore with dense and apically rounded, aculeate projections ..... 42. *D. petersenii*
          - 12b. Lamina thinly herbaceous or submembranous, with sparsely nodose hairs; free pinnae often more than 5 pairs, rarely 2 or 3 pairs.
            - 13a. Lamina narrowly lanceolate, lanceolate, or broadly lanceolate, 3–5 × as long as wide; indusial margin usually erose, few lacerate.
              - 14a. Lamina narrowly or broadly lanceolate, 4–5 × as long as wide, less than 5 cm wide; indusial margin mostly flat when young, rarely incurved; perispore with verrucose and fossulate (muriform) ornamentation ..... 43. *D. conilii*
              - 14b. Lamina broadly lanceolate, ca. 3 × as long as wide, 8–11 cm wide; indusial margin incurved when young; surface of perispore with irregular tuberculate ornamentation ..... 44. *D. lushanensis*
            - 13b. Lamina narrowly deltoid, 2–3 × as long as wide; indusial margin lacerate, ciliate, flat when young.
              - 15a. Free pinnae more than 5 pairs, basal pinnae prominently longer than above; indusial surface with ± tiny nodose hairs ..... 45. *D. pseudoconilii*

- 15b. Free pinnae 2 or 3 pairs, basal 1 pair often slightly reduced or nearly as long as second one; indusial surface glabrous ..... 46. *D. pachyphylla*
- 11b. Lamina ovate, oblong, deltoid, broadly lanceolate, or broadly oblong-lanceolate, acuminate to long acuminate at apex, rarely acute.
- 16a. Lamina broadly lanceolate or oblong-lanceolate, 2–4 × as long as wide, less than 12 cm wide, apex acuminate or acute; margin of indusia shallowly erose or subentire, involute when young.
- 17a. Lamina broadly lanceolate, basal pinnae not reduced; sori subcostular, perispore surface with irregular auriculate ornamentation ..... 47. *D. shandongensis*
- 17b. Lamina oblong or broadly lanceolate, 2 or 3 basal pairs of pinnae gradually reduced; basal pair of pinnae oblique, ovate, ca. 1/2 × as long as middle pinnae; sori medial, perispore surface densely long aculeate and with long clavate ornamentation ..... 48. *D. abbreviata*
- 16b. Lamina ovate, oblong, deltoid, or narrowly deltoid, 2 × or less as long as wide, apex acuminate to long acuminate; margin of indusia deeply or shallowly lacerate, often erose when old, incurved or flat when young.
- 18a. Free pinnae mostly ascending at 60° angle, base broadly cuneate or cuneate, pinna lobes prominently ascending, with sparse nodose hairs on both surfaces of lamina; surface of indusia glabrous ..... 49. *D. japonica*
- 18b. Free pinnae usually ascending at angles more than 70° or spreading, pinna lobes spreading or oblique at angles more than 50° (often 60°–70°); rachis and costae abaxially usually with prominently thick, long, nodose hairs; adaxial surface of pinna with slender pointed short nodose hairs; surface of indusia hairy or glabrous.
- 19a. Stipe and rachis with dense pale brown, transparent or translucent, lanceolate to linear, thickly clathrate membranous scales and thick nodose hairs 2–3 mm.
- 20a. Pinna lobes entire or undulate at margin, at most shallowly crenate, rachis with dense thick long nodose hairs on abaxial side, mixed with 2- or 3-cells-wide, thickly clathrate, long linear scales; indusial surface hairy, margin flat when young, perispore surface densely thick clavate and with aculeate ornamentation ..... 50. *D. kiusiana*
- 20b. Pinna lobes crenate at margin; basal and medial parts of rachis dense with 2- or 3-cells-wide, thickly clathrate, long linear scales, mixed with few thick, long nodose hairs, upper part of rachis with sparse scales and many nodose hairs; indusial surface glabrous, margin mostly flat when young, partly incurved, perispore surface with dense mostly truncate and clavate ornamentation ..... 51. *D. jinshoshanensis*
- 19b. Stipe and rachis below often with nodose hairs ca. 1.5 mm and sparsely scaly.
- 21a. Pinnae below middle broadly cuneate or cuneate; pinna lobes often oblong or ligulate-oblong, apex acute or truncate, oblique, rarely rounded ..... 42. *D. petersenii*
- 21b. Pinnae below middle shallowly cordiform or truncate at base; pinna lobes ligulate-oblong or oblique, falcate oblong, apex rounded.
- 22a. Pinna lobes usually entire or repand, sometimes crenate; indusial surface hairy, margin lacerate, incurved when young; perispore surface with dense thick uniformly slender clavate ornamentation ..... 52. *D. dimorphophyllum*
- 22b. Pinna lobes usually serrate, or finely repand; indusial surface usually glabrous, margin lacerate, usually flat when young, rarely incurved; perispore surface with most apically truncate clavate, sometimes narrow, flakelike projections ..... 53. *D. longipes*
- 1b. Stipe base swollen, usually winged with pneumatophore.
- 23a. Lowest pinnule not auricled and slightly reduced; sori linear, J-shaped, U-shaped, or orbicular-reniform, not or rarely diplazioid.
- 24a. Sori oblong or shortly linear, sometimes curved; indusia oblong, lunate, J-shaped, or horseshoe-shaped.
- 25a. Lamina 3-pinnate; pinnules stalked, pinnatifid to pinnatifid at margin, lateral veins pinnate ..... 1. *D. pterorachis*
- 25b. Lamina pinnate-pinnatifid; pinnules entire or toothed at margin, lateral veins simple or forked.
- 26a. Lamina ovate, pinnae stalked; stipe and rachis with dense multicellular hairs; spore surface with long spines ..... 2. *D. erecta*
- 26b. Lamina oblong, pinnae sessile; stipe and rachis with sparse vermiculate hairs consisting of 2 or 3 rows of cells; spore surface with folded or rugate processes.
- 27a. Segments entire (occasionally repand), lateral veins simple; sori mostly shortly linear (sometimes slightly curved), occasionally J-shaped ..... 3. *D. chinensis*
- 27b. Segments toothed, lateral veins 2- or 3(or 4)-forked; sori horseshoe-shaped, J-shaped, oblong, or elliptic.
- 28a. Lamina with sparse brown spinelike thick hairs adaxially; lateral veins usually forked ..... 4. *D. setigera*
- 28b. Lamina subglabrate, without spinelike thick hairs adaxially; lateral veins usually 2–4-forked.

- 29a. Rhizomes ascending or suberect; sori usually narrowly oblong, lunate, or J-shaped ..... 5. *D. coreana*  
 29b. Rhizomes shortly creeping; sori shortly oblong, J-shaped, or horseshoe-shaped ..... 6. *D. henryi*
- 24b. Sori mostly orbicular or elliptic; indusia orbicular-reniform, horseshoe-shaped, J-shaped, or lunate.
- 30a. Lamina 2-pinnate-pinnatifid with pinnules free or connected by costal wing.
- 31a. Pinnules free, shortly stalked ..... 13. *D. boryana*  
 31b. Pinnules ± connected with costa.
- 32a. Lamina thickly herbaceous, pinnules subquadrangular at base, pinnatifid 1/2 or less to costule, segments entire or repand-toothed ..... 11. *D. okuboana*  
 32b. Lamina thinly herbaceous, pinnules broadly cuneate at base, pinnatifid more than 2/3 to costule, segments crenate ..... 12. *D. viridifrons*
- 30b. Lamina 2-pinnatipartite with pinnules adnate to costa.
- 33a. Sori elliptic or orbicular-elliptic, indusia lunate or horseshoe-shaped ..... 7. *D. confusa*  
 33b. Sori orbicular or suborbicular, indusia orbicular-reniform, occasionally horseshoe-shaped.
- 34a. Stipe and rachis with sparse dark brown ovate-lanceolate scales; segments crenate; veins forked to 3(or 4)-forked ..... 8. *D. stenopterum*  
 34b. Stipe and rachis clothed with very many blackish brown, shiny, broadly lanceolate scales; segments entire or toothed; lateral veins forked, occasionally simple or 3-forked.
- 35a. Pinnae narrowly elliptic or elliptic, pinnatisect nearly to costae; pinna segments unevenly long, basiscopic segments longer than acroscopic segments, often falcate ..... 9. *D. falcatipinnula*  
 35b. Pinnae lanceolate, pinnatifid, segments even, oblong ..... 10. *D. unifurcata*
- 23b. Lowest pinnule auricled and slightly to hardly reduced; sori linear, J-shaped, diplazioid, or U-shaped.
- 36a. Rhizomes ascending or shortly creeping; lamina with only 3 pairs of lower pinnae slightly shortened, basal pair of pinnae usually more than 3 cm; multicellular short hairs present at sinus between segments ..... 14. *D. pycnosora*
- 36b. Rhizomes erect; lamina with more pairs of lower pinnae gradually shortened or only basal 2 or 3 pairs slightly shortened; multicellular short hairs absent or present at sinus between segments; perispore surface with rugose, rugate, saccate, papillate, baculate processes, or ridged folds.
- 37a. Multicellular hairs ± present at sinus between segments.
- 38a. Lamina with only few pairs of lower pinnae slightly shortened, basal pair of pinnae never shortened as auriculate, usually more than 2 cm, stipes usually more than 10–15 cm.
- 39a. Indusia with short glandular hairs on back ..... 15. *D. auriculata*  
 39b. Indusia without or with short glandular hairs only on lower part of back ..... 16. *D. giraldii*
- 38b. Lamina with numerous pairs of lower pinnae gradually shortened toward base, basal pair of pinnae no more than 1–2 cm, often auriculate, stipes usually within 10–15 cm.
- 40a. Multicellular hairs sparsely present on surfaces of segments ..... 19. *D. sichuanensis*  
 40b. Multicellular long hairs densely present on surfaces of segments.
- 41a. Spore surface with few discontinuous low folds or rugose folds; rachis and costae with dense multicellular long hairs and scale hairs; hairs absent at margin of segments ..... 17. *D. hirtirachis*  
 41b. Spore surface with rugate, saccate folds, or papillate, verrucose processes; rachis and costae only with sparse multicellular hairs; segments with multicellular long hairs at margin ..... 18. *D. liangshanensis*
- 37b. Multicellular hairs absent at sinus between segments.
- 42a. Perispore surface with continuous low folds or discontinuous rugose folds.
- 43a. Numerous pairs of lower pinnae gradually shortened toward base, basal pair of pinnae no more than 2 cm, often auriculate.
- 44a. Fertile fronds only ca. 30 cm; segments thinner, less than 2 mm wide, subentire at margin, pinnae and segments approximate; multicellular hairs thicker and longer on abaxial surface of rachis and costae ..... 20. *D. sikkimensis*  
 44b. Fertile fronds more than 60 cm; segments more than 4 mm wide, serrulate at margin, pinnae and segments separate; multicellular hairs thin and short on abaxial surface of rachis and costae ..... 21. *D. medogensis*
- 43b. Only 2 or 3 pairs of lower pinnae slightly shortened toward base, basal pair of pinnae usually more than 3 cm.
- 45a. Multicellular hairs very short on adaxial surface of fertile pinnae, inconspicuous; hairs thin, short, and sparse on abaxial surface of rachis and costae; indusia subentire ..... 22. *D. vegetior*  
 45b. Multicellular hairs visible on adaxial surface of fertile pinnae; hairs thick and long on abaxial surface of rachis and costae; indusia slightly erose or shortly ciliate at margin ..... 23. *D. acuta*
- 42b. Perispore surface with rugate, saccate folds or papillate, verrucose, or baculate processes.
- 46a. Only few pairs of lower pinnae slightly shortened toward base, basal pair of pinnae usually more than 2 cm, never auriculate, stipes usually more than 10–15 cm.

- 47a. Spore surface with dense baculate processes or spines ..... 24. *D. emeiensis*  
 47b. Spore surface with sparse rugate, saccate folds or papillate, verrucose processes.  
 48a. Lower pinnae narrowly deltoid-ovate or ovate-lanceolate, prominently broadened toward base, their basal segments reflexed ..... 25. *D. ludingensis*  
 48b. Lower pinnae lanceolate, not broadened toward base, their basal segments explanate ..... 26. *D. wilsonii*  
 46b. Numerous pairs of lower pinnae gradually shortened toward base, basal pair of pinnae no more than 1–2 cm, often auriculate, stipes usually 10–15 cm.  
 49a. Multicellular hairs thin, short, and sparse at abaxial surfaces of rachis and costae.  
 50a. Segments truncate at apex ..... 27. *D. vermiformis*  
 50b. Segments obtuse-rounded or obtuse at apex ..... 28. *D. shennongensis*  
 49b. Multicellular hairs thick, long, and rather dense on abaxial surfaces of rachis and costae.  
 51a. Segments truncate at apex ..... 29. *D. truncata*  
 51b. Segments rounded or obtuse, occasionally rounded-truncate at apex.  
 52a. Fertile fronds less than 30 cm; pinnae fewer than 12 pairs, less than 5 cm; segments 5–7 pairs ..... 30. *D. brevipinna*  
 52b. Fertile fronds more than 30 cm; pinnae up to 20 pairs, more than 5 cm; segments more than 12 pairs.  
 53a. Fertile fronds up to more than 1 m, lamina linear-oblongate, pinnae more than 25–30 pairs ..... 31. *D. dolosa*  
 53b. Fertile fronds 30–70 cm, lamina oblong or oblanceolate, pinnae 20–25 pairs ..... 32. *D. jiulongensis*

**1. *Deparia pterorachis*** (Christ) M. Kato, Bot. Mag. (Tokyo) 90: 35. 1977.

翅轴对囊蕨 *chi zhou dui nang jue*

*Athyrium pterorachis* Christ, Bull. Herb. Boissier 4: 668. 1896; *Cornopteris pterorachis* (Christ) Tardieu; *Dryoathyrium pterorachis* (Christ) Ching; *Lunathyrium pterorachis* (Christ) Kurata.

Rhizomes long creeping, ascending at apex. Fronds subcaespitose; fronds 1.2–1.5 m; stipe upward pale brown-stramineous, 30–70 cm, base 5–6 mm in diam., with sparse brownish, broadly lanceolate scales, upper part glabrate; lamina 3-pinnatifid, oblong, 50–70 cm or longer, 25–40 cm wide at middle, slightly narrowed to base, acuminate; pinnae ca. 16 pairs, alternate, subsessile, slightly ascending, basal pair shorter and narrowed toward base; second pair of pinnae linear-lanceolate, up to 20 × 3–4 cm, acuminate, base equilateral and truncate; pinnules 20–25 pairs, narrowly oblong or lanceolate, 1.5–2.5 cm × 4–6 mm, base broadened and adnate to costae, with interpinular sinuses often V-shaped, pinnatifid to pinnatifid, apex obtuse-rounded; segments oblong or subtriangular, entire; third pair and upper pinnae similar to second pair but gradually shortened, with pinnules shallowly lobed or toothed. Veins pinnate in segment, lateral veins 2–4-paired, simple. Lamina herbaceous when dried, dark green; rachis, costae, and costules with sparse brown lanceolate small scales and scalelike vermiculate hairs. Sori oblong or horseshoe-shaped, 1 (or 2) per segment; indusia brownish, elongated or horseshoe-shaped, thickly membranous, entire, persistent. Perispore with foldlike processes.  $2n = 80$ .

Damp areas in coniferous forests; 800–1000 m. Heilongjiang, Jilin [Japan, Korea, E Russia].

**2. *Deparia erecta*** (Z. R. Wang) M. Kato, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(4): 404. 1984.

直立对囊蕨 *zhi li dui nang jue*

*Athyriopsis erecta* Z. R. Wang, Acta Phytotax. Sin. 20:

237. 1982; *Dryoathyrium articulatifoliosum* Ching & W. M. Chu ex Y. T. Hsieh; *D. chingii* (Z. Y. Liu) W. M. Chu ex P. S. Wang & X. Y. Wang; *D. erectum* (Z. R. Wang) W. M. Chu & Z. R. Wang; *Lunathyrium chingii* Z. Y. Liu.

Rhizomes creeping, ascending at apex. Fronds caespitose; fertile fronds up to 55–113 cm; stipe upward brownish stramineous, 30–40(–68) cm, 2–3(–4.2) mm in diam., base not beak-shaped, with sparse brown, ovate or broadly lanceolate scales, upper part glabrate; lamina 2-pinnatifid, narrowly ovate or deltoid-ovate, 25–40(–48) × 14–24 cm, base rounded-cuneate, apex acuminate; pinnae 5–8(–12) pairs, lower 1–6 pairs subopposite, basal 1 or 2 pairs nearly equally long, shortly stalked, stalks up to 1.5 cm; upper pinnae alternate, ascending or subspreading, 2–5 cm apart, falcate-lanceolate; middle and lower pinnae 10–14.5 × 2.5–4 cm, subequilateral, base truncate, apex acuminate; basal pinnae prominently narrowed and slightly inequilateral to base, pinnatifid; segments 10–15(–17) pairs, basal segments subopposite, others alternate, slightly ascending, approximate, oblong or rectangular, 1–2 cm × 6–11 mm, shallowly toothed on lateral margin, obtuse-rounded or subtruncate at apex. Veins pinnate in segment, lateral veins 6–9 pairs, simple or forked, occasionally 3- or 4-forked. Lamina herbaceous when dried, greenish brown; rachis and costae with sparse brown lanceolate small scales and scalelike hairs. Sori oblong, occasionally shortly linear, J-shaped, or horseshoe-shaped, 1–3 mm, abaxial, medial, 1–7 pairs per segment; indusia brownish, oblong, occasionally reniform or horseshoe-shaped, basal acroscopic one often hooked, membranous, erose at margin, persistent. Perispore with long spines.  $2n = 80^*$ .

• Valley forests, wet areas; (200–)1200–2500 m. Chongqing, Guizhou, Hubei, Hunan, Sichuan, NE Yunnan.

The long spines on the perispore of *Deparia erecta* are unique in the genus.

**3. *Deparia chinensis*** (Ching) Z. R. Wang, **comb. nov.**

中华对囊蕨 *zhong hua dui nang jue*

Basionym: *Dryoathyrium chinense* Ching, Fl. Tsinling. 2: 214. 1974.

Rhizomes creeping, ascending at apex. Fronds subcaespitose; fertile fronds up to 80 cm; stipe upward stramineous, up to 30 cm, base ca. 2 mm in diam., with sparse brown lanceolate scales, upper part glabrate; lamina 2-pinnatipartite, oblong, 40–50 × 20–25 cm at middle, narrowed at base, acuminate at apex; pinnae ca. 15 pairs, alternate, subsessile, slightly ascending, lanceolate, middle and lower pinnae 12–14 × 2–2.5 cm, subequilateral, truncate at base, pinnatipartite at margin, long acuminate at apex; segments 17–20 pairs, oblong, 1–1.2 cm × 6–7 mm, entire or sparsely repand, obtuse-rounded or subtruncate; upper pinnae similar to lower pinnae but gradually shorter, pinnatifid to pinnatipartite; segments oblong or rectangular, entire. Veins pinnate in segment, lateral veins 6–8 pairs, usually simple, occasionally forked. Lamina thickly herbaceous when dried, dark green, rachis and costae with sparse brown lanceolate small scales and scalelike vermiculate hairs. Sori shortly linear, sometimes slightly curved, occasionally J-shaped or horseshoe-shaped, abaxial on acroscopic veins; indusia dark brown, elongated, sometimes lunate, J-shaped, or horseshoe-shaped, membranous, entire, persistent. Perispore with lophate folds.

• Valley forests, damp areas; 1000–2100 m. Chongqing, S Shaanxi, Sichuan.

**4. *Deparia setigera*** (Ching ex Y. T. Hsieh) Z. R. Wang, **comb. nov.**

刺毛对囊蕨 *ci mao dui nang jue*

Basionym: *Dryoathyrium setigerum* Ching ex Y. T. Hsieh, Bull. Bot. Res., Harbin 5(3): 153. 1985.

Rhizomes creeping, ascending at apex. Fronds caespitose; fertile fronds 50–60 cm; stipe upward stramineous, 20–25 cm, ca. 2 mm in diam. at base, densely clothed with brown lanceolate scales, upper part glabrate; lamina 2-pinnatipartite, oblong, 30–35 × 16–20 cm, narrowed at base, acuminate at apex; pinnae 10–14 pairs, basal pinnae subopposite, other pinnae alternate, sessile, subspreading, lanceolate, middle pinnae 10–12 × 2–2.2 cm, equilateral, subtruncate at base, pinnatipartite, acuminate at apex; segments oblong, 8–10 × 4–5 mm, entire or repand-crenate, obtuse-rounded or truncate. Veins pinnate in segment, lateral veins ca. 5 pairs, simple or forked. Fronds herbaceous when dried, green; rachis and costae with brownish broadly lanceolate small scales and scalelike vermiculate hairs. Sori oblong, J-shaped, or horseshoe-shaped, medial or basal, 4–6 pairs per segment; indusia brown, elongated, J-shaped, or horseshoe-shaped, membranous, entire, persistent. Perispore with lophate folds.

• Valley forests, damp areas; 400–2100 m. Chongqing, Guizhou, Hunan, Sichuan, Zhejiang.

**5. *Deparia coreana*** (Christ) M. Kato, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(4): 392. 1984.

朝鲜对囊蕨 *chao xian dui nang jue*

*Athyrium coreanum* Christ, Bull. Herb. Boissier, sér. 2, 2: 827. 1902; *A. decursivum* Yabe; *Dryoathyrium coreanum*

(Christ) Tagawa; *Lunathyrium coreanum* (Christ) Ching; *L. ningshenense* Ching.

Rhizomes shortly creeping, ascending or suberect, clothed with brownish, membranous, lanceolate scales at apex and stipe base. Fronds approximate; fertile fronds 60–80(–95) cm; stipe dark brown at base, upward stramineous, 30–40(–47) cm, 3(–4) mm in diam., base swollen, with pneumatophores, upper part gradually sparsely scaly; lamina 2-pinnatipartite to 2-pinnatisect, oblong-ovate, slightly longer than or as long as stipe, 18–25 cm wide, apex pinnatifid-acuminate; pinnae 12–15(–18) pairs, lower pinnae subopposite, slightly shortly stalked or subsessile, oblique; basal 1 or 2 pairs of pinnae slightly shortened, prominently narrowed to base, 4–6 cm apart; middle pinnae lanceolate, 10–15 × (1.5–)3 cm, subtruncate at base, acroscopic base subparallel to costa, basisopic base slightly cuneate, pinnatipartite or subpinnatisect, apex long acuminate; pinna segments 15(–20) pairs, basal segments of lowest 2 or 3 pairs of pinnae shorter, middle segments oblong, (0.8–)1–1.2(–2) cm × (4–)5 mm, connected by narrow wing, serrate, much separated from each other, obtuse or obtuse-rounded. Veins visible on surfaces, pinnate in segment, lateral veins 6–8 pairs, 2- or 3-forked. Lamina herbaceous when dried, pale green, rachis and costae with sparse brown multicellular long hairs on abaxial side, shorter hairs more sparse on adaxial side. Sori mostly narrowly oblong or lunate, sometimes hooked, abaxial; indusia brownish, thick, bullate, sparsely ciliate at margin. Spores bilateral, surface with few long foldlike processes.  $2n = 160$ , (240).

Valley forests; 700–1000 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Shaanxi [Japan, Korea].

*Deparia coreana* is very close to *D. henryi* and has often been treated as conspecific with it. However, *D. coreana* differs from *D. henryi* in the swollen base of the stipe with pneumatophores and the thick bullate indusia.

**6. *Deparia henryi*** (Baker) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

鄂西对囊蕨 *e xi dui nang jue*

*Aspidium henryi* Baker, Ann. Bot. (Oxford) 5: 306. 1891; *Athyrium henryi* (Baker) Diels; *Dryoathyrium henryi* (Baker) Ching; *Lunathyrium henryi* (Baker) Kurata.

Rhizomes shortly creeping, ascending at apex. Fronds subcaespitose; fertile fronds 50–95 cm; stipe upward stramineous, 20–35 cm, 3–4 mm in diam. at base, base with sparse dark brown lanceolate scales, upper part glabrate; lamina 2-pinnatipartite, oblong, 30–60 × 20–25 cm, slightly narrowed to base, acuminate at apex; pinnae 12–18 pairs, alternate, subsessile, slightly ascending, broadly lanceolate, pinnae below middle 12–20 × 3–4 cm, base subequilateral, truncate or rounded-cuneate, pinnatipartite, apex caudate-acuminate; segments falcate-oblong, 2–2.5 cm × 6–8 mm, margin incised-toothed, apex obtuse-rounded or shortly acute; upper pinnae gradually shorter, pinnatifid to pinnatipartite; segments oblong or rhomboid, entire or serrate. Veins pinnate in segment, lateral veins 8–10 pairs, 2- or 3-forked. Lamina herbaceous when dried, dark green, rachis and costae with sparse brown broadly lanceolate small scales and scalelike vermiculate hairs. Sori shortly oblong, sometimes curved, J-shaped, or horseshoe-shaped, inframedial;

indusia brown, elongate, occasionally J- or horseshoe-shaped, membranous, lacerate into cilia at margin, persistent. Perispore with many rugate folds.  $2n = 240^*$ .

• Damp areas in broad-leaved forests and shrubs; 1000–2000 m. Chongqing, Fujian, SE Gansu, Guizhou, S Henan, Hubei, Hunan, S Shaanxi, Sichuan, Yunnan.

**7. *Deparia confusa* (Ching & Y. P. Hsu) Z. R. Wang, *comb. nov.***

陕甘对囊蕨 shan gan dui nang jue

Basionym: *Dryoathyrium confusum* Ching & Y. P. Hsu, Fl. Tsinling, 2: 213. 1974.

Rhizomes creeping, ascending at apex. Fronds approximate; fertile fronds 50–65 cm; stipe upward stramineous, 20–25 cm, ca. 2 mm in diam. at base, base with sparse brown ovate-lanceolate scales, upper part glabrate; lamina 2-pinnatipartite, narrowly ovate, 30–40 × 23–28 cm at middle, base narrowed and rounded-cuneate, apex acuminate and pinnatifid; pinnae ca. 16 pairs, alternate, sessile, subspreading, lanceolate, basal pinnae shortened, second basal pair 10–13 × 2.4–3 cm, somewhat caudate-acuminate, base subequilateral, rounded-cuneate; segments ca. 15 pairs, basal segments opposite, other segments alternate, spreading, oblong or rectangular, 1–1.5 cm × 5–7 mm, obtuse-rounded, subdentate; third basal pair of pinnae slightly larger, similar to second pair. Veins pinnate in segment, lateral veins usually forked, only basal acroscopic one often simple. Lamina herbaceous when dried, pale green, rachis, costae, and costules with sparse brown broadly lanceolate small scales and brown scalelike vermiculate hairs. Sori sparse, orbicular or elliptic, abaxial on base of acroscopic veins; indusia pale brown, lunate, occasionally horseshoe-shaped, membranous, entire, persistent. Perispore with baculate or spinelike ornamentation.

• Damp areas in broad-leaved forests; 1300–1500 m. SE Gansu, C and S Shaanxi.

**8. *Deparia stenopterum* (Christ) Z. R. Wang, *comb. nov.***

川东对囊蕨 chuan dong dui nang jue

Basionym: *Phegopteris stenoptera* Christ, Bull. Herb. Boissier 6: 963. 1898, based on *Polypodium stenopterum* Baker, J. Bot. 26: 229. 1888, not *Polypodium stenopteron* Baker, J. Bot. 24: 183. 1886; *Athyrium dielsii* C. Christensen, nom. illeg. superfl.; *Dryoathyrium dielsii* Ching, nom. illeg. superfl.; *D. stenopterum* (Christ) Ching ex Y. T. Hsieh; *Dryopteris dielsii* C. Christensen, nom. illeg. superfl.; *Nephrodium stenopterum* (Christ) Diels (1899), not *N. stenopteron* Baker (1890).

Rhizomes creeping, ascending at apex. Fronds approximate; fertile fronds 55–85 cm; stipe upward stramineous, 20–40 cm, 2–2.5 cm in diam. at base, base with sparse brown narrowly lanceolate scales, upper part glabrate; lamina 2-pinnatipartite, ovate-oblong, 25–45 × 18–30 cm at middle, base narrowed and rounded-cuneate, apex acuminate; pinnae 8–12 pairs, basal pinnae subopposite, other pinnae alternate, shortly stalked or sessile, subspreading, broadly lanceolate, middle pinnae 12–18 × 2.5–4 cm, caudate, base inequilateral, acroscopic base narrowly cuneate or subtruncate, pinnatipartite; segments 15–18

pairs, basal segments subopposite, other segments alternate, falcate, oblong, basal pair shortened, second and third pairs of segments 1.2–2 cm × 4–8 mm, crenulate, obtuse-rounded or shortly acute. Veins pinnate in segment, lateral veins (2 or)3- or 4-forked. Lamina herbaceous when dried, green. Rachis, costae, and costules with sparse brown lanceolate small scales and brown, scalelike vermiculate hairs. Sori small, orbicular, abaxial, medial; indusia brown, orbicular-reniform, small, membranous, entire, persistent. Perispore with baculate and spinelike ornamentation.

• Damp areas in evergreen broad-leaved forests and shrubs; 500–2200 m. Guizhou, Hubei, Hunan, Sichuan, Yunnan.

**9. *Deparia falcaticinnula* (Z. R. Wang) Z. R. Wang, *comb. nov.***

镰小羽对囊蕨 lian xiao yu dui nang jue

Basionym: *Dryoathyrium falcaticinnulum* Z. R. Wang, Acta Phytotax. Sin. 20: 238. 1982.

Rhizomes creeping. Fronds approximate; fertile fronds 50–60 cm; stipe upward stramineous, ca. 24 cm, 2–3 mm in diam. at base, base with sparse blackish brown broadly lanceolate scales, upper part glabrate; lamina 2-pinnatipartite or nearly 2-pinnate, ovate-oblong, 30–34 × 17–21 cm, base rounded, apex acuminate; pinnae 12–15 pairs, basal 1 or 2 pairs largest, opposite, sessile, other pinnae alternate, narrowly elliptic or elliptic, lower pinnae 10–14 × 2.5–3.5 cm, narrowed, cuneate and inequilateral to base, long acuminate at apex; segments 14–16 pairs, basal 1 or 2 pairs prominently shortened, basispic segments longer than acroscopic segments; acroscopic segments oblong, 1.2–1.8 cm × ca. 5 mm, toothed, rounded; basispic segments falcate, lanceolate, up to 3.2 cm × ca. 6 mm, toothed, acuminate. Veins pinnate in segment, lateral veins 4–20 pairs, 2- or 3-forked, rarely simple. Lamina herbaceous when dried, dark green; rachis, costae, and costules with sparse short multicellular brown hairs. Sori small, almost orbicular-reniform, abaxial, medial; indusia dark brown, reniform, small, membranous, entire, fugacious. Perispore with papillate or spinelike ornamentation.

• Forests on mountain slopes, rare; 700–1100 m. Sichuan.

It is possible that there are hybrids between *Deparia falcaticinnula* and *D. unifurcata*.

**10. *Deparia unifurcata* (Baker) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.**

单叉对囊蕨 dan cha dui nang jue

*Nephrodium unifurcatum* Baker, J. Bot. 26: 228. 1888; *Aspidium pandiforme* Christ; *Athyrium unifurcatum* (Baker) C. Christensen; *Dryoathyrium jinfoshanense* Ching & Z. Y. Liu; *D. unifurcatum* (Baker) Ching; *Dryopteris pandiformis* (Christ) C. Christensen; *D. tosensii* Kodoma; *D. unifurcata* (Baker) C. Christensen; *Lunathyrium unifurcatum* (Baker) Kurata; *Parathyrium unifurcatum* (Baker) Holttum.

Rhizomes long creeping. Fronds distant; fertile fronds 45–95 cm; stipe upward stramineous, 20–40 cm, 2–3 mm in diam. at base, base with sparse blackish brown broadly lanceolate or

linear scales, upper part glabrate; lamina 2-pinnatifid, ovate-oblong, 25–55 × 20–28 cm, base slightly narrowed, apex acuminate; pinnae 12–14 pairs, basal pinnae subopposite, other pinnae alternate, subsessile, ascending, lanceolate, middle pinnae 13–16 × 3–4 cm, base narrowed and rounded-truncate, pinnatifid, apex acuminate; segments 12–15 pairs, oblong, basal segments shortened, upper segments 1.5–2.5 cm × 6–8 mm, entire or crenate, obtuse-rounded or truncate. Veins pinnate in segment, lateral veins forked, occasionally 3-forked. Lamina herbaceous when dried, pale green, rachis, costae, and costules with sparse black or dark brown lanceolate small scales and brown, scalelike vermiculate hairs. Sori small, orbicular, abaxial, medial; indusia red-brown, small, orbicular-reniform, membranous, subentire or lacinate, persistent. Perispore with baculate or spinelike ornamentation.  $2n = 80^*$ , 160;  $n = 2n = 120$  (apomictic).

Mountain forests, damp areas at streamsides, wet broad-leaved forests; 200–2800 m. Chongqing, Guizhou, Hubei, Hunan, S Shaanxi, Sichuan, Taiwan (Hualian, Nantou), Yunnan, Zhejiang [Japan].

**11. *Deparia okuboana*** (Makino) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

大久保对囊蕨 da jiu bao dui nang jue

*Athyrium okuboanum* Makino, Bot. Mag. (Tokyo) 13: 16. 1899; *A. unifurcatum* (Baker) C. Christensen var. *okuboanum* (Makino) H. Itô; *A. viridifrons* Makino f. *okuboanum* (Makino) Makino; *Dryoathyrium okuboanum* (Makino) Ching; *D. viridifrons* (Makino) Ching var. *okuboanum* (Makino) Ching ex S. H. Fu; *Dryopteris okuboana* (Makino) Koidzumi; *Lunathyrium okuboanum* (Makino) Sugimoto; *L. unifurcatum* Kurata var. *okuboanum* (Makino) Sa. Kurata.

Rhizomes creeping, ascending at apex. Fronds subcaespitose; fertile fronds up to 1.2 m; stipe upward stramineous, 30–50 cm, 3–5 mm in diam. at base, with sparse brown lanceolate scales, upper part glabrate; lamina 3-pinnatifid or 3-pinnate, broadly ovate or ovate-oblong, 30–80 × 25–40 cm, base rounded-cuneate and narrowed, apex acuminate; pinnae 10–14 pairs, alternate, shortly stalked or subsessile, oblong-lanceolate, 20–28 × 5–9 cm, narrowed toward base, acuminate at apex; pinnules 12–16 pairs, basal pinnules subopposite, other pinnules alternate, sessile, spreading, basal pinnules smaller, oblong, 1–1.2 cm × ca. 5 mm, subequilateral, obtuse-rounded; large pinnules oblong, 3–8 cm × 7–15 mm, base broadly cuneate, decurrent and adnate to costules with narrow costular wings, shallowly lobed to pinnatifid, apex obtuse to acuminate; segments oblong, oblique, entire, obtuse-rounded. Veins pinnate in segment, lateral veins 2–4 pairs, simple. Lamina thickly papery when dried, grass-green, rachis, costae, and costules with sparse brownish broadly lanceolate small scales and scalelike vermiculate hairs. Sori orbicular, abaxial; indusia greenish brown, orbicular-reniform or somewhat horseshoe-shaped, membranous, entire or lacinate, persistent. Perispore with baculate or spinelike ornamentation.  $2n = 120$  (apomictic).

Valley forests, forest margins, wet areas, streamsides; near sea level to 2500 m. Anhui, Fujian, SE Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, S Shaanxi, Sichuan, Yunnan, Zhejiang [Japan, Vietnam].

**12. *Deparia viridifrons*** (Makino) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

绿叶对囊蕨 lü ye dui nang jue

*Asplenium viridifrons* Makino, Bot. Mag. (Tokyo) 13: 15. 1899; *Athyrium henryi* (Baker) Diels var. *viridifrons* (Makino) Ohwi; *Cornopteris viridifrons* (Makino) Tardieu; *Dryoathyrium viridifrons* (Makino) Ching; *Lunathyrium viridifrons* (Makino) Sa. Kurata; *Parathyrium viridifrons* (Makino) Holttum.

Rhizomes creeping, moderately stout. Fronds approximate; fertile fronds up to 1.2 m; stipe upward stramineous, 35–55 cm, 3–4 mm in diam. at base, base with sparse brownish broadly lanceolate scales, upper part glabrate; lamina 3-pinnatifid, deltoid-ovate or ovate-lanceolate, 40–65 × 30–55 cm, base hardly narrowed and rounded-cuneate, apex acuminate; pinnae 8–10 pairs, alternate but basal pair subopposite, stalked, ascending, oblong, large pinnae 22–30 × 10–15 cm at middle, base truncate, apex acuminate; pinnules 12–14 pairs, alternate, subsessile, continued to narrow costal wing, spreading, lanceolate, deeply pinnatifid; segments 10–12 pairs, alternate, ascending, rectangular, 6–12 × 2.5–3.5 mm, crenate, obtuse-rounded at apex. Veins pinnate in segment, lateral veins simple or forked. Lamina herbaceous when dried, green, rachis, costae, and costules with sparse brownish lanceolate small scales and scalelike vermiculate hairs. Sori small, orbicular or rotund, abaxial; indusia brown, orbicular-reniform, membranous, subentire or lacinate, persistent. Perispore with many folds irregularly rugate.  $2n = 80$ .

Forests, near forest margins; 300–2100 m. Fujian, Guizhou, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang [Japan, Korea].

**13. *Deparia boryana*** (Willdenow) M. Kato, Bot. Mag. (Tokyo) 90: 36. 1977.

对囊蕨 dui nang jue

*Aspidium boryanum* Willdenow, Sp. Pl., ed. 4, 5: 285. 1810; *A. edentulum* Kunze; *Athyrium boryanum* (Willdenow) Tagawa; *A. edentulum* (Kunze) Ching; *A. subfluviale* (Hayata) Tagawa; *A. unifurcatum* (Baker) C. Christensen var. *subfluviale* (Hayata) H. Itô; *Cornopteris boryanum* (Willdenow) Tardieu; *Ctenitis boryana* (Willdenow) Copeland; *Deparia edentula* (Kunze) X. C. Zhang; *D. subfluvialis* (Hayata) M. Kato; *Dryoathyrium boryanum* (Willdenow) Ching; *D. edentulum* (Kunze) Ching; *Dryopteris boryana* (Willdenow) C. Christensen; *D. edentula* (Kunze) Kuntze; *D. subfluvialis* Hayata; *Lastrea boryana* (Willdenow) T. Moore; *L. edentula* (Kunze) T. Moore; *Lunathyrium boryanum* (Willdenow) H. Ohba; *Nephrodium boryanum* (Willdenow) Baker (1867), not Hooker (1862); *N. divisum* Wallich ex Hooker; *N. edentulum* (Kunze) Baker; *Parathyrium boryanum* (Willdenow) Holttum; *Polypodium subtripinnatum* C. B. Clarke.

Rhizomes creeping, ascending or suberect at apex. Fronds subcaespitose; fertile fronds 1.2–2 m; stipe upward pale brown-stramineous, (35–)40–95 cm, up to 1 cm in diam. at base, base with sparse dark brown subulate lanceolate scales, upper part glabrate; lamina 3(or 4)-pinnatifid, broadly ovate, (50–)80–105 × (30–)60–85 cm at middle, base narrowed and rounded-

cuneate, apex acuminate; pinnae (10–)12–15 pairs, alternate, stalked, slightly ascending, oblong-lanceolate, basal pinnae up to  $40 \times$  ca. 15 cm at middle, base equilateral, truncate, apex acuminate; pinnules 14–16(–18) pairs, alternate, sessile or stalked, spreading, broadly lanceolate to oblong, (5–)6–10  $\times$  1.5–2 cm, base equilateral, truncate, pinnatifid, apex acuminate; segments ca. 12 pairs, basal segments usually shortened, suboblong, (6–)7–20  $\times$  2.5–3.5(–7) mm, crenate-serrate or entire, obtuse-rounded. Veins pinnate in segment, lateral veins simple or forked. Lamina herbaceous when dried, yellow-green, with sparse short pale hairs adaxially, rachis, costae, and costules with sparse brown lanceolate small scales and scalelike vermiculate hairs. Sori small, orbicular, abaxial, medial or subcostular; indusia brown, orbicular-reniform, membranous, subentire or irregularly toothed, frequently abortive or fugacious. Perispore with strialike folds.  $2n = 80$ .

Damp areas, streamsides, evergreen or broad-leaved forests; 400–3300 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Shaanxi, Sichuan, Taiwan, SE Xizang, Yunnan, Zhejiang [India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Africa].

**14. *Deparia pycnosora*** (Christ) M. Kato, Bot. Mag. (Tokyo) 90: 36. 1977.

东北对囊蕨 *dong bei dui nang jue*

Rhizomes stout, ascending or shortly creeping, densely clothed with brownish, membranous, broadly ovate or ovate-lanceolate large scales at apex and stipe bases. Fronds caespitose; fertile fronds (30–)40–70(–87) cm; stipe chestnut-black at base, upward gradually stramineous, occasionally reddish chestnut, 8–20(–31) cm, upward with sparse, brown, membranous, lanceolate scales; lamina pinnate, broadly lanceolate to oblong-lanceolate, (24–)30–40(–59)  $\times$  (5–)8–12(–18) cm, apex acuminate; pinnae pinnatifid, 18–25 pairs, only few lower pairs gradually shortened; basal pinnae usually more than 2.5 cm, rarely shorter; middle pinnae narrowly lanceolate, (2.5–)4–5(–9)  $\times$  0.7–2.5 cm, base subtruncate, apex acuminate; lower pinnae subopposite, upward pinnae alternate, spreading, 1–3 cm apart, pinnatifid near to costae; pinna lobes (7–)12–15(–19) pairs, contiguous, oblong, 4–10  $\times$  2–3 mm, margin entire or  $\pm$  crenate, apex rounded or obtuse and crenate. Veins visible on both surfaces, pinnate, ca. 5 pairs, simple or forked. Lamina herbaceous when dried, green, with sparse multicellular short hairs along rachis, costae, midribs, and veins. Sori narrowly lunate to linear, 3–5 pairs per lobe, almost from midrib to lamina margin, 1–1.5 mm, often dense at maturity; indusia similar to sori, pale brown, persistent. Spores bilateral, perispore surface with few low folds.  $2n = 80$ , 160.

Damp places in mixed forests; 200–1000 m. Hebei, Heilongjiang, Jilin, Liaoning, Shandong [N Japan, Korea, E Russia].

*Deparia pycnosora* is similar to the North American *Lunathyrium acrostichoides* (Swartz) Ching in the ascending to shortly creeping rhizome, multicellular short hairs borne at sinuses between pinna lobes, and spore surface with low folds. The two may be vicariants in E Asia and North America.

1a. Pinnae 0.7–1.5 cm wide, pinna lobes 4–6(–10) mm; veins simple ..... 14a. var. *pycnosora*

1b. Pinnae 2–2.5 cm wide, pinna lobes ca. 10 mm; veins usually forked ..... 14b. var. *longidens*

**14a. *Deparia pycnosora* var. *pycnosora***

东北对囊蕨(原变种) *dong bei dui nang jue* (*yuan bian zhong*)

*Athyrium pycnosorum* Christ, Bull. Herb. Boissier, sér. 2, 2: 827. 1902; *Lunathyrium changbeiense* Ching & J. J. Chien; *L. pycnosorum* (Christ) Koidzumi; *L. pycnosorum* var. *acutum* J. J. Chien; *L. shandongense* J. X. Li & F. Z. Li.

Fronds smaller: pinnae 0.7–1.5 cm wide, pinna lobes usually 4–6  $\times$  2–3 mm, entire or  $\pm$  crenate, multicellular hairs fewer at sinuses between pinna lobes; veins simple.

Damp places in mixed forests; 200–1000 m. Hebei, Heilongjiang, Jilin, Liaoning, Shandong [N Japan, Korea, E Russia].

**14b. *Deparia pycnosora* var. *longidens*** (Z. R. Wang) Z. R. Wang, **comb. nov.**

长齿对囊蕨 *chang chi dui nang jue*

Basionym: *Lunathyrium pycnosorum* var. *longidens* Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 509. 1999.

Fronds with much larger pinnae and pinna lobes, i.e., pinnae 2–2.5 cm wide, pinna lobes ca. 1 cm  $\times$  4–5 mm, prominently toothed at margin; multicellular hairs shorter and sparser at sinuses between pinna lobes; veins frequently forked.

• Damp places in mixed forests. Heilongjiang (Daguokui Shan, Shangzhi).

**15. *Deparia auriculata*** (W. M. Chu & Z. R. Wang) Z. R. Wang, **comb. nov.**

大耳对囊蕨 *da er dui nang jue*

Rhizomes moderately stout, erect, clothed with dark brown, membranous, lanceolate scales at apices and stipe bases. Fronds caespitose; fertile fronds 80–90 cm; stipe stramineous, 10–25 cm, 4–7 mm in diam., with sparse brownish, hyaline, multicellular hairs, upward scales gradually sparse; lamina pinnate-pinnatifid, oblong-lanceolate or lanceolate, 20–63  $\times$  7–18 cm, slightly narrowed or hardly narrowed to base, apex pinnatifid-acuminate; pinnae 12–22 pairs, middle pinnae alternate, spreading, lanceolate, 7–13  $\times$  1.5–2.5 cm, base slightly broadened, subtruncate, pinnatifid, apex acuminate; only few pairs of lower pinnae slightly or hardly shortened, abruptly prominently broadened at base, subopposite; segments ca. 18 pairs, oblong, separated from each other, ca. 8  $\times$  4 mm, base adnate to narrow wing, basal acroscopic segments of basal pinnae prominently or slightly elongated, apex rounded-obtuse or obtuse. Veins visible abaxially, pinnate in segments, 5–7 pairs, simple, sometimes forked in lower segments of pinnae, ascending. Lamina herbaceous or subpapery when dried; rachis, costae, and veins abaxially with rather dense, thick, multicellular long hairs, with short multicellular hairs at sinus between pinna segments. Sori oblong or lunate, 4–7 sori per segment, 1–2 mm, approximate; indusia similar to sori, sometimes J-shaped at apices of lamina or pinnae, brownish, ciliate or prominently erose at margin, with some glandular-hairlike trichomes borne

on back. Spores bilateral, perispore surface with rugate, rugate-saccate, or papillate processes.

• Under alpine shrubs, slightly shaded wet places, coniferous forests on mountain slopes; 2800–3600 m. W Sichuan, NW Yunnan.

*Deparia auriculata* is similar to *D. giraldii* in shape but differs by the basal acroscopic segments of the basal pair or several lower pairs of pinnae prominently enlarged and pinnatifid to pinnatifid; rachis and costae with rather dense, thick, long multicellular hairs abaxially; and indusia prominently ciliate at margin with glandular hairlike trichomes on the back.

- 1a. Acroscopic basal lobes of lower pinnae prominently larger than others, pinnatifid or pinnatifid ..... 15a. var. *auriculata*  
 1b. Acroscopic basal lobes of lower pinnae slightly larger, toothed at margin ..... 15b. var. *zhongdianensis*

### 15a. *Deparia auriculata* var. *auriculata*

大耳对囊蕨(原变种) da er dui nang jue (yuan bian zhong)

Basionym: *Lunathyrium auriculatum* W. M. Chu & Z. R. Wang, Acta Phytotax. Sin. 32: 85. 1994.

Fronds with basal acroscopic segments of basal pair of pinnae prominently elongated, ca. 2 × as long as other segments, narrowly deltoid-ovate, pinnatifid or pinnatifid, acute to shortly acuminate at apex.

• Under alpine shrubs, slightly shaded wet places; 2900–3600 m. W Sichuan, NW Yunnan.

### 15b. *Deparia auriculata* var. *zhongdianensis* (Z. R. Wang) Z. R. Wang, **comb. nov.**

中甸对囊蕨 zhong dian dui nang jue

Basionym: *Lunathyrium auriculatum* var. *zhongdianense* Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 511. 1999.

Fronds with basal acroscopic segments of lower pinnae slightly enlarged, not pinnatifid or pinnatifid, toothed or long toothed at margin.

• Coniferous forests on mountain slopes; ca. 2800 m. NW Yunnan (Zhongdian).

### 16. *Deparia giraldii* (Christ) X. C. Zhang, Lycophytes Ferns China, 385. 2012.

陕西对囊蕨 shan xi dui nang jue

*Athyrium giraldii* Christ, Nuovo Giorn. Bot. Ital., n.s., 4: 91. 1897; *A. sargentii* C. Christensen; *A. subsimile* Christ; *Deparia subsimilis* (Christ) Fraser-Jenkins; *Lunathyrium giraldii* (Christ) Ching.

Rhizomes erect or ascending, clothed with brown, membranous, ovate-lanceolate scales at apices and stipe bases. Fronds caespitose; fertile fronds (30–)50–70(–90) cm; stipe stramineous, occasionally brownish chestnut abaxially, (6–)10–15(–28) cm, 1.5–4 mm in diam., base with rather dense scales, upward scales sparse or nearly absent, with sparse, thin, short

multicellular hairs; lamina pinnate, oblong-lanceolate or ovate-lanceolate, (25–)35–60(–75) × 10–15(–28) cm, base slightly narrowed, apex acuminate; pinnae pinnatifid, (15–)20–25 pairs, middle pinnae linear-lanceolate, 5–8(–14) × 1–2 cm, base broader, truncate, apex acuminate, pinnae alternate, ascending, 2–2.5 cm apart, only few pairs of lower pinnae slightly shortened, subopposite; basal pinnae 2–4.5 cm, not auriculate; pinna segments 15–22 pairs, oblong, (4–)6(–10) × 3–4 mm, adnate to narrow wing, subspreading, 1–2 mm apart, crenulate or subentire at margin, apex obtuse-rounded or obtuse; segments of basal pinnae longer. Veins visible abaxially, pinnate in segments, 4–6(or 7) pairs, simple. Lamina herbaceous or subpapery when dried, green or greenish brown, rachis and costae abaxially with sparse hyaline multicellular short hairs, with multicellular hairs at sinus between segments. Sori oblong to narrowly lunate, 1–1.5 mm, 2–6 pairs per segment; indusia similar to sori, pale brown, erose or somewhat ciliate at margin, usually with short glandular hairs on lower part of back, persistent. Spores bilateral, perispore surface rugate-saccate, papillate or verrucose processes.  $2n = 80^*$ .

• Valley forests; 900–2900 m. S Gansu, Henan, Hubei, Ningxia, Shaanxi, Shanxi, Sichuan.

### 17. *Deparia hirtirachis* (Ching ex Z. R. Wang) Z. R. Wang, **comb. nov.**

毛轴对囊蕨 mao zhou dui nang jue

Basionym: *Lunathyrium hirtirachis* Ching ex Z. R. Wang, Acta Phytotax. Sin. 32: 87. 1994.

Rhizomes erect, densely scaly at their apices and stipe bases; scales dark brown, ovate-lanceolate, up to 1.5 cm, membranous. Fronds caespitose; fertile fronds ca. 80 cm; stipe stramineous to pale brownish, ca. 15 cm, 3–4 mm in diam., base densely scaly, upward densely clothed with narrowly lanceolate scales and brownish multicellular long hairs; lamina pinnate-pinnatifid, narrowly oblong, ca. 65 × 20 cm, gradually narrowed toward base, apex acuminate; pinnae 20–30 pairs, middle pinnae alternate, ascending, 2–3 cm apart, linear-lanceolate, up to 10 × ca. 1.8 cm, base subtruncate, pinnatifid, apex acuminate, 5 or 6 pairs of lower pinnae gradually shortened to base, lanceolate; basal pinnae auriculate, 1–2 cm, basicopic side broader; pinna segments 20 pairs or more, approximate, spreading, oblong, ca. 8 mm, adnate to broad wings of costae, toothed at margin, apex rounded. Veins on abaxial side visible, pinnate in segments, 5–7 pairs, simple. Lamina herbaceous when dried, rachis and costae with rather dense multicellular long hairs on both surfaces, veins with sparse brownish, hyaline multicellular long hairs on both surfaces, with few short multicellular hairs at sinus between pinna segments. Sori oblong, medial on veins, 3 or 4 pairs per segment, ca. 1 mm; indusia similar to sori, brown, slightly bulging, ciliate-lacerate at margin, persistent. Spores bilateral, perispore surface with few low continuous folds.

Evergreen forest margins, streamsides, damp areas; 2400–3900 m. NW Yunnan [NW Myanmar].

*Deparia hirtirachis* is similar to *D. dolosa* in shape but differs by the spore surface with few continuous folds and no auriculate lobelike

processes, stipe and rachis with dense multicellular long hairs and scale-like hairs, and lamina with multicellular long hairs on both surfaces.

**18. *Deparia liangshanensis*** (Ching ex Z. R. Wang) Z. R. Wang, **comb. nov.**

凉山对囊蕨 *liang shan dui nang jue*

Rhizomes stout, ascending. Fronds caespitose, (45–)100 cm; stipe stramineous, much shorter than lamina, densely clothed with brown, lanceolate scales and multicellular, tortuous, hyaline hairs at base, upward sparsely scaly; lamina pinnate with pinnatifid pinnae, oblong-lanceolate or oblanceolate, base narrowly cuneate, apex pinnatifid-acuminate; middle pinnae lanceolate, 4–12 cm, base slightly broadened, broadly cuneate or subtruncate, apex acuminate, pinnae alternate, ascending or subspreading, separated; lower pinnae numerous, gradually shortened, 3 or 4 pairs of basal pinnae less than 1 cm, deltoid auriculate; segments (14–)20 pairs, approximate, oblong, adnate to broad wings of costae, subentire or slightly crenate, apex rounded. Veins visible abaxially, pinnate in segments, up to (4–)6 or 7 pairs, simple. Lamina herbaceous when dried, with rather dense tortuous, hyaline multicellular hairs on both surfaces and at segment margins and sinus between segments. Sori shortly linear, approximate; indusia similar to sori, curved, single or double, brownish, long hairy, pilose, or almost glabrate, eroselike or sparsely ciliate at margin. Spores bilateral, perispore surface with rugate, rugate-saccate, or papillate processes.

• Streamsides, forests, damp areas, alpine areas in mountains; 1900–2200 m. W Guizhou, SW Sichuan, Yunnan.

- 1a. Fertile fronds (50–)100 cm; middle pinnae 6–12 cm; indusia with short hairs or glabrous ..... 18a. var. *liangshanensis*  
 1b. Fertile fronds ca. 45 cm; middle pinnae 4–5 cm; indusia with long, multicellular hairs ..... 18b. var. *sericea*

**18a. *Deparia liangshanensis* var. *liangshanensis***

凉山对囊蕨(原变种) *liang shan dui nang jue* (yuan bian zhong)

Basionym: *Lunathyrium liangshanense* Ching ex Z. R. Wang, Acta Phytotax. Sin. 32: 89. 1994.

Fertile fronds (50–)100 cm; middle pinnae 6–12 cm; indusia with short hairs or glabrous.

• Streamsides, forests, damp areas, alpine areas in mountains; 1900–2200 m. W Guizhou, SW Sichuan, Yunnan.

*Deparia liangshanensis* is similar to *D. giraldii* in shape but is easily recognized by numerous pairs of lower pinnae gradually shortened toward the base, basal pair of pinnae often auriculate, stipes shorter, with dense multicellular hairs throughout, segments also with multicellular long hairs at margin.

**18b. *Deparia liangshanensis* var. *sericea*** (Ching & Z. R. Wang) Z. R. Wang, **comb. nov.**

绢毛对囊蕨 *juan mao dui nang jue*

Basionym: *Lunathyrium liangshanense* var. *sericeum* Ching & Z. R. Wang, Acta Phytotax. Sin. 32: 89. 1994.

Plants smaller; fertile fronds ca. 45 cm, middle pinnae 4–5 cm, densely sericeous on frond surfaces, with multicellular long hairs on indusia.

• Alpine areas in mountains. NW Yunnan.

**19. *Deparia sichuanensis*** (Z. R. Wang) Z. R. Wang, **comb. nov.**

四川对囊蕨 *si chuan dui nang jue*

Rhizomes erect, clothed with brownish, membranous, ovate-lanceolate scales at apices and stipe bases. Fronds caespitose; stipe stramineous or slightly chestnut-colored abaxially, much shorter than lamina, base densely scaly, upward scales sparse or nearly absent; lamina pinnate-pinnatifid, elliptic to oblanceolate, gradually narrowed toward base, apex pinnatifid-acuminate; pinnae ascending or spreading, linear-lanceolate, deltoid-lanceolate, or oblong-lanceolate, base subtruncate, apex acuminate, pinnae separated, numerous pairs of lower pinnae gradually shortened, lanceolate, subopposite, basal pinnae often shortened as auricles; pinna segments oblong, obtuse-rounded or obtuse, truncate or rounded at apex, adnate to narrow wings of costae, ascending. Veins visible on surfaces, pinnate in segments, simple. Lamina herbaceous when dried, greenish brown, rachis and costae with somewhat dense, multicellular hairs abaxially, with multicellular hairs at sinus between segments, or subglabrous or sparsely hairy. Sori oblong or shortly linear, medial on veins; indusia glabrate or short hairs only on lower part of back, ciliate at margin, persistent. Spores bilateral, perispore surface with rugate-saccate, rugate, or papillate processes.

• Forests on mountain slopes, damp areas at streamsides; 1400–3500 m. Chongqing, S Gansu, Guizhou, Hubei, Sichuan, SE Xizang, Yunnan.

*Deparia sichuanensis* is similar to *D. liangshanensis* in shape but is distinguished by the lamina sparsely hairy on both surfaces, pinna segments without multicellular long hairs at margin, at most occasionally with 1 or 2 short hairs between teeth. This species is also similar to *D. shennongensis* but is distinguished by the multicellular hairs at the sinus between pinna segments, and rachis and costae with dense relatively long multicellular hairs abaxially.

- 1a. Hairs on abaxial surface of rachis and costae thick and long ..... 19a. var. *sichuanensis*  
 1b. Hairs on abaxial surface of rachis and costae thin and short.  
 2a. Pinnae deltoid-lanceolate, pinna segments 2–3 mm wide, truncate at apex ..... 19b. var. *gongshanensis*  
 2b. Pinnae oblong-lanceolate, pinna segments 4–6 mm wide, rounded at apex ..... 19c. var. *jinfoshanensis*

**19a. *Deparia sichuanensis* var. *sichuanensis***

四川对囊蕨(原变种) *si chuan dui nang jue* (yuan bian zhong)

Basionym: *Lunathyrium sichuanense* Z. R. Wang, Acta Phytotax. Sin. 32: 87. 1994.

Hairs on abaxial surface of rachis and costae thick and long; pinna segments obtuse-rounded or obtuse at apex.

• Mountain slopes, damp areas at streamsides; 1400–3400 m. Chongqing, S Gansu, Guizhou, Sichuan, SE Xizang, Yunnan.

**19b. *Deparia sichuanensis* var. *gongshanensis*** (Z. R. Wang) Z. R. Wang, **comb. nov.**

贡山对囊蕨 *gong shan dui nang jue*

Basionym: *Lunathyrium sichuanense* var. *gongshanense* Z. R. Wang, Acta Phytotax. Sin. 32: 88. 1994.

Rachis and costae with thin, short, multicellular hairs sparse on abaxial side or subglabrate; pinnae deltoid-lanceolate; pinna segments thinner and approximate, 2–3 mm wide, and truncate at apex.

• Coniferous forests on mountain slopes; ca. 3500 m. Yunnan (Gongshan).

**19c. *Deparia sichuanensis* var. *jinfoshanensis*** (Z. R. Wang) Z. R. Wang, **comb. nov.**

鄂渝对囊蕨 *e yu dui nang jue*

Basionym: *Lunathyrium sichuanense* var. *jinfoshanense* Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 511. 1999.

Rachis and costae with thin, short hairs sparse on abaxial side, or subglabrate; pinna segments rounded at apex and undulate-crenulate at margin.

• Forests on mountain slopes; 1500–2100 m. Chongqing, Hubei.

**20. *Deparia sikkimensis*** (Ching) Nakaike & S. Malik, Cryptog. Fl. Pakistan 1: 273. 1992 [*“shikkimensis”*].

锡金对囊蕨 *xi jin dui nang jue*

*Lunathyrium sikkimense* Ching, Acta Phytotax. Sin. 9: 72. 1964.

Rhizomes ascending. Fronds caespitose; fertile fronds ca. 35 cm; stipe upward stramineous, ca. 10 cm, ca. 1.5 mm in diam., base densely scaly, upward glabrate; lamina pinnate, narrowly oblong-lanceolate, ca. 30 × 7 cm, acuminate at apex; pinnae pinnatipartite, ca. 16 pairs, 3 or 4 lower pairs gradually shortened toward base, basal pair ca. 1.4 cm, subopposite, separated, middle pinnae alternate, ca. 1.2 cm apart, linear, ca. 4 cm × 8 mm, shortly acuminate at apex, base truncate, oblique, pinnatipartite; segments 12–14 pairs, thin, approximate, rectangular or oblong, 3–4 mm, less than 2 mm wide, entire, obtuse or subtruncate at apex. Veins visible abaxially, 4 or 5 pairs per segment, simple. Lamina papery when dried, brown, rachis stramineous, rachis and costae with more brown-red multicellular hairs abaxially. Sori small, broadly ovate or oblong, 2–4 pairs per segment; indusia similar to sori, dark brown, entire. Spores bilateral, perispore surface rugose.

Forests; 3000–4300 m. Xizang (Yadong) [India (Darjeeling)].

*Deparia sikkimensis* is the smallest species in the genus, with the pinnae and segments very small and thin.

**21. *Deparia medogensis*** (Ching & S. K. Wu) Z. R. Wang, **comb. nov.**

墨脱对囊蕨 *mo tuo dui nang jue*

Rhizomes erect or ascending, moderately stout, bearing remaining stipe bases, up to 5–6 cm in diam., scaly at apex and stipe bases; scales large, red-brown or brown, ovate-lanceolate,

up to 15 × 3–4 mm, membranous. Fronds caespitose; fertile fronds 70–130 cm; stipe stramineous, sometimes slightly chestnut-colored, 10–30 cm, 3–5 mm in diam., base densely scaly, upward scales gradually sparse; lamina pinnate-pinnatipartite, oblanceolate or oblong-oblanceolate, 48–85 × 12–26 cm at middle, gradually narrowed toward base, apex pinnatifid and shortly acuminate; pinnae 20–25 pairs, lower 5–7 pairs of pinnae gradually shortened toward base, subopposite, upward alternate, spreading or slightly ascending; basal pinnae auriculate, ca. 1 cm, ca. 4 cm apart; middle pinnae narrowly lanceolate, 7–16 × 1.2–2 cm, base subtruncate or broadly cuneate, broadest (up to 2.5 cm), pinnatipartite almost to costae, apex acuminate or long acuminate; segments of middle pinnae more than 15–25 pairs, spreading, oblong, base broadened, adnate to narrow wing, separated by narrow space, prominently toothed at margin, apex obtuse-rounded or obtuse. Veins slightly visible on both surfaces, pinnate in segments, 5–7 pairs, simple, oblique. Lamina herbaceous when dried, rachis, costae, and veins with sparse thin, short multicellular hairs abaxially, with sparse red-brown short thick hairs adaxially. Sori oblong or shortly linear, occasionally J-shaped or horseshoe-shaped on basal acroscopic side of distal segments of lamina or pinnae, 1–2 mm, 3–6 pairs per segment, approximate; indusia similar to sori, brownish, erose at margin or subciliate, persistent. Spores bilateral, perispore surface with few low folds.

• Broad-leaved, mixed, and coniferous forests; 2500–4000 m. SE Xizang, Yunnan.

*Deparia medogensis* is very similar to plants called *Lunathyrium allantodioides* (Beddome) Ching (Acta Phytotax. Sin. 9: 72. 1964; *Athyrium allantodioides* Beddome, Ferns Brit. India, t. 221. 1867 (Type K!); *Deparia allantodioides* (Beddome) Kato) from N India, Bhutan, Nepal, Pakistan, and Taiwan. The chromosome number reports from India were diploid or tetraploid,  $2n = 80$  or  $160$ . But the spores of the type specimens in K are unequal in size, rounded, black, abortive, which shows it should be a hybrid, *Lunathyrium × allantodioides* (Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 308. 1999). The relationship between them needs further study.

- 1a. Ventral face of lobes and back of indusium without glands ..... 21a. var. *medogensis*
- 1b. Ventral face of lobes and back of indusium with small, lemon-yellow, transparent, granular glands ..... 21b. var. *glandulifera*

**21a. *Deparia medogensis* var. *medogensis***

墨脱对囊蕨(原变种) *mo tuo dui nang jue* (yuan bian zhong)

Basionym: *Lunathyrium medogensis* Ching & S. K. Wu in C. Y. Wu, Fl. Xizang. 1: 120. 1983; *L. medogensis* var. *weimingii* Z. R. Wang.

Ventral face of lobes and back of indusium without glands.

• Damp places in broad-leaved forests; 2800–4000 m. SE Xizang, NW Yunnan.

**21b. *Deparia medogensis* var. *glandulifera*** (W. M. Chu) Z. R. Wang, **comb. nov.**

粒腺对囊蕨 *li xian dui nang jue*

Basionym: *Lunathyrium medogense* var. *glanduliferum* W. M. Chu, Fl. Yunnan. 20: 720. 2006.

Ventral face of lobes and back of indusium with small, lemon-yellow, transparent, granular glands.

- Beside streams under *Abies* forests; ca. 3100 m. Yunnan.

**22. *Deparia vegetior*** (Kitagawa) X. C. Zhang, Lycophytes Ferns China, 391. 2012.

河北对囊蕨 he bei dui nang jue

Rhizomes erect, sometimes branched, short, apex like base of stipe, densely clothed with red-brown or brown, membranous, broadly lanceolate large scales, long scales, and multicellular hairs. Fronds caespitose; stipe stramineous, red-brownish, or brown, subglabrate abaxially; lamina pinnate-pinnatifid, narrowly oblong or oblanceolate, rarely oblong or obovate; pinnae (15–)20 pairs, alternate, ascending, lower pinnae gradually slightly shortened, middle pinnae lanceolate, base broadly cuneate, pinnatifid, apex acuminate; pinna segments (10–)15–18(–20) pairs, slightly ascending, oblong, ovate-oblong, or obtuse-triangular, margin subentire or undulate-crenate, apex rounded-obtuse or obtuse-acute. Veins impressed adaxially, slightly convex abaxially, pinnate in segments, 4 or 5 pairs, simple or occasionally forked. Lamina herbaceous or papery, greenish brown, brown, or pale brown; sterile lamina abaxially with abundant short multicellular hairs, fertile lamina subglabrate on both surfaces; rachis and costae concolored to stipe, with sparse short hairs or subglabrate abaxially. Sori oblong, 2–4 pairs per segment; indusia pale brown, lunate, subentire, persistent. Spores bilateral, perispore surface with few low folds.

- Valley forests, wet areas, streamsides; 400–2800 m. Chongqing, Gansu, Hebei, Henan, Shaanxi, Shandong, Shanxi, Sichuan.

- 1a. Lamina oblong or obovate, lower pinnae gradually slightly narrowed, basal pinna segments slightly broadened; segments deltoid-oblong, ca. 2 × as long as broad, toothed at margin; veins frequently forked ..... 22c. var. *miyunensis*
- 1b. Lamina narrowly oblong or oblanceolate, lower pinnae not narrowed toward base; segments oblong, nearly as broad as long, serrulate or subentire at margin; veins simple.
- 2a. Lamina herbaceous; indusia brown, membranous, distally open when sori mature ..... 22a. var. *vegetior*
- 2b. Lamina nearly papery; indusia pale brown, papery, smooth, still covering sori and conchiform when mature ..... 22b. var. *turgida*

**22a. *Deparia vegetior* var. *vegetior***

河北对囊蕨(原变种) he bei dui nang jue (yuan bian zhong)

*Athyrium pycnosorum* Christ var. *vegetius* Kitagawa, Rep. First Sci. Exped. Manchoukuo 4(2): 72. 1935; *Lunathyrium*

*pycnosorum* Koidzumi var. *vegetius* (Kitagawa) Sa. Kurata; *L. vegetius* (Kitagawa) Ching.

Lamina herbaceous; indusia brown, membranous, distally open when sori mature.  $2n = 160^*$ .

- Valley forests, wet areas, streamsides; 400–2600 m. Gansu, Hebei, Henan, Shaanxi, Shandong, Shanxi, Sichuan.

This taxon has been confused with *Deparia acrostichoides* (Swartz) M. Kato (*Athyrium acrostichoides* (Swartz) Diels; *Lunathyrium acrostichoides* (Swartz) Ching).

**22b. *Deparia vegetior* var. *turgida*** (Ching & Z. R. Wang) Z. R. Wang, **comb. nov.**

壳盖对囊蕨 ke gai dui nang jue

Basionym: *Lunathyrium vegetius* var. *turgidum* Ching & Z. R. Wang, Acta Phytotax. Sin. 32: 91. 1994.

Lamina narrowly oblong or oblanceolate, pinna segments as long as broad, veins simple. Indusia pale brown, papery, relatively smooth on surface, conchiform when mature and covering sori, perispore surface rugose.

- Damp areas, streamsides, forests; 1400–2800 m. Chongqing, Sichuan.

**22c. *Deparia vegetior* var. *miyunensis*** (Ching & Z. R. Wang) Z. R. Wang, **comb. nov.**

密云对囊蕨 mi yun dui nang jue

Basionym: *Lunathyrium vegetius* var. *miyunense* Ching & Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 509. 1999.

Lamina oblong or obovate; lower pinnae slightly shortened toward base, basal pinnae prominently shortened; pinna segments widely separated from each other, broader and longer, ca. 2 × as long as broad, deltoid-ovate or oblong, margin prominently toothed, apex obtuse; veins frequently forked.  $2n =$  ca. 160\*.

- Damp areas, streamsides, broad-leaved forests; 1100–1200 m. Beijing (Miyun: Wuling Shan).

**23. *Deparia acuta*** (Ching) Fraser-Jenkins, New Sp. Syndr. Indian Pteridol. 104. 1997.

尖片对囊蕨 jian pian dui nang jue

Rhizomes erect, densely scaly at apex and stipe bases; scales red-brown, oblong, membranous, acuminate at apex. Fronds caespitose; fertile fronds 30–80 cm; stipe pale stramineous, 15–21 cm, 2–2.5 mm in diam., densely scaly at base; scales brown, lanceolate, ca. 1 cm; stipe upward naked; lamina pinnate-pinnatifid, narrowly elliptic or oblong-lanceolate, 35–45 × 10–15 cm at middle, base narrowed, apex acuminate; pinnae 15–20 pairs, slightly ascending, sessile, separated by narrower space, lower pinnae subopposite, upper pinnae alternate, only few of lower pinnae slightly shortened, basal pinnae 2.5–4 cm, second basal pinnae up to 6 cm; middle pinnae lanceolate, somewhat falcate, 7–9 × 1.5–2 cm at base, 2–3 cm apart, base equilateral, truncate, broader, pinnatifid into narrow costal wings, apex acuminate; pinna segments 10–17 pairs, subspreading, distant or approximate, oblong, serrulate, sub-

entire, or dentate at margin, obtuse or obtuse-rounded at apex; basal segments larger, ca. 1 cm × 4 mm, upper segments 7–8 mm. Veins visible abaxially, 5–7 pairs per segment, up to 9 pairs in basal segments, simple, oblique. Lamina herbaceous when dried, pale greenish brown, rachis and costae with brown multicellular hairs abaxially, costules with very sparse, short thick hairs on both surfaces, without multicellular hairs at sinus between pinna segments. Sori lunate or shortly linear, 3–5 pairs per segment, up to 6 pairs in basal pinna segments, oblique; indusia similar to sori, brown, firm, entire, persistent. Spores bilateral, perispore surface with rugose folds.

Forests, valleys; 2700–4000 m. Sichuan, Xizang [W Himalaya, N India, N Pakistan].

Fraser-Jenkins (Taxon. Revis. Indian Subcontinental Pteridophytes, 240. 2008) argued that *Deparia acuta* should be called *D. subsimilis* (Christ) Fraser-Jenkins (l.c.: 239; *Athyrium subsimile* Christ, Bull. Soc. Bot. Ital. 1898. 29. 1898) and that *A. subsimile* is not conspecific with *D. giraldii*.

- 1a. Pinna segments 10–13 pairs ..... 23c. var. *liubaensis*  
 1b. Pinna segments 13–17 pairs.  
 2a. Pinna segments distant,  
 serrulate or subentire at margin ..... 23a. var. *acuta*  
 2b. Pinna segments approximate,  
 dentate at margin ..... 23b. var. *bagaensis*

### 23a. *Deparia acuta* var. *acuta*

尖片对囊蕨(原变种) jian pian dui nang jue (yuan bian zhong)

*Lunathyrium acutum* Ching, Acta Phytotax. Sin. 9: 73. 1964; *L. bomiense* Ching & S. K. Wu; *L. latibasis* Ching; *L. tibeticum* Ching.

Pinna segments 13–17 pairs, distant, with serrulate or subentire margin.

Forests, valleys; 2700–4000 m. Sichuan, Xizang [W Himalaya, N India, N Pakistan].

### 23b. *Deparia acuta* var. *bagaensis* (Ching & S. K. Wu) Z. R. Wang, **comb. nov.**

巴嘎对囊蕨 ba ga dui nang jue

Basionym: *Lunathyrium bagaense* Ching & S. K. Wu in C. Y. Wu, Fl. Xizang. 1: 118. 1983; *L. acutum* var. *bagaense* (Ching & S. K. Wu) Z. R. Wang.

Pinna segments 13–17 pairs, approximate, oblong, subtruncate, dentate at margin, obtuse at apex.

- Forests; ca. 3400 m. Xizang.

### 23c. *Deparia acuta* var. *liubaensis* (Z. R. Wang) Z. R. Wang, **comb. nov.**

六巴对囊蕨 liu ba dui nang jue

Basionym: *Lunathyrium vegetius* (Kitagawa) Ching var. *liubaense* Z. R. Wang, Acta Phytotax. Sin. 32: 91. 1994; *L. acutum* var. *liubaense* (Z. R. Wang) Z. R. Wang.

Pinna segments 10–13 pairs.

- About 3300 m. Sichuan (Kangding, Liuba).

The spore surface of *Deparia acuta* var. *liubaensis* has folded processes, an intermediate character between *D. acuta* var. *acuta* and *D. vegetior*. It is more similar to var. *acuta* in the long multicellular hairs on the abaxial surface of rachis, costae, and fertile pinnae, and the indusia shortly ciliate at margin. However, the pinna segments are fewer than in var. *acuta*, and in this character var. *liubaensis* is similar to *D. vegetior*. *Deparia acuta* var. *liubaensis* occurs in localities between *D. acuta* and *D. vegetior*. Their relationship needs further study.

### 24. *Deparia emeiensis* (Z. R. Wang) Z. R. Wang, **comb. nov.**

棒孢对囊蕨 bang bao dui nang jue

Basionym: *Lunathyrium emeiense* Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 510. 1999.

Fronds caespitose; fertile fronds ca. 90 cm; stipe ca. 20 cm, ca. 4 mm in diam., subglabrous; lamina pinnate-pinnatifid, narrowly oblong-lanceolate, ca. 58 × 18 cm, base gradually narrowed, apex acuminate; pinnae ca. 20 pairs, middle pinnae alternate, ascending, linear-lanceolate, ca. 10.5 × 1.8–2 cm, base broader and subtruncate, subequilateral, pinnatifid, apex long acuminate; lower 5 or 6 pairs of pinnae gradually shortened toward base; basal pinnae spreading, lanceolate, ca. 2 × 1 cm, acroscopic base broader, ca. 5 cm apart from second basal pinnae, upper pinnae gradually closer; pinna segments ca. 15 pairs, ascending, separated by narrow space, oblong, adnate to narrow wing, apex and distal margin serrulate, apex obtuse-rounded. Veins visible on both surfaces, pinnate in segments, 6 or 7 pairs, simple, occasionally forked, oblique. Lamina herbaceous when dried, greenish brown, rachis, costae, and veins abaxially occasionally with short multicellular hairs or subglabrate. Sori oblong to shortly linear, 1–2 mm, medial, 2–4 pairs per segment; indusia similar to sori, brown, slightly erose at margin. Spores bilateral, perispore surface with dense baculate or thin long rugate processes.

- Shrub groves on mountain slopes, damp areas; 2000–2100 m. Sichuan (Emei Shan).

*Deparia emeiensis* is very similar to *D. wilsonii*; however, the segments are prominently toothed at the margin, and the spore surface has dense baculate or thin long rugate processes.

### 25. *Deparia ludingensis* (Z. R. Wang & Li Bing Zhang) Z. R. Wang, **comb. nov.**

泸定对囊蕨 lu ding dui nang jue

Basionym: *Lunathyrium ludingense* Z. R. Wang & Li Bing Zhang, Acta Bot. Yunnan. 17: 303. 1995.

Rhizomes erect, stout, densely clothed with brown, membranous, ovate-lanceolate scales at apex and stipe bases. Fronds caespitose; fertile fronds up to 97 cm; stipe ca. 27 cm, ca. 5 mm in diam. at base; lamina pinnate-pinnatifid, oblong-lanceolate, ca. 70 × 21 cm, base slightly narrowed, sterile, apex acuminate; pinnae 26 pairs, sessile, alternate, narrowly deltoid-ovate to ovate-lanceolate, 5–11 × 2–2.5 cm at middle, apex long acuminate; lower pinnae prominently broadened at base, pinnatifid to narrow wings of costa; pinna segments 11–18 pairs, alternate, spreading, oblong, 12–16 × 3–5 mm, very approximate, toothed at margin, apex acute or obtuse-rounded;

basal segments recurved to rachis. Veins visible, pinnate in segments, 6–9 pairs, alternate, often forked. Lamina herbaceous when dried, green. Sori oblong to shortly linear; indusia pale brown, oblong or lunate, membranous, erose at margin, persistent. Spores bilateral, perispore surface with more dense rugate-saccate or papillate processes.

- About 3600 m. Sichuan (Luding).

*Deparia ludingensis* is close to *D. wilsonii* but differs in the lower pinnae ovate-triangular or ovate-lanceolate, prominently enlarged at base, pinna base ± recurved to the rachis, and pinna segments acute or obtuse-rounded at apex and dentate at margin.

**26. *Deparia wilsonii*** (Christ) X. C. Zhang, *Lycophytes Ferns China*, 391. 2012.

峨山对囊蕨 e shan dui nang jue

Rhizomes erect, stout, densely scaly at apices and stipe bases; scales brown, broadly lanceolate to linear-lanceolate, membranous. Fronds caespitose; fertile fronds up to 1–1.5 m; stipe up to 50 cm, up to 6 mm in diam., base scaly, upward sparsely scaly; lamina pinnate, oblong to narrowly oblong, up to 100 × 30 cm, apex pinnatifid-acuminate; pinnae pinnatifid, up to 30 pairs, lower pinnae slightly shortened; middle pinnae lanceolate or narrowly lanceolate, up to 20 × 3 cm, base broadened, subtruncate or broadly cuneate, pinnatifid to wings of costa, apex long acuminate; pinna segments up to 25 pairs, approximate or distant, oblong or triangular, up to 10 × 5 mm, margin sparsely crenulate or subentire, or prominently toothed, apex ± rounded, subtruncate or obtuse-triangular. Veins visible, pinnate in segments, simple or forked. Lamina herbaceous or thickly herbaceous when dried, green, with short or long hairs on rachis and costae abaxially. Sori oblong to shortly linear; indusia pale brown, oblong to shortly linear, occasionally J-shaped or double, subentire at margin. Spores bilateral, perispore surface with dense rugate-saccate or papillate processes.

- Damp areas, forests on mountain slopes, streamsides, shrub groves, mixed forests, valley forests; 1400–3800 m. S Gansu, Guizhou, W Hubei, Sichuan, Xizang, NW Yunnan.

- 1a. Pinna segments subentire or crenulate at margin ..... 26a. var. *wilsonii*
- 1b. Pinna segments prominently toothed at margin.
- 2a. Pinnae narrowly triangular, or pinna segments obtuse-triangular; pinna segments with long teeth at margin; veins frequently forked, at least on basal segments of middle pinnae.
- 3a. Pinnae narrowly triangular, gradually broadened to base; pinna segments oblong or narrowly ovate, approximate, toothed at margin; veins sometimes forked only in basal segments of middle pinnae ..... 26b. var. *incisoserrata*
- 3b. Pinnae lanceolate or oblanceolate, not gradually broadened to base;

pinna segments obtuse-triangular, widely distant, with long teeth or lobed at margin; veins mostly 2-forked, occasionally

3-forked ..... 26c. var. *habaensis*

- 2b. Pinnae linear-lanceolate; pinna segments oblong, serrulate at margin; veins simple.
- 4a. Plants 80–100 cm or more, hairs on abaxial surface of rachis and costae thin, short .... 26d. var. *maxima*
- 4b. Plants less than 80 cm, multicellular hairs on abaxial surface of rachis and costae thick, long ..... 26e. var. *muliensis*

**26a. *Deparia wilsonii* var. *wilsonii***

峨山对囊蕨(原变种) e shan dui nang jue (yuan bian zhong)

*Athyrium wilsonii* Christ, Bull. Herb. Boissier, sér. 2, 3: 512. 1903; *Lunathyrium wilsonii* (Christ) Ching.

Pinna segments subentire or crenulate at margin.  $2n = 80^*$ .

- Damp areas, forests on mountain slopes, streamsides; 1400–3700 m. S Gansu, Guizhou, W Hubei, Sichuan, SE Xizang, NW Yunnan.

**26b. *Deparia wilsonii* var. *incisoserrata*** (Ching & Z. R. Wang) Z. R. Wang, **comb. nov.**

锐裂对囊蕨 rui lie dui nang jue

Basionym: *Lunathyrium wilsonii* var. *incisoserratum* Ching & Z. R. Wang, Acta Phytotax. Sin. 32: 92. 1994.

Pinnae narrowly triangular, broadened at base; pinna segments oblong or narrowly ovate, approximate, toothed; veins usually simple but forked in basal segments of middle pinnae.

- Streamsides, forests, shrub groves, wet grassy areas; 2800–3500 m. NW Yunnan (Dêqên).

The epithet was first introduced as “*Lunathyrium incisoserratum*” (Ching in Y. L. Zhang et al., *Sporae Pterid. Sin.* 232. 1976), but this was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**26c. *Deparia wilsonii* var. *habaensis*** (Ching & Z. R. Wang) Z. R. Wang, **comb. nov.**

哈巴对囊蕨 ha ba dui nang jue

Basionym: *Lunathyrium wilsonii* var. *habaense* Ching & Z. R. Wang, Acta Phytotax. Sin. 32: 91. 1994.

Pinnae lanceolate or oblanceolate; pinna segments distant, obtuse-triangular, with long teeth or shallowly lobed at margin, veins frequently forked.

- Valley forests; ca. 2800 m. NW Yunnan (Zhongdian).

**26d. *Deparia wilsonii* var. *maxima*** (Ching & Z. R. Wang) Z. R. Wang, **comb. nov.**

大对囊蕨 da dui nang jue

Basionym: *Lunathyrium wilsonii* var. *maximum* Ching & Z. R. Wang, Acta Phytotax. Sin. 32: 92. 1994.

Plants large (up to 100 cm or more). Pinnae and pinna segments broader, pinna segments prominently toothed at margin. Hairs on rachis and costae abaxially thin and short.

- Mixed forests, wet areas; 2200–3100 m. S Gansu, Sichuan.

The epithet was first introduced as "*Lunathyrium maximum*" (Ching in Y. L. Zhang et al., Sporae Pterid. Sin. 233. 1976), but this was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**26. *Deparia wilsonii* var. *muliensis* (Z. R. Wang) Z. R. Wang, comb. nov.**

木里对囊蕨 mu li dui nang jue

Basionym: *Lunathyrium wilsonii* var. *muliense* Z. R. Wang, Acta Phytotax. Sin. 32: 92. 1994.

FronDS less than 80 cm, with hairs on rachis and costae abaxially thick and long. Pinnae linear-lanceolate; pinna segments oblong and serrulate at margin.

- Coniferous forests on mountain slopes; 3300–3800 m. Sichuan, Xizang.

**27. *Deparia vermiformis* (Ching, Boufford & K. H. Shing) Z. R. Wang, comb. nov.**

湖北对囊蕨 hu bei dui nang jue

Basionym: *Lunathyrium vermiforme* Ching, Boufford & K. H. Shing, J. Arnold Arbor. 64: 23. 1983.

Rhizomes erect, short, apex clothed with dark brown, membranous, lanceolate scales. Fronds caespitose; fertile fronds ca. 74 cm; stipe upward dark stramineous, less than 20 cm, ca. 2 mm in diam., base densely scaly, upward gradually glabrate; lamina pinnate-pinnatipartite, oblong-lanceolate, ca. 55 × 18 cm at middle, base gradually narrowed, apex acuminate; pinnae ca. 20 pairs, spreading, separated by narrow space, many lower pinnae gradually shortened, space between pinnae broader than in upper pinnae; basal pinnae auriculate, ca. 1 cm; middle pinnae lanceolate to narrowly lanceolate, somewhat falcate, ca. 10 × 1.6 cm at base, base subtruncate, pinnatipartite, apex acuminate; pinna segments ca. 20 pairs, approximate, oblong, ca. 7 × 4 mm, margin subentire, apex obliquely truncate or obtuse-rounded. Veins visible on both surfaces, pinnate in segments, 4 or 5 pairs, simple. Lamina herbaceous when dried, green, pinnae subglabrate on both surfaces, rachis and costae abaxially with sparse thin, short multicellular hairs. Sori shortly linear, never curved even in distal parts of lamina or pinnae, 3 or 4 pairs per segment; indusia shortly linear, subentire. Spores bilateral, surface with rugate, rugate-saccate, or papillate processes.

- Valleys, damp areas; ca. 1500 m. W Hubei (Lichuan).

**28. *Deparia shennongensis* (Ching, Boufford & K. H. Shing) X. C. Zhang, Lycophytes Ferns China, 390. 2012.**

华中对囊蕨 hua zhong dui nang jue

*Lunathyrium shennongense* Ching, Boufford & K. H.

Shing, J. Arnold Arbor. 64: 21. 1983; *L. centrochinense* Ching ex K. H. Shing.

Rhizomes stout, erect or ascending, apex together with stipe base with brown or blackish brown, membranous, broadly lanceolate, large scales. Fronds caespitose; fertile fronds (30–)70(–100) cm; stipe stramineous or reddish brown, (8–)12(–17) cm, 2(–4) mm in diam., grooved adaxially, with sparse, thin, short hairs or subglabrate; lamina pinnate-pinnatipartite, oblanceolate or oblong-oblanceolate, (25–)60–80 × (6–)15–20 cm, base gradually narrowed, apex acuminate; pinnae (15–)20–22(–30) pairs, lower 6–10 pairs of pinnae gradually shortened; basal pinnae often deltoid, small, auricle ca. 1 cm, subopposite, more widely separated from second basal pinnae; middle pinnae alternate, 1–3 cm apart, spreading or slightly ascending, narrowly lanceolate, (3–)10–12 × 1–2 cm, broadest at base, base subtruncate, sessile, pinnatipartite, apex long acuminate; pinna segments ca. 22 pairs, oblong, middle pinnae (3–)7–8 × 3(–5) mm at base, basal segments slightly longer, margin subentire or crenate, apex rounded-obtuse and crenate. Veins visible on both surfaces, pinnate in segments, 5–7 pairs per segment, simple. Lamina herbaceous when dried, green, rachis and costae abaxially with sparse short multicellular hairs or subglabrate, adaxial surface with sparse brown short hairs. Sori elliptic or shortly linear, 1.5–2 mm, (3 or)4 or 5( or)6 pairs per segment; indusia pale brown, elliptic or shortly linear, occasionally J-shaped in distal parts of lamina and pinnae, margin slightly erose or subentire. Spores bilateral, perispore surface with rugate, rugate-saccate, or papillate processes.  $2n = 80^*$ .

- Mountain slopes, forests, wet places; 200–3300 m. Anhui, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Yunnan, Zhejiang.

*Deparia shennongensis* is similar to *D. dolosa* in the shape of fronds, but the rachis and costae are abaxially shortly hairy or subglabrate (vs. long hairy on both surfaces). This species is diploid, while *D. dolosa* is tetraploid.

**29. *Deparia truncata* (Ching ex Z. R. Wang) Z. R. Wang, comb. nov.**

截头对囊蕨 jie tou dui nang jue

Basionym: *Lunathyrium truncatum* Ching ex Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 510. 1999.

Rhizomes ascending, clothed with brown, membranous, broadly lanceolate scales at apex, like stipe bases. Fronds caespitose; fertile fronds 50–60 cm; stipe stramineous, ca. 10 cm, ca. 2 mm in diam., with sparse multicellular hairs and narrow scales; lamina pinnate, oblong, 40–50 × ca. 14 cm at middle, apex acuminate; pinnae pinnatipartite, ca. 20 pairs, lower 5 or 6 pairs of pinnae gradually shortened, ca. 5 mm; middle pinnae alternate, 2.5–3 cm apart, slightly ascending, linear-lanceolate, 8–9 × ca. 1.5 cm, base subtruncate, pinnatilobed to 2/3 to costa, apex long acuminate; pinna segments ca. 15 pairs, approximate, nearly as long as wide or slightly longer, oblong, ca. 4 mm, margin entire or subentire, apex truncate or retuse. Veins visible abaxially, ca. 5 pairs per segment, simple. Lamina papery when dried, greenish brown, rachis stramineous, with sparse multicellular long hairs, costae abaxially with sparse short multi-

cellular hairs. Sori approximate, shortly linear, 1.5–2 mm, 2 or 3 pairs per segment; indusia yellow-brown, shortly linear, entire or slightly erose at margin, persistent. Spores bilateral, perispore surface with more dense papillate processes.

- About 3500 m. NW Yunnan.

**30. *Deparia brevipinna*** (Ching & K. H. Shing ex Z. R. Wang) Z. R. Wang, **comb. nov.**

短羽对囊蕨 *duan yu dui nang jue*

Basionym: *Lunathyrium brevipinnum* Ching & K. H. Shing ex Z. R. Wang, *Acta Phytotax. Sin.* 32: 85. 1994.

Rhizomes erect, short, scaly at apex, like stipe bases; scales brown, lanceolate, ca. 4 mm, membranous. Fronds caespitose; fertile fronds ca. 30 cm; stipe stramineous, 5–7 cm, rarely longer, ca. 1.4 mm in diam., subglabrate; lamina pinnate-pinnatifid, lanceolate, 20–25 × ca. 6 cm at middle, base slightly narrowed, apex acuminate; pinnae ca. 15 pairs, spreading, sessile, upper pinnae alternate; lower pinnae subopposite, ca. 2 cm apart, lower 2 pairs of pinnae slightly shortened; basal pinnae ca. 1.5 cm, not auriculate; middle pinnae lanceolate, ca. 3 × 1–1.3 cm, base broader, pinnatifid to wings of costa, apex acute or shortly acuminate; pinna segments 6–8 pairs, approximate, ascending, deltoid-oblong, margin entire, apex obtuse, rarely obtuse-acute; basal segments slightly larger, up to 5 × ca. 2.6 mm, sparsely crenate. Veins visible abaxially, pinnate in segments, 3 or 4 pairs, up to 5 pairs in basal acroscopic segments, simple, oblique. Lamina herbaceous when dried, greenish brown, subglabrate, only abaxial side of costae with sparse short, brown, thin multicellular hairs. Sori 3–6 per segment, small, oblong-ovate, oblique; indusia pale green, shortly lunate, thick, margin slightly erose, persistent. Spores bilateral, perispore surface with denser rugate-saccate or papillate processes.

- Shrub groves; 2200–3000 m. Yunnan.

*Deparia brevipinna* is close to *D. shennongensis* in shape but differs by the leaves smaller, pinnae fewer, usually less than 12 pairs, shorter, usually ca. 3 cm, no more than 5 cm, slightly broadened at base, and pinna segments fewer, 5–7 pairs, rounded-obtuse or subtruncate at apex.

"*Lunathyrium latibasis*" (Ching in Y. L. Zhang et al., *Sporae Pterid. Sin.* 233. 1976), not Ching (1983), belongs here but was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**31. *Deparia dolosa*** (Christ) M. Kato, **comb. nov.**

昆明对囊蕨 *kun ming dui nang jue*

Rhizomes erect or ascending, clothed with brown-red, membranous, broadly lanceolate large scales at apex. Fronds caespitose; fertile fronds (30–)100–120 cm; stipe stramineous or slightly reddish brown, (6–)24 cm, base with brown, ovate-lanceolate scales, upper part with thin scales or tortuous, hyaline, multicellular hairs; lamina pinnate-pinnatifid, narrowly oblong-lanceolate or narrowly oblanceolate, (25–)80 × (10–)15(–25) cm, gradually narrowed to base, apex pinnatifid–shortly acuminate; pinnae (10–)30 pairs or more, lower pinnae subopposite, upper pinnae alternate, spreading or slightly as-

ending, ca. 2 cm apart, 7 or 8 pairs of lower pinnae gradually shortened; basal pinnae 1–2 cm, broadened, triangular; middle pinnae lanceolate to narrowly lanceolate, (4–)8–10(–13) × 1–2 cm, broader at base, base subtruncate or broadly cuneate, pinnatifid, apex acuminate; pinna segments (10–)15(–20) pairs, separated by narrow space, slightly ascending, oblong or deltoid-oblong, (3–)8–9(–12) × 3–5 mm, adnate to broad wing of costa, margin toothed or subentire, apex obtuse or obtuse-rounded. Veins visible on both surfaces, pinnate in segments, 4 or 5(–7) pairs, simple, sometimes forked in basal segments. Lamina herbaceous when dried, brown-green, rachis, costae, and veins on both surfaces with sparse longer multicellular hairs. Sori oblong or shortly linear, sometimes J-shaped in distal part of pinna, 1.5–2 mm, 3–5 pairs per segment; indusia similar to sori, brownish, slightly erose at margin, persistent. Spores bilateral, perispore surface with rugate, rugate-saccate, or papillate processes.  $2n = 160^*$ .

- Valleys, forests, wet areas; 1900–3500 m. SW Sichuan, Yunnan.

- 1a. Pinna segments oblong, 8–9 × ca. 4 mm, toothed at margin ..... 31a. var. *dolosa*
- 1b. Pinna segments deltoid-oblong, ca. 5 × 3 mm, subentire at margin ..... 31b. var. *chinensis*

**31a. *Deparia dolosa* var. *dolosa***

昆明对囊蕨(原变种) *kun ming dui nang jue* (yuan bian zhong)

Basionym: *Athyrium dolosum* Christ, *Bull. Acad. Int. Géogr. Bot.* 17: 136. 1907; *Lunathyrium dolosum* (Christ) Ching.

Pinna segments oblong, larger (8–9 × ca. 4 mm) and toothed at margin.

- Valleys, forests, wet areas; 1900–3500 m. SW Sichuan, Yunnan.

"*Lunathyrium pubescens*" (Ching in Y. L. Zhang et al., *Sporae Pterid. Sin.* 233. 1976) belongs here but was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**31b. *Deparia dolosa* var. *chinensis*** (Z. R. Wang) Z. R. Wang, **comb. nov.**

耿马对囊蕨 *geng ma dui nang jue*

Basionym: *Lunathyrium dolosum* var. *chinense* Z. R. Wang, *Fl. Reipubl. Popularis Sin.* 3(2): 316. 1999.

Pinna segments deltoid-oblong, small (ca. 5 × 3 mm), subentire at margin.

- Forests; ca. 2300 m. SW Yunnan (Gengma).

The epithet was first introduced as "*Lunathyrium chinense*" (Ching in Y. L. Zhang et al., *Sporae Pterid. Sin.* 231. 1976), but this was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**32. *Deparia jiulongensis*** (Ching) Z. R. Wang, **comb. nov.**

九龙对囊蕨 *jiu long dui nang jue*

Rhizomes erect or ascending, densely clothed with brown or dark brown, membranous, broadly lanceolate scales at apex,

like stipe bases. Fronds caespitose; fertile fronds (30–)70–80 cm; stipe stramineous or brownish red, (5–)10–14(–20) cm, (2–)3–4 mm in diam., with rather dense, crispate, zigzag, thick multicellular hairs and narrow scales in lower part, upward gradually sparse; lamina pinnate-pinnatifid, oblanceolate or oblong-lanceolate, (25–)50–60(–65) × (8–)12–15(–20) cm, pinnatifid and shortly acuminate at apex, gradually narrowed toward base; pinnae (15–)20 pairs, many lower pinnae gradually shortened; basal pinnae often 0.5–1 cm, subopposite; upper pinnae alternate; middle pinnae spreading or slightly ascending, narrowly lanceolate, (4–)8–10 × 1–2 cm, broadened to base, base subtruncate, apex long acuminate; pinna segments ca. 12 pairs, approximate, oblong, (3–)5–8 × 3–4(–5) mm, margin subentire, sometimes crenulate, apex obtuse-rounded. Veins visible on both surfaces, pinnate in segments, 5–7 pairs, simple. Lamina herbaceous when dried, rachis and costae abaxially with thick multicellular hairs. Sori oblong or lunate, sometimes J-shaped in distal parts of lamina and pinnae, 1.5–2 mm, 3–5 pairs per segment; indusia similar to sori, pale brown, margin slightly erose or shortly ciliate, persistent; spores bilateral, perispore surface with rather densely rugose-saccate or papillate processes.

Forests, wet places, rock crevices, mountain slopes; 900–2700 m. Anhui, Jiangxi, Sichuan, Taiwan, Zhejiang [C and S Japan].

- 1a. Stipe stramineous; multicellular hairs on stipe and rachis straight; indusia shortly ciliate at margin ..... 32a. var. *jiulungensis*  
 1b. Stipe stramineous or brownish red; multicellular hairs on stipe and rachis crispate; indusia slightly erose at margin ..... 32b. var. *albosquamata*

### 32a. *Deparia jiulungensis* var. *jiulungensis*

九龙对囊蕨(原变种) *jiu long dui nang jue* (yuan bian zhong)

Basionym: *Lunathyrium jiulungense* Ching, Bull. Bot. Res., Harbin 2(2): 71. 1982; *L. orientale* Z. R. Wang & J. J. Chien var. *huangshanense* Z. R. Wang; *L. orientale* var. *jiulungense* (Ching) Z. R. Wang.

Stipe stramineous; multicellular hairs on stipe and rachis straight; indusia shortly ciliate at margin.

• Rock crevices, mountain slopes, forests, wet places; 900–2700 m. Anhui, Jiangxi, Sichuan, Zhejiang.

### 32b. *Deparia jiulungensis* var. *albosquamata* (M. Kato) Z. R. Wang, **comb. nov.**

东亚对囊蕨 *dong ya dui nang jue*

Basionym: *Deparia pycnosora* (Christ) M. Kato var. *albosquamata* M. Kato, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(4): 396. 1984; *D. albosquamata* (M. Kato) Nakaike; *D. orientalis* (Z. R. Wang & J. J. Chien) Nakaike; *Lunathyrium orientale* Z. R. Wang & J. J. Chien.

Stipe stramineous or brownish red, multicellular hairs on stipe and rachis crispate, zigzag; indusia slightly erose at margin.

Forests, wet places; 900–2200 m. Anhui, Taiwan [C and S Japan].

Material of this species was originally identified as *Athyrium pycnosorum* Christ or *Lunathyrium pycnosorum* (Christ) Koidzumi.

### 33. *Deparia heterophlebia* (Mettenius ex Baker) R. Sano, Acta Phytotax. Geobot. 51(1): 17. 2000.

网脉对囊蕨 *wang mai dui nang jue*

*Asplenium heterophlebium* Mettenius ex Baker in Hooker & Baker, Syn. Fil. 243. 1867; *Anisogonium heterophlebium* (Mettenius ex Baker) Beddome; *Athyrium heterophlebium* (Mettenius ex Baker) Copeland; *Dictyodroma heterophlebia* (Mettenius ex Baker) Ching; *Diplazium hemionitideum* Christ; *D. heterophlebium* (Mettenius ex Baker) Diels; *D. rude* Christ.

Rhizome with dense scales at apex; scales brown, linear-lanceolate, ca. 5 mm, slightly curled; frond caespitose. Fertile frond up to 80 cm. Stipe brown, up to 30 cm, ca. 4 mm in diam., with dense smaller scales than on rhizome. Lamina pinnate, elliptic, up to 50 × 20 cm, herbaceous, slightly narrowed to base; free pinnae 1–5 pairs; basal pinnae slightly shorter, opposite or subopposite; upper pinnae sessile or very shortly stalked, slightly oblique, lanceolate, oblique or subfalcate, base truncate, margin often wavy, occasionally slightly lobed, apex acuminate, shortly pointed; pinna lobes symmetrical, wide, oval, apex blunt. Veins reticulate, distally free, evident. Lamina coarse with small wormlike scales, or with short multicellular hairs, dense on abaxial side, sparse on adaxial side. Sori 2 or 3 pairs per veinlet group, double or single; indusia brown when mature. Spores semicircular. *n* = 41 (but needs reexamination).

Dense forests, on ground, cliffs; 1300–1600 m. Xizang (Moto), Yunnan [India, Malaysia, Myanmar, Nepal, Thailand].

### 34. *Deparia yunnanensis* (Ching) R. Sano, Acta Phytotax. Geobot. 51(1): 18. 2000.

云南对囊蕨 *yun nan dui nang jue*

*Dictyodroma yunnanensis* Ching, Acta Phytotax. Sin. 9: 59. 1964.

Rhizome apex densely scaly; scales brown or dark brown, ovate-lanceolate. Fertile frond light brown when dried, up to 70 cm, with brown or dark brown, small, thin scales. Lamina 1-pinnate-pinnatifid, oblong, up to 40 × 18 cm; free lateral pinnae 6–8 pairs, lanceolate, slightly oblique, sometimes subfalcate, base not narrowed, subtruncate, shortly stalked or sessile, margin slightly serrate, apex shortly acuminate; middle pinnae 8–10 × up to 3 cm; pinna lobes small, asymmetrical, apex obtuse, falcate; basal lobes slightly shorter than upper lobes, spreading; veins of pinnae and lobes obvious. Lamina dark brown when dried; stipe, rachis, and costae with sparse brown wormlike or shaggy small multicellular scales or hairs, costae adaxially with short multicellular hairs, but hairs very sparse. Sori located on both sides of veins, 1 or 2 pairs, oblique, mostly linear, single; indusia brown when mature.

• Dense forests; ca. 1500 m. Yunnan (Daweishan, Pingbian).

### 35. *Deparia formosana* (Rosenstock) R. Sano, Acta Phytotax. Geobot. 51(1): 17. 2000.

全缘对囊蕨 *quan yuan dui nang jue*

*Diplazium formosanum* Rosenstock, Hedwigia 56: 337. 1915; *Dictyodroma basipinnatifida* (Ching) Ching; *D. formosana* (Rosenstock) Ching; *Diplazium basipinnatifidum* Ching; *D. odoratissimum* Hayata.

Rhizome apex with broad lanceolate brown scales. Stipe gray, 20–30 cm, base also scaly, sometimes upward with small narrowly lanceolate scales. Fertile frond of young plants deeply pinnatifid; lamina narrowly triangular, base cordate, lower lobes oval-lanceolate or broadly lanceolate, apex shortly acuminate. Fertile frond of adult plants elliptic, up to 45 × 28 cm, with 1 or 2 (or 3) pairs of free lower pinnae, apex abruptly narrowed, and pinnatilobate and acuminate, or undulate to entire. Pinnae opposite or subopposite, oblong, subfalcate, base rounded, slightly asymmetrical, sessile or with indistinct stalk, entire, sometimes wavy, apex acuminate. Veins obvious on both sides, anastomosing with polygonal areoles formed by equally thin veinlets. Lamina gray-green when dried, lighter colored on abaxial surface; both sides of rachis and abaxial side of costae with rust-yellow short multicellular hairs and wormlike or coarse hairlike small scales. Sori with variable length, 1–3 irregular rows from costa to lamina margin, sori on acroscopic veinlets double, other sori single; indusia brown when mature, long, narrow. Spore bean-shaped.

Forests beside streams, forested slopes; 500–1400 m. Taiwan, Yunnan (Suijiang) [Japan].

**36. *Deparia hainanensis*** (Ching) R. Sano, Acta Phytotax. Geobot. 51(1): 18. 2000.

海南对囊蕨 hai nan dui nang jue

*Dictyodroma hainanensis* Ching, Acta Phytotax. Sin. 9: 60. 1964.

Rhizome apex with wrinkled light brown broadly lanceolate or ovate scales. Fertile frond up to 85 cm. Stipe light brown or dark brown, up to 30 cm, ca. 3 mm in diam., base with sparse scales same as on rhizome, glabrous upward. Lamina lower part pinnate, upper part pinnatifid, elliptic or narrowly triangular, up to 50 × 30 cm, apical part abruptly acute. Pinnae 3–6 pairs, nearly flat or basal pair slightly inclined, sessile or with indistinct short stalk, usually lanceolate, equally narrow downward or of slightly varying width, up to 16 × 4 cm, base slightly cordate, apex acuminate; basal 1 or 2 pairs often shorter, sometimes nearly as long as upper pinnae, apical pinnae often adnate to rachis. Pinna lobe margin entire or shallowly repand, with few crenate teeth. Main vein obvious on both sides, lateral veins not obvious, or occasionally slightly obvious on lower part, anastomosing with polygonal areoles, distal veins free or connected by inframarginal veinlets. Lamina gray brown when dried, pale abaxially, shiny; rachis and base of costae with sparse brown short multicellular hairs and wormlike or hairlike small scales, costae adaxially with short nodose hairs. Sori variously long, with 1–3 irregular rows of areoles, mostly single, rarely double; indusia broad, brown when mature. Spores semi-circular.

• Dense forests, beside streams; 800–1000 m. Hainan (Baisha, Qiongzong).

**37. *Deparia lancea*** (Thunberg) Fraser-Jenkins, New Sp. Syndr. Indian Pteridol. 101. 1997.

单叶对囊蕨 dan ye dui nang jue

*Asplenium lanceum* Thunberg, Fl. Jap. 333. 1784; *A. subsinuatum* Wallich ex Hooker & Greville; *Athyrium dubium* (D. Don) Ohwi (1956), not Ching (1949); *A. lanceum* (Thunberg) Milde (1870), not T. Moore (1860); *Diplazium lanceum* (Thunberg) C. Presl (1836), not Bory (1833); *D. simplicifolium* Kodama; *D. subsinuatum* (Wallich ex Hooker & Greville) Tagawa; *Micropodium lanceum* (Thunberg) J. Smith; *Scolopendrium dubium* D. Don; *Triblemma lancea* (Thunberg) Ching.

Rhizome slender, with black or brown, lanceolate scales; frond caespitose. Fertile frond up to 40 cm; stipe pale gray, 8–15 cm, base with brown scales; lamina lanceolate or linear-lanceolate, 10–25 × 2–3 cm, gradually narrowed to both ends, entire or slightly repand at margin; midrib prominent on both surfaces; veinlets ascending, 3–4 per vein, parallel, reaching margin. Lamina papery or subleathery. Sori widespread throughout lamina except in basal part, linear, single or occasionally double, medial; indusia pale brown, membranous. Spores reniform in equatorial view, perispore thin and hyaline, with irregularly thickly aculeate or clavate processes.

Often in acidic soils, on rocks in forests; 200–1600 m. Anhui, Fujian, Guangdong (and islands), Guangxi, Guizhou, Hainan, Henan, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [India, Japan, Myanmar, Nepal, Philippines, Sri Lanka, Vietnam].

**38. *Deparia tomitaroana*** (Masamune) R. Sano, J. Pl. Res. 113: 162. 2000.

羽裂叶对囊蕨 yu lie ye dui nang jue

*Diplazium tomitaroanum* Masamune, J. Soc. Trop. Agric. 2: 33. 1930; *Athyrium dubium* (D. Don) Ohwi var. *crenatum* (Makino) Ohwi; *D. lanceum* (Thunberg) C. Presl var. *crenatum* Makino; *D. lanceum* var. *grandicrenatum* Nakai ex H. Itô.

Rhizome slender, 2–3 mm in diam., black-brown, apex with dense scales; scales black-brown or yellow-brown, lanceolate, 2–3 × ca. 0.5 mm, thick, margin sparsely subserrate or subentire. Stipe black-brown at base, upward stramineous or gray-stramineous, 5–35 cm, 1–2 mm in diam., as scaly as rhizome; scales on upper part of stipe deciduous, sparse or glabrous, shallowly grooved on abaxial side; lamina lanceolate or narrowly linear-lanceolate, 10–15 × 1.5–5.5 cm, base up to half width of middle, truncate or cordiform, pinnatilobate to pinnatipartite, base often pinnatilobate to costa, 1–4 pairs of lobes adnate or free, apex long acuminate or acuminate; lobes up to 30 pairs, entire or slightly repand, up to 3 × 1 cm, upper and lower lobes gradually reduced, basal lobes usually larger than upper ones, oblong, symmetrical, apex rounded; veins prominent or slightly visible on both side of lamina, pinnate per lobes, veinlets simple or forked, ascending, reaching margin, 3–13 pairs per lobe. Lamina herbaceous, green when dry, dark abaxially; costa stramineous or gray-stramineous, shallowly grooved adaxially, prominent abaxially, sparsely scaly with black linear scales, with sparse gray-white unicellular thin nodose hairs,

then deciduous; sori shortly linear, single or double, up to 13 pairs per lobe; indusia similar to sori, pale brown, membranous, entire. Spores reniform, lobes not prominent; perispore hyaline, with irregular aculeate and clavate processes on surface, apex of processes sparsely small aculeate.

Broad-leaved forests; 100–800 m (in Taiwan). Chongqing (Jingyun Shan), Fujian (Nanjing, Nanping), Guangdong, Hainan (Baisha), Hunan (Yizhang), Jiangxi, Sichuan (Emei Shan, Leshan), Taiwan, Yunnan (Guangnan), Zhejiang (Cangnan) [Japan].

Some specimens of *Deparia tomitaroana* from China are often mistakenly identified as *Diplazium zeylanicum* (Hooker) T. Moore (= *Deparia zeylanica* (Hooker) M. Kato) from Sri Lanka.

**39. *Deparia omeiensis*** (Z. R. Wang) M. Kato, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(4): 404. 1984.

峨眉对囊蕨 e mei dui nang jue

*Athyriopsis omeiensis* Z. R. Wang, Acta Phytotax. Sin. 20: 236. 1982.

Rhizome erect, ca. 1.2 cm in diam. including remaining stipe bases, apex like stipe base with sparse brown, ovate-lanceolate scales; frond caespitose. Fertile frond 28–38 cm; stipe 13–21 cm, 1–1.5 mm in diam.; lamina narrowly ovate, 12–19 × 7–10 cm, base subtruncate, apex acuminate; pinnae 7–9 pairs, subspreading, sessile, basal 1 or 2 pairs opposite, reduced, symmetrical; middle pinnae alternate, narrowly oblong or lanceolate, 3–5 × 1–1.8 cm, base truncate, pinnatifid, apex acute; pinna lobes 6–9 pairs, spreading, suboblong, contiguous, 7–9 × 3–8 mm, margin crenate or subentire, apex subtruncate; veins pinnate, veinlets simple, 3 or 4 pairs per pinna lobe, oblique. Lamina thinly herbaceous, dark green when dry, both sides of rachis, costae, and veins with sparse light brown, curly short nodose hairs. Sori linear or oblong, 1–3 pairs per lobe, single or double on basic acroscopic veinlets; indusia dark brown, thickly membranous, margin not incurved, lacerate, ciliate. Spores semicircular in polar view, perispore surface with sparse auriculate flake-shaped and obtuse aculeate irregular projections.

• Deep valleys; ca. 2000 m. Sichuan (Emei Shan).

**40. *Deparia concinna*** (Z. R. Wang) M. Kato, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(4): 404. 1984.

美丽对囊蕨 mei li dui nang jue

*Athyriopsis concinna* Z. R. Wang, Acta Phytotax. Sin. 20: 237. 1982; *A. membranacea* Ching & Z. Y. Liu.

Plants summer-green. Rhizome ascending, up to 1.5 cm in diam. including remaining stipe bases, apex and stipe base with sparse brown, ovate-lanceolate scales ca. 5 mm; fronds caespitose. Fertile fronds 23–55 cm; stipe 8–30 cm, 1–2 mm in diam.; lamina ovate-oblong, 12–25 × 8–20 cm, abruptly narrowed at apex, acuminate; free pinna 5–9 pairs, spreading or slightly ascending, lanceolate or oblong-lanceolate, up to 10 × 3 cm, base truncate or broadly cuneate, sessile, pinnatifid, apex acuminate or acute, rarely subrounded; basal pinnae usually reflexed, reduced or not, basal basicopic lobes often prominently short; pinna lobes up to 15 pairs, slightly ascending, oblong, up to 1.5 cm × 8 mm, margin crenate or subentire, apex subrounded

or subtruncate; veins pinnate with up to 7 pairs of veinlets, veinlets simple or forked. Lamina thinly herbaceous, light green when dry; both sides of costae and midribs hairy with gray-white or light brown, long and short nodose hairs, between veinlets ± with gray-white short nodose hairs. Sori oblong, 0.5–1.5 mm, usually single, double on basal acroscopic veinlets; indusia not incurved at margin, erose, with short deciduous hairs. Spores elliptic in polar view, semicircular in equatorial view, perispore surface with dense and unevenly long aculeate projections.  $n = ca. 80^*$ .

• Evergreen broad-leaved forests; 1000–1800 m. Chongqing (Nanchuan), Guizhou, Hunan (Yizhang), Sichuan (Emei), Yunnan (Lunan).

**41. *Deparia dickasonii*** M. Kato, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(4): 404. 1984.

斜生对囊蕨 xie sheng dui nang jue

*Athyriopsis dickasonii* (M. Kato) W. M. Chu; *A. hunanensis* Z. R. Wang & S. F. Wu.

Rhizome ascending, up to 2 cm in diam. including remaining stipe bases, apex and stipe base with sparse light brown, ovate-lanceolate scales up to 1 cm; fronds 2–5, caespitose; lamina subdimorphic. Fertile frond up to 70 cm; stipe brown at base, upward (and rachis) light brown or green-stramineous, up to 35 cm, 1–2 mm in diam., upper part with sparse deciduous scales; lamina ovate to narrowly ovate, up to 35 × 20 cm, apex acuminate, or abruptly narrowed then acuminate; free pinnae 6–14 pairs, linear-lanceolate or narrowly elliptic-lanceolate, up to 10 × 2 cm, base truncate, pinnatifid, apex acuminate or long acuminate, sometimes slightly abruptly narrowed, then acuminate; pinna lobes up to 14 pairs, slightly ascending, contiguous, rectangular or oblong, margin sparsely shallowly crenate, shallowly repand, or entire, apex rounded or subtruncate; veins pinnate per lobe; veinlets up to 6 (or 7) pairs, simple or forked. Lamina herbaceous, dark green or brown-green on adaxial surface when dry, light green on abaxial surface; rachis with dense thin light yellow-brown, multicellular hairs and hair-like scales, costa and veins also with similar nodose hairs, abaxial surface of lamina between veinlets with sparse gray-white short nodose hairs. Sori narrowly oblong or oblong, slightly curved or straight, mostly single, medial-supramedial, double on basal acroscopic veinlets, up to 5 pairs per each lobe; indusia light brown, membranous, margin flat when young, slightly dentate or subentire, with sparse thin short hairs. Spores orbicular in polar view, semicircular in equatorial view, perispore not hyaline, with densely clavate and thinly aculeate projections.

Broad-leaved forests; 1400–2300 m. Guizhou (Suiyang), Hunan (Sangzhi), Yunnan [Myanmar].

*Deparia dickasonii* is similar to *D. minamitanii* Serizawa of Kyushu, Japan, in the prominently subdimorphic fronds and the sterile fronds with short stipes, but it differs by its scales on the stipe base ovate-lanceolate, up to 1 cm, and lamina of fertile frond as long as the stipe or longer (vs. scales lanceolate, up to 5 mm, and lamina of fertile frond considerably shorter than the stipe in *D. minamitanii*). The sterile fronds of *D. dickasonii* number 1 or 2 per plant, while those of *D. minamitanii* number up to 5.

**42. *Deparia petersenii*** (Kunze) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

毛叶对囊蕨 mao ye dui nang jue

*Asplenium petersenii* Kunze, Analect. Pteridogr. 24. 1837; *A. lasiopteris* (Kunze) Mettenius; *Athyriopsis attenuata* Ching; *A. japonica* (Thunberg) Ching var. *oshimense* (Christ) Ching; *A. lasiopteris* (Kunze) Ching; *A. petersenii* (Kunze) Ching; *Athyrium oshimense* Christ; *Diplazium japonicum* (Thunberg) Beddome var. *coreanum* Baker; *D. lasiopteris* Kunze; *D. oshimense* (Christ) H. Itô; *D. petersenii* (Kunze) Christ; *Lunathyrium lasiopteris* (Kunze) Nakaike; *L. petersenii* (Kunze) H. Ohba.

Plants evergreen. Rhizome slender, creeping, dark brown, 2–5 mm in diam., apex with dense red-brown broadly lanceolate scales; fronds distant to approximate, variable, smallest ca. 6 × 1 cm, large fronds up to 1 m × 25 cm; stipe usually dark brown at base, upward stramineous, 2–40(–50) cm, 1–3 mm in diam. at base, with sparse pale brown to red-brown (rarely dark castaneous), broadly to narrowly lanceolate scales and curly nodose short hairs; lamina variable, usually broadly ovate-lanceolate or oblong-lanceolate, sometimes ovate, narrowly deltoid, or deltoid, up to 50 × 25 cm; free pinnae up to 10(–12) pairs below pinnatilobate apex, pinnae of small fronds often lanceolate or oblong-lanceolate, sometimes deltoid, ca. 5 × 1 cm, with only 1 or 2 pairs of free pinnae; pinnae of large fronds spreading or slightly ascending, subfalcate or sometimes straight, basal pinnae sometimes reflexed, shortly stalked or sessile, lanceolate or oblong-lanceolate, up to 15 × 3.5(–4) cm, base broadly cuneate or subtruncate, wider on acroscopic side than on basiscopic side, sometimes slightly auriculate, basal lobes not reduced or slightly so, usually broader, pinnatilobate or pinnatipartite, apex acuminate or long acuminate; pinnae of small fronds mostly ovate-rhomboid, obliquely ovate, or narrowly ovate, margin entire, repand, or shallowly lobed, apex rounded or acute; smallest pinnae ca. 5 × 4 mm; pinna lobes up to 15 pairs, subspreading, oblong, ligulate-elliptic, or falcate, margin entire, shallowly repand, or crenate, apex oblique, truncate, or acute, sometimes obtuse; veins pinnate with less than 7 pairs of veinlets, veinlets ascending, simple or forked, visible on both surfaces. Lamina herbaceous, green or gray-green to light yellow-green when dry, darker adaxially; abaxial side of rachis, costae, and veins hairy with many red-brown or yellow-brown to light gray-brown, long, nodose hairs, lamina between veinlets glabrous or with pale white nodose hairs, sometimes with few, brown, lanceolate scales; adaxial side of rachis, costae, and veinlets with short pointed nodose hairs. Sori shortly linear or linear-oblong, rarely J-shaped, less than 6 pairs per lobe, inframedial from veinlet base or near veinlet base to 2/3–4/5 of veinlet length, sometimes medial, single or double on basal acroscopic veinlets, covering entire surface of pinna lobes when mature; indusia gray-white when young, later brown or yellow-brown, membranous, glabrous or with short nodose hairs, margin lacerate, flat, not incurved. Spores semicircular in equatorial view, elliptic in polar view, perispore prominent, hyaline, with long clavate and aculeate projections.  $n = 80$  (4×).

Various habitats, including broad-leaved forests and wastelands; sea level to 2500(–3600) m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiang-

xi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [S Japan, Korea; S and SE Asia, Oceania].

*Deparia petersenii* is distributed widely in Asia to tropical Oceania, in subtropical montane regions. In China, it is widely distributed south of the Qinling, near streams in evergreen broad-leaved forests lower than 2500 m, though it was also discovered at 3600 m near hot springs on Gongga Shan, Sichuan. There is great variability in the size and morphology of fertile plants.

Plants of *Deparia petersenii* with pinnae usually prominently oblique, pinna lobes oblique with angles of ca. 30°, acuminate at apex, and indusial margin flat and not incurved when young were recognized as *Athyriopsis japonica* var. *oshimense* (FRPS 3(2): 336. 1999). Further taxonomic examination is needed.

“*Athyriopsis petersenii* var. *coreana*” (Ching, Fl. Jiangsu. 1: 41. 1977) belongs here but was not validly published because a full and direct reference to the author and place of valid publication of the basionym was not provided (*Melbourne Code*, Art. 41.5).

**43. *Deparia conilii*** (Franchet & Savatier) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

钝羽对囊蕨 dun yu dui nang jue

*Asplenium conilii* Franchet & Savatier, Enum. Pl. Jap. 2: 227. 1877; *A. japonicum* Thunberg var. *oldhamii* Hooker & Baker; *Athyriopsis conilii* (Franchet & Savatier) Ching; *Athyrium conilii* (Franchet & Savatier) Tagawa; *A. conilii* var. *oldhamii* (Hooker & Baker) Tagawa; *Diplazium conilii* (Franchet & Savatier) Makino; *D. grammitoides* C. Presl var. *conilii* (Franchet & Savatier) Nakai; *D. japonicum* (Thunberg) Beddome var. *conilii* (Franchet & Savatier) Makino; *D. japonicum* var. *latipes* Rosenstock; *D. japonicum* var. *oldhamii* (Hooker & Baker) C. Christensen; *D. oldhamii* (Hooker & Baker) Christ; *Lunathyrium conilii* (Franchet & Savatier) Sa. Kurata; *L. conilii* var. *oldhamii* (Hooker & Baker) Sa. Kurata.

Plants summer-green. Rhizome slender, creeping, dark brown, 1–1.5 mm in diam., with sparse pale brown ovate or ovate-lanceolate membranous scales; fronds distant or approximate. Lamina dimorphic, stipe of sterile frond short. Fertile fronds up to 50 cm; stipe dark brown at base, upward light green-stramineous or stramineous, 9–20 cm, 0.5–1 mm in diam. at base, base sparsely scaly, upward with sparse small deciduous lanceolate scales; lamina 1-pinnate, narrowly lanceolate or lanceolate, 15–25 × 4–7 cm, base wider or shorter than or as wide as middle, apex acuminate; pinnae 15–25 pairs, spreading or base slightly deflexed, oblong or shortly lanceolate, 2–4 × 0.5–1 cm, base asymmetrical, acroscopic base subauriculate, basiscopic base rounded-cuneate, sessile, pinnatilobate or pinnatipartite, apex rounded, acute, or shortly acuminate; pinna lobes 4–8 pairs, oblong to rectangular, entire, slightly ascending, apex truncate or rounded; veins pinnate with 2–4 pairs of simple veinlets, visible on both sides. Lamina thinly herbaceous, green or light brown when dry, dark on adaxial surface; rachis with sparse pale brown lanceolate scales and long nodose hairs, costa and veins adaxially with sparse short nodose hairs. Sori shortly linear, 1–3 pairs per pinna lobe, single or double on acroscopic veinlet; indusia brown, membranous, margin usually erose, sometimes lacerate, rarely incurved, usually not incurved when young. Spores elliptic in polar view, semicircular in

equatorial view, perispore with prominently hyaline, verrucose and muriform protuberances.  $n = 120$  (6 $\times$ ).

Valleys. Anhui, Gansu, Henan, Hunan, Jiangsu, Jiangxi, Shandong, Taiwan. Zhejiang [Japan, Korea].

The authors have not seen material of *Lunathyrium conilii* var. *angustatum* (Nakai) Serizawa (Sci. Rep. Takao Mus. 5: 21. 1973; *Diplazium thunbergii* Nakai ex Momose var. *angustatum* Nakai, Bull. Natl. Sci. Mus. 27: 14. 1949; *L. angustatum* (Nakai) H. Ohba), which has sometimes been included within *Deparia conilii*.

#### 44. *Deparia lushanensis* (J. X. Li) Z. R. He, **comb. nov.**

鲁山对囊蕨 *lu shan dui nang jue*

Basionym: *Athyriopsis lushanensis* J. X. Li, Acta Phytotax. Sin. 26: 162. 1988.

Plants summer-green. Rhizome slender, creeping, ca. 3 mm in diam., apex with pale brown, broadly lanceolate thin scales; fronds separate. Fertile frond up to 60 cm; stipe black at base, upward light stramineous, 10–30 cm, ca. 1 mm in diam., base sparsely scaly, upward with sparse narrowly lanceolate, pale brown scales and nodose hairs; lamina broadly lanceolate, up to 40  $\times$  12 cm, acuminate at apex; free pinnae up to 15 pairs, mostly alternate, spreading, lanceolate, pinnatifid, apex acute or rounded; basal pinnae larger, up to 7  $\times$  2.5 cm, shortly stalked, other pinnae sessile; pinna lobes up to 8 pairs, rectangular or oblong, acroscopic basal lobe larger, margin sparsely shallowly crenate, apex truncate or rounded; veins per lobes pinnate with less than 4 pairs of veinlets, ascending, simple, rarely forked. Lamina thinly herbaceous, pale green when dry; rachis with sparse yellow-brown scales and nodose hairs, costae with sparse nodose hairs. Sori shortly linear, 1–3 pairs per lobe, single, medial or subbasal, double on acroscopic basal veinlets; indusia yellow-brown, membranous, glabrous, persistent, margin shallowly erose, incurved when young. Spores suborbicular in polar view, semicircular in equatorial view, perispore with irregular tuberculate ornamentation.

• Shandong (Lushan).

#### 45. *Deparia pseudoconilii* (Serizawa) Serizawa, J. Jap. Bot. 54: 182. 1979.

阔基对囊蕨 *kuo ji dui nang jue*

*Lunathyrium pseudoconilii* Serizawa, Sci. Rep. Takao Mus. 5: 21. 1973; *Athyriopsis pseudoconilii* (Serizawa) W. M. Chu.

Plants summer-green. Rhizome creeping, black, slender, 1–1.5 mm in diam., apex with dense brown lanceolate thin scales; fronds separate, basal part of stipes persistent. Lamina subdimorphic; fertile frond 35–65 cm; stipe purple at base, upward stramineous, or purple throughout, 20–35 cm, 0.5–1 mm in diam., base sparsely scaly, scales like those on rhizome; lamina lanceolate or narrowly long deltoid, up to 15(–30) cm, up to 6(–15) cm wide, base usually widest, apex acuminate; free pinnae up to 7(–10) pairs, spreading or slightly reflexed, basal pinnae usually prominently larger, elliptic to elliptic-lanceolate, (1.5–)3(–8)  $\times$  (0.9–)1.3(–2) cm, base asymmetrical, wider on acroscopic side, pinnatifid to pinnatifid, apex obtuse, acute,

or acuminate; upper pinnae shorter; pinna lobes rounded or truncate at apex, margin repand or sparsely serrate; veins in lobes mostly pinnate, veinlets simple, rarely forked, up to 4(–6) pairs. Lamina thinly herbaceous when dry, pale green, darker on adaxial surface, both surfaces of rachis with dense pale brown curly nodose hairs, both sides of costae and adaxial side of veinlets with sparse short nodose hairs. Sori linear, usually straight or slightly curved, single or double on acroscopic basal veinlet; indusia yellow-brown, surface usually with short nodose hairs, margin lacerate, flat when young. Spores semicircular in equatorial view, perispore surface with dense apically truncate long clavate ornamentation.  $n = 120$ .

Zhejiang [Japan].

#### 46. *Deparia pachyphylla* (Ching) Z. R. He, **comb. nov.**

阔羽对囊蕨 *kuo yu dui nang jue*

Basionym: *Athyriopsis pachyphylla* Ching, Acta Phytotax. Sin. 9: 66. 1964.

Rhizome slender, creeping, apex like base of stipe, with sparse pale brown, lanceolate, membranous scales; fronds separate. Fertile frond up to 40 cm; stipe brown at base, upward pale green, 12–17 cm, ca. 1.2 mm in diam., base with sparse pale brown, curly short nodose hairs, upper part subglabrous; lamina narrowly deltoid, 17–25  $\times$  7–12 cm, apex acuminate; free pinnae 2 or 3 pairs, slightly ascending, sessile, oblong-lanceolate, apex subacute or obtuse; basal pinnae not reduced or slightly so, 5–6  $\times$  2.5–3 cm, base slightly narrowed, basispic base cuneate with reduced pinna lobes, acroscopic base truncate, pinnatifid 1/2–2/3; lobes 5–7 pairs, ligulate-oblong, 4–6  $\times$  5–8 mm, margin sparsely crenate or irregularly shallowly repand, entire, apex rounded or subtruncate; veins prominent, thin, ascending, pinnate per lobes; veinlets 3–5 pairs, simple, rarely forked. Lamina thinly herbaceous or submembranous when dry, green; rachis and costa with sparse pale brown curly short hairs. Sori 2–4 pairs per lobe, ascending, linear, 3–4 mm, often double on acroscopic basal veinlets of upper pinna lobes; indusia gray, thinly membranous, lacerate, persistent.

• Forests; ca. 800 m. NW Hubei, Hunan.

#### 47. *Deparia shandongensis* (J. X. Li & Z. C. Ding) Z. R. He, **comb. nov.**

山东对囊蕨 *shan dong dui nang jue*

Basionym: *Athyriopsis shandongensis* J. X. Li & Z. C. Ding, Acta Phytotax. Sin. 26: 163. 1988.

Plants summer-green. Rhizome slender, creeping, ca. 2 mm in diam., apex with brown, entire, broadly lanceolate scales; fronds sparse. Lamina subdimorphic; fertile frond larger than sterile, stipe dark brown at base, upward stramineous, up to 30 cm (in sterile frond less than 10 cm), ca. 2 mm in diam. at base, with sparse lanceolate, pale brown, entire, thin scales and nodose hairs; lamina broadly lanceolate, up to 38  $\times$  12 cm, apex acuminate; free pinnae up to 15 pairs, mostly alternate, sessile, lanceolate or falcate-lanceolate, up to 8  $\times$  2.5 cm, base broadly cuneate, slightly asymmetrical, often wider on acroscopic side, pinnatifid, apex acute or acuminate; pinna lobes up to 10

pairs, rectangular or oblong, apex truncate; lobes rarely lanceolate, margin entire or crenate, apex rounded; veins pinnate with up to 6 pairs of veinlets, veinlets simple or forked, ascending. Lamina herbaceous, green when dry, dark on adaxial surface; rachis stramineous, with sparse brown, lanceolate scales and nodose hairs, both sides of costae and veins sparsely nodose-hairy. Sori shortly linear, mostly straight, usually elliptic when mature, 1–4 pairs per lobe, subbasal, usually single, double on acroscopic basal veinlets; indusia yellow-brown, membranous, margin shallowly erose, incurved when young. Spores elliptic in polar view, semicircular in equatorial view, perispore with irregular auriculate projections.

- Wet areas in forests; 200–500 m. Shandong.

Like *Deparia lushanensis*, *D. shandongensis* is endemic to Shandong, the northernmost distributional range of the genus in China. It is distinct from *D. lushanensis* in the frond, indusia, and spore ornamentation.

**48. *Deparia abbreviata*** (W. M. Chu) Z. R. He, **comb. nov.**

岳麓山对囊蕨 yue lu shan dui nang jue

Basionym: *Athyriopsis abbreviata* W. M. Chu, Acta Phytotax. Sin. 21: 221. 1983.

Rhizome slender, creeping, ca. 2 mm in diam., with sparse pale brown, broadly lanceolate, entire, membranous scales. Fronds distant to approximate, subdimorphic; sterile fronds similar to fertile fronds, with stipe usually prominently short, lamina somewhat small; fertile fronds up to 60 cm; stipe brown-green when dry, 15–25 cm, ca. 1.5 mm in diam. at base, sparsely scaly; scales similar to those on rhizome, those on upper part sparser, gradually smaller, lanceolate or narrowly lanceolate; lamina broadly oblong-lanceolate, 20–35 × 5–13 cm, base slightly reduced, 3.5–7 cm wide, apex acuminate; free pinnae 8–12 pairs, sessile or subsessile, pinnatifid to pinnatipartite; lower pinnae spreading or reflexed, obliquely ovate or short ovate-lanceolate, 2–3.5 × 1.5–2.5 cm, apex obtuse or acute; middle pinnae slightly ascending or spreading, lanceolate, up to 7.5 × 2 cm, apex usually acuminate, rarely acute; pinna lobes up to 10 pairs in largest middle pinnae, approximate, oblong or rectangular, slightly oblique, margin shallowly repand or shallowly crenate, apex rounded or truncate; veins per lobe pinnate, with up to 5 pairs of veinlets, veinlets simple or forked, oblique. Lamina thinly herbaceous, dark green when dry, pale green underneath; rachis with sparse, deciduous, dark brown, narrowly lanceolate scales and curly short nodose hairs, costae and veinlets with slightly shorter nodose hairs. Sori shortly linear, straight or slightly curved, up to 3 pairs per lobe, single or double on basal acroscopic veinlets, medial; indusia pale brown, membranous, glabrous, margin lacerate, denticulate, or subentire, incurved when young; spores elliptic or suborbicular in polar view, semicircular in equatorial view, perispore surfaces with dense long aculeate and thinly clavate projections.

- Evergreen broad-leaved forests beside streamlets; 100–1200 m. Guangxi (Baise), Hunan (Changshan).

*Deparia abbreviata* is similar to *D. japonica* but differs by the lamina narrowly elliptic, gradually reduced to base with basal pinnae

often obliquely ovate, and perispore surface with long aculeate and thinly clavate projections.

**49. *Deparia japonica*** (Thunberg) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

东洋对囊蕨 dong yang dui nang jue

Plants summer-green. Rhizome slender, creeping, apex with yellow-brown, broadly lanceolate or lanceolate scales; fronds distant to approximate. Fertile frond up to 1 m; stipe scaly and hairy; lamina bipinnatilobate, oblong or broadly oblong-lanceolate, sometimes triangular, base slightly or not reduced, apex long acuminate or abruptly narrowed, acuminate; pinnae 4–8 pairs, oblique or occasionally spreading, straight or subfalcate, oblong-lanceolate or lanceolate, base subtruncate, apex long acuminate or caudate; pinna lobes 5–18 pairs, oblique at angles of 40°–45°, rectangular or oblong, or falcate-lanceolate, margin sparsely dentate or repand, rarely shallowly lobed, apex subtruncate or rounded to acute; veins pinnate with less than 8 pairs of veinlets, oblique, forked or simple, often not prominently adaxially, slightly visible abaxially. Lamina herbaceous, rachis with sparse pale brown lanceolate scales and nodose soft hairs, costae and veins with nodose hairs on both sides. Sori shortly linear, straight, mostly single, medial, double on basal acroscopic veinlets; indusia pale brown, membranous, glabrous, margin lacerate, incurved when young.  $n = 120 (6\times)$ .

Wet areas, beside valley streamlets; below 2000 m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Shanghai, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, India, Korea, N Myanmar, Nepal].

- 1a. Pinnae not variegated; indusial margin lacerate, ciliate, perispore surface with shortly aculeate projections ..... 49a. var. *japonica*
- 1b. Pinnae variegated; indusial margin denticulate, perispore surface with long clavate and aculeate projections ..... 49b. var. *variegata*

**49a. *Deparia japonica* var. *japonica***

东洋对囊蕨(原变种) dong yang dui nang jue (yuan bian zhong)

*Asplenium japonicum* Thunberg in Murray, Syst. Veg., ed. 14, 934. 1784; *Athyriopsis japonica* (Thunberg) Ching; *A. petiolata* Ching; *Athyrium japonicum* (Thunberg) Copeland; *Diplazium japonicum* (Thunberg) Beddome; *D. thunbergii* Nakai ex Momose; *Lunathyrium japonicum* (Thunberg) Sa. Kurata.

Pinnae not variegated; indusial margin lacerate, ciliate, perispore surface with shortly aculeate projections.  $n = 120 (6\times)$ .

Wet areas, beside valley streamlets; sea level to 2000 m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Shanghai, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, India, Korea, N Myanmar, Nepal].

**49b. *Deparia japonica* var. *variegata*** (W. M. Chu & Z. R. He) Z. R. He, **comb. nov.**

花叶东洋对囊蕨 hua ye dong yang dui nang jue

Basionym: *Athyriopsis japonica* var. *variegata* W. M. Chu & Z. R. He, Acta Phytotax. Sin. 36: 375. 1998.

Pinnæ yellow-variegated on adaxial surface; indusial margin denticulate, perispore ornamentation long clavate and aculeate.

• Broad-leaved forests, beside streamlets; below 2000 m. Yunnan (Kunming).

**50. *Deparia kiusiana*** (Koidzumi) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

中日对囊蕨 *zhong ri dui nang jue*

*Diplazium kiusianum* Koidzumi, Acta Phytotax. Geobot. 1: 27. 1932; *Athyriopsis kiusiana* (Koidzumi) Ching; *Athyrium japonicum* (Thunberg) Copeland var. *kiusianum* (Koidzumi) Ohwi; *A. kiusianum* (Koidzumi) Tagawa; *Deparia dimorphophylla* (Koidzumi) M. Kato var. *kiusiana* (Koidzumi) Serizawa; *Lunathyrium dimorphophyllum* (Koidzumi) Sa. Kurata var. *kiusianum* (Koidzumi) Sa. Kurata; *L. lasiopteris* (Kunze) Nakaike var. *kiusianum* (Koidzumi) Nakaike.

Plants summer-green. Rhizome slender, creeping, deep below soil surface, ca. 2.5 mm in diam., apex with brown, lanceolate, membranous scales; fronds sparsely arranged. Fertile frond up to 80 cm; stipe stramineous, 25–40 cm, densely scaly along entire length with pale brown, linear to lanceolate membranous translucent scales and nodose soft hairs up to 3 mm, scales on upper part narrow; lamina ovate, narrowly elliptic, or narrowly subdeltoid, 18–40 × 10–25 cm, base slightly narrowed or not, apex abruptly narrowed; free pinnæ 7–12 pairs, spreading or slightly ascending, narrowly elliptic or linear-lanceolate, 3.5–15 × 1–3.5 cm, base broadly cuneate or subtruncate, rarely shallowly cordate, sessile or lower pinnæ shortly stalked, apex acuminate or shortly acuminate; upper pinnæ adnate, pinnatipartite up to or near costa; pinna lobes up to 18 pairs, slightly oblique or spreading, oblong or slightly obliquely ligulate-oblong, entire, repand, or shallowly crenate at apex, apex truncate or rounded, sometimes slightly impressed; veins pinnate with less than 7 pairs of veinlets, simple or forked. Lamina herbaceous, brown-green when dry, darker on adaxial surface; rachis hairy along entire length with dense, pale brown, hyaline, often shrunken, soft, nodose hairs 2–3 mm, lower part of rachis hairy and scaly with 2- or 3-cells-wide, linear, hyaline scales, abaxial side of costae and both sides of veinlets with nodose hairs, lamina between veinlets with ± gray-white nodose hairs. Sori shortly linear, straight or slightly curved, 1–6 pairs per lobe, mostly single, subcostular, double on basal acroscopic veinlets; indusia yellow-brown when mature, membranous, with short nodose hairs, margin lacerate, flat when young. Spores semicircular in polar view, perispore surface with dense clavate and aculeate ornamentation.

Broad-leaved forests, mixed coniferous and broad-leaved forests, beside streamlets in forests; below 1500 m. N Guizhou (Daozhen), S Shandong (Pingyi) [Japan].

**51. *Deparia jinshanensis*** (Z. Y. Liu) Z. R. He, *comb. nov.*

金佛山对囊蕨 *jin fo shan dui nang jue*

Basionym: *Athyriopsis jinshanensis* Z. Y. Liu, Bull. Bot. Res., Harbin 4(3): 11. 1984.

Plants summer-green. Rhizome slender, creeping, deep below soil surface, dark black, ca. 2.5 mm in diam., apex with brown lanceolate scales; fronds distant to approximate. Fertile frond up to 1 m; stipe brown to dark brown at base, upward stramineous, 20–60 cm, 2–3 mm in diam. at base, scaly along entire length with pale brown, lanceolate to linear, translucent membranous scales, with nodose long soft hairs up to 3 mm; lamina narrowly elliptic or ovate, 25–60 × 20–25 cm, base not or slightly narrowed, apex acuminate; free pinnæ ca. 10 pairs, ascending, basal pinnæ sometimes reflexed, narrowly elliptic or linear-lanceolate, 3–16 × 1–4 cm, base truncate, shallowly cordiform or broadly cuneate, sessile or shortly stalked, with upper pinnæ adnate, pinnatipartite near or to costa, apex acuminate or long acuminate; pinna lobes up to 20 pairs, subspreading, ligulate-oblong or obliquely oblong, margin crenate, apex rounded; veins pinnate with less than 8 pairs of veinlets, veinlets bifurcate, trifurcate, or simple. Lamina herbaceous, pale green abaxially, green adaxially when dry, or pale brown on both surfaces, darker adaxially; rachis with dense 2- or 3-cells-wide, light brown, thickly clathrate, hyaline, thinly linear scales 2–3 mm, with fewer pale brown, hyaline, often shrunken, thin nodose soft hairs, upper part of rachis less densely minutely scaly and nodose-hairy, abaxial side of costae with sparse, thin, nodose soft hairs, both sides of veinlets with ± gray-white nodose hairs, lamina between veinlets glabrous. Sori shortly linear, straight or subfalcate, 1–7 pairs per lobe, mostly single or double on basal acroscopic veinlets, medial-costular, proximal end near costule; indusia yellow-brown, membranous, glabrous, margin lacerate or erose, mostly flat when young, some incurved. Spores elliptic in polar view, semicircular in equatorial view, perispore surface with dense clavate projections.

• Broad-leaved forests; 1600–1900 m. Chongqing (Nanchuan), Guizhou (Tongzi).

**52. *Deparia dimorphophyllum*** (Koidzumi) M. Kato, Bot. Mag. (Tokyo) 90: 37. 1977.

二型叶对囊蕨 *er xing ye dui nang jue*

*Diplazium dimorphophyllum* Koidzumi, Acta Phytotax. Geobot. 1: 27. 1932; *Athyriopsis dimorphophylla* (Koidzumi) Ching ex W. M. Chu; *Athyrium dimorphophyllum* (Koidzumi) Tagawa; *A. japonicum* (Thunberg) Copeland var. *dimorphophyllum* (Koidzumi) Ohwi; *Lunathyrium dimorphophyllum* (Koidzumi) Sa. Kurata.

Plants summer-green. Rhizome long creeping, deep below soil surface, 2–4 mm in diam., apex with dense pale brown, lanceolate or broadly lanceolate, thinly membranous scales; fronds sparse. Lamina prominently subdimorphic, fertile frond larger or stipe prominently longer than sterile; stipe stramineous, 1–2 mm in diam., base densely scaly, scales similar to those on rhizome, upward with sparse narrow scales and multicellular nodose hairs, apical part subshiny, up to 40(–65) cm, in sterile frond less than 30 cm; lamina pinnatilobate, ovate-elliptic, ovate, or narrowly subdeltoid, up to 45(–50) × 25(–28) cm, in sterile frond shorter, apex gradually or abruptly narrowed,

acuminate; free pinnae less than 8 pairs, slightly ascending, elliptic-lanceolate or lanceolate, up to 16 × 5 cm, base truncate or broadly cuneate, pinnatipartite, apex acuminate or long acuminate; pinna lobes up to 15 pairs, slightly ascending, ligulate-oblong or falcate-oblong, margin entire, repand, or crenate, apex rounded; veins pinnate with less than 11 pairs of veinlets, veinlets oblique, forked or simple. Lamina herbaceous, green when dry, darker adaxially; rachis and costae with sparse small scales and with nodose hairs, or nearly shiny; veinlets with sparse short nodose hairs or glabrous, lamina between veins with ± pale white or pale brown nodose hairs. Sori linear, straight or slightly curved, 1–10 pairs per lobe, medial or inframedial, mostly single or double on basal acroscopic veinlets; indusia yellow-brown, membranous, hairy, margin lacerate, incurved when young. Spores semicircular or subreniform in equatorial view, perispore surface with dense, thick, uniform, thinly clavate projections.  $n = 120$  (6×).

Forests, forest margins; sea level to 1000 m. Anhui, Guizhou, Henan, Hunan, Jiangxi, Zhejiang [Japan].

**53. *Deparia longipes*** (Ching) Shinohara, Amer. Fern J. 96(3): 99. 2006.

狭叶对囊蕨 xia ye dui nang jue

*Athyriopsis longipes* Ching, Acta Phytotax. Sin. 9: 68. 1964; *A. angustifolia* S. F. Wu.

Plants summer-green. Rhizome slender, creeping, dark brown, 2–3 mm in diam., with sparse yellow-brown, lanceolate, membranous scales; fronds distant. Lamina subdimorphic, stipe of fertile frond prominently longer than in sterile frond; fertile frond up to 90 cm; stipe dark brown at base, upward stramin-

ous, 18–45 cm, 1–3 mm in diam. at base, base sparsely scaly, scales similar to those on rhizome, upward with more brown to dark brown, shiny lanceolate scales and yellow-brown small nodose hairs, then scales and hairs gradually deciduous; lamina narrowly deltoid, base not narrowed, or ovate, 16–45 cm, base slightly narrowed, apex acuminate to long acuminate, sometimes abruptly narrowed; free pinnae 7–12 pairs, mostly alternate, spreading or slightly ascending, sessile, base truncate or broadly cuneate, occasionally shallowly cordate, pinnatipartite, apex lanceolate or oblong-lanceolate, rarely subacute; upper pinnae symmetrical or nearly symmetrical, basal pinnae asymmetrical with basispic lobes longer; pinna lobes 7–17 pairs, contiguous, ascending or subspreading, ligulate-oblong, margin toothed or repand, rarely pinnatipartite or subentire, apex rounded; middle pinna lobes 1–2 cm × 5–8 mm; veins pinnate with 1–8 pairs of veinlets, visible on both sides, forked or simple. Lamina herbaceous, green or pale green when dry, darker on adaxial side; both sides of rachis, costae, and veins with sparse gray-white, pale brown nodose soft hairs, hairs on abaxial side of costae thick, long. Sori shortly linear, straight or slightly oblique, 1–7 pairs per pinna lobe, mostly single, medial or inframedial, proximate end of sori near costa, double on basal acroscopic veinlets; indusia light brown when young, yellow-brown when old, membranous, hairy or glabrous, margin flat, lacerate, then erose, long or shortly ciliate. Spores orbicular in polar view, semicircular in equatorial view, perispore prominent, hyaline, surface ornamentation with mostly clavate, apically truncate, sometimes narrow flakelike projections.

• Evergreen broad-leaved forests in valleys, bamboo forests, shrubs beside streamlets; 1700–2500 m. Hunan, Sichuan, Taiwan (Taizhong, Taoyuan, Yilan), Xizang, Yunnan.

#### Putative Hybrids

From abortive spores and morphological features of specimens, many hybrids can be considered. Here only two hybrids that have been published as “species” are listed.

***Deparia* ×*kanghsienense*** (Ching & Y. P. Hsu) Z. R. He, **comb. nov.**

康县对囊蕨 kang xian dui nang jue

Basionym: *Lunathyrium* ×*kanghsienense* Ching & Y. P. Hsu, Fl. Tsinling, 2: 212. 1974, pro sp.

The type of this hybrid is morphologically intermediate between *Deparia liangshanensis* var. *sericea* and *D. sichuanensis*. It is similar to *D. liangshanensis* in the multicellular long hairs on the surface of indusia but differs by the pinna segments without long multicellular hairs at margin, at most occasionally with few short hairs between teeth. The hairs on pinna segments are much denser than in *D. sichuanensis*. The spores are mostly abortive.

• 1300–1400 m. Gansu (Kangxian).

***Deparia* ×*nanchuanense*** (Ching & Z. Y. Liu), Z. R. He, **comb. nov.**

南川对囊蕨 nan chuan dui nang jue

Basionym: *Lunathyrium* ×*nanchuanense* Ching & Z. Y. Liu, Bull. Bot. Res., Harbin 3(4): 15. 1983, pro sp.

This hybrid is morphologically intermediate between

*Deparia shennongensis* and *D. vegetior*. It is similar to *D. vegetior* in the hairs on the abaxial surface of rachis and costae very thin, short, and sparse, and multicellular hairs absent at sinuses between pinna segments, and multicellular hairs on the adaxial surface of veins in fertile pinnae very short. It is also similar to *D. shennongensis* in the lower pinnae gradually shortened and spore surface with rugate folds or baculate processes. Some spores in each sporangium are abortive.

• Forests; 1600–1700 m. Chongqing (Jinfo Shan).

There are other formerly undescribed species, e.g., “*Lunathyrium subimbricatum*” (Ching in Y. L. Zhang et al., Sporae Pterid. Sin. 233, t. 45, f. 21, 25. 1976; 栉比蛾眉蕨 jie bi e mei jue) in broad-leaved forests, rock crevices, watersides, 2700–2800 m, W Yunnan (Yongping); and “*Lunathyrium heterocarpum*” (Ching in Y. L. Zhang et al., Sporae Pterid. Sin. 232, t. 46, f. 10, 15. 1976; 杂果蛾眉蕨 za guo e mei jue) in forests on mountain slopes, ca. 3300 m, Sichuan (Li Xian). The former is similar to *Deparia sichuanensis*, but the plant is larger with basal pinna segments prominently broadened. It is also similar to *D. wilsonii*. The spores are completely abortive. The latter hybrid is intermediate between *D. dolosa* and *D. shennongensis* in its pinnae to 30 pairs or more, pinna segments to 20 pairs or more, and rachis and costae with rather dense multicellular long hairs abaxially. The spores are partly abortive, and “good” spores are variable in size.

**2. CORNOPTERIS** Nakai, Bot. Mag. (Tokyo) 44: 7. 1930.

角蕨属 jiao jue shu

He Zhaorong (和兆荣); Masahiro Kato

*Neoathyrium* Ching & Z. R. Wang.

Plants hygrophytic, evergreen or summer-green. Rhizome mostly creeping, ascending or erect, few thinly creeping, apex and bases of stipes scaly; scales brown or red-brown, lanceolate, ovate-lanceolate, or ovate, entire; fronds approximate or caespitose, occasionally distant. Stipe fleshy or herbaceous, flattened when dry, base thickened and often warty, deeply grooved on adaxial side, subglabrous; lamina variably dissected from 2-pinnatifid to 3-pinnate or more, elliptic to ovate-deltoid, apex acuminate; pinnae lanceolate or broadly lanceolate, or lower pinnae ovate-lanceolate, sessile or shortly stalked, subspreading, asymmetrical or nearly symmetrical, apex acuminate or long acuminate; pinnules often pinnatifid; rachis and costae broadly grooved between narrow ridges on adaxial side, fleshy hornlike processes borne in grooves at base of costae and costules; veins free, pinnate, veinlets simple, bifurcate to pinnate, not reaching lamina margin. Lamina brown-green, dark brown, or black-brown, glabrous, or rachis or costae abaxially with multicellular short nodose hairs and sparsely lanceolate brown scales, rarely with unicellular short hairs. Sori linear, elliptic, or orbicular, on veinlets, exindusiate. Spores bilateral, elliptic in polar view, semicircular or reniform in equatorial view, perispore prominent, surface with few-rugate ornamentation.  $x = 40$ .

About 16 species: mainly distributed in tropical and subtropical Asia; 12 species (six endemic) in China.

*Cornopteris crenulatoserrulata* (species no. 12) was assigned to the monotypic genus *Neoathyrium*, which was recognized in FRPS (3(2): 94. 1999).

Knapp (Ferns Fern Allies Taiwan, 442. 2011) noted that *Cornopteris philippinensis* M. Kato has been reported for Taiwan but that the voucher specimen (*Murakami, Saito & Chen 344*) differs from Philippine material and might instead correspond to a form of *C. opaca*. He lists its status for Taiwan as unconfirmed.

- 1a. Sori orbicular; lamina 2- or 3-pinnate, pinnules or secondary pinnules pinnatifid.
  - 2a. Rhizome long creeping.
    - 3a. Projections absent from lateral ridges of stipe base, pinnules up to  $9 \times 3$  cm; rachis, costae, and costules abaxially with glandular unicellular hairs ..... 9. *C. pseudofluvialis*
    - 3b. Projections present on lateral ridges of stipe base, pinnules up to  $4-6 \times 1.5$  cm; rachis, costae, and costules abaxially with eglandular unicellular hairs ..... 12. *C. crenulatoserrulata*
  - 2b. Rhizome ascending to erect.
    - 4a. Lamina 2-pinnate, at most nearly 3-pinnate; ultimate lobes entire or shallow crenate at apex ..... 10. *C. banajaoensis*
    - 4b. Lamina 3-pinnate, ultimate pinnule usually pinnatifid; ultimate lobes acute or serrate at apex ..... 11. *C. badia*
- 1b. Sori elliptic or linear; lamina 1-pinnate to 2-pinnate.
  - 5a. Lamina 2-pinnate, pinnules pinnatifid.
    - 6a. Rhizome ascending to erect ..... 5. *C. opaca*
    - 6b. Rhizome creeping.
      - 7a. Pinnules of lower pinnae usually obtuse-rounded at apex, rarely pointed, pinnatifid to pinnatifid or dentate ..... 6. *C. decurrenti-alata*
      - 7b. Pinnules of lower pinnae pointed, pinnatifid to pinnatifid.
        - 8a. Pinnules of basal pinnae oblong-lanceolate, base not reduced, apex shortly acuminate or acute; pinnule lobes obtuse-crenate or subentire; lamina abaxially with unicellular short hairs, rarely also with 2- or 3-celled short nodose hairs ..... 7. *C. christenseniana*
        - 8b. Pinnules of basal pinnae ovate-lanceolate or subovate, base reduced, apex usually acuminate or long acuminate; pinnule lobes pinnatifid or crenate; lamina abaxially with multicellular short nodose hairs ..... 8. *C. major*
  - 5b. Lamina 1-pinnate, pinnae pinnatifid with at most basal 1 (to few) pair of free adnate pinnules.
    - 9a. Lamina narrowly elliptic-lanceolate; all pinnae sessile.
      - 10a. Rhizome erect; pinnae contiguous, base shallowly cordate, middle part of pinna as wide as or slightly narrower than base; rachis and costae abaxially with dense curly multicellular short nodose hairs ..... 1. *C. approximata*
      - 10b. Rhizome creeping; pinnae prominently spaced, base truncate and prominently broader; rachis and costae glabrous abaxially ..... 2. *C. latibasis*
    - 9b. Lamina ovate; lower pinnae shortly stalked.
      - 11a. Rhizome creeping ..... 6. *C. decurrenti-alata*
      - 11b. Rhizome ascending or erect.
        - 12a. Middle and upper pinnae usually pinnatifid, rarely pinnatifid; veinlets mostly simple, rarely forked, forked veinlets mostly suprasedial ..... 3. *C. omeiensis*

12b. Middle and upper pinnae pinnatipartite to pinnatisect; veinlets mostly bifurcate or pinnate, forked veinlets mostly inframedial.

13a. Basal acroscopic lobes of upper pinnae narrower and longer than basisopic ones ..... 4. *C. latiloba*

13b. Basal acroscopic pinna lobes shorter than basisopic ones ..... 5. *C. opaca*

**1. *Cornopteris approximata*** W. M. Chu, Acta Bot. Yunnan. 3: 342. 1981.

密羽角蕨 mi yu jiao jue

Rhizome short, erect; fronds caespitose. Fertile frond ca. 60 cm; stipe stramineous, shorter than lamina, base 2–3 mm in diam., with sparse broadly lanceolate brown thin scales and short thin hairs; lamina 1-pinnate, narrowly elliptic-lanceolate, ca. 40 × 15 cm, apex acuminate; pinnae up to 15 pairs, spreading, contiguous, sessile, lanceolate, subfalcate, up to 10 × 3 cm, base slightly asymmetrical, shallowly cordate, pinnatifid to pinnatipartite, serrate, apex acuminate; basal pinnae slightly reflexed, shorter, asymmetrical, base slightly reduced; pinna lobes up to 15 pairs, rectangular, margin shallowly repand or slightly rounded-crenate, apex rounded or truncate; veinlets up to 7 pairs, forked or simple, rarely pinnate. Lamina thinly papery, dark brown; rachis and costae abaxially with dense slightly curly, multicellular nodose hairs. Sori elliptic or shortly linear, subbasal near costae; spores reniform in equatorial view, perispore prominent, slightly rugate.

• Beside streamlets of evergreen broad-leaved forests; ca. 1800 m. NE Yunnan (Suijiang).

**2. *Cornopteris latibasis*** W. M. Chu, Acta Bot. Yunnan. 3: 344. 1981.

阔基角蕨 kuo ji jiao jue

Rhizome creeping or ascending; fronds caespitose. Fertile frond 40–80 cm; stipe brown when dry, shorter than lamina, base 2–3 mm in diam., scaly and hairy from base to apex with ovate or broadly lanceolate brown thin scales and short thin hairs; lamina 1-pinnate, narrowly elliptic-lanceolate, 30–50 × 10–23 cm, base slightly reduced, apex acuminate, pinnatilobate; pinnae 10–15 pairs, spreading or nearly so, well spaced, sessile, sickle-shaped or lanceolate, up to 12 × 2–3 cm, base slightly asymmetrical, truncate, wider than above, pinnatilobate to pinnatifid, apex acuminate; basal pinnae short, reflexed; pinna lobes broadly deltoid or subelliptic, subentire, obtuse at apex; veinlets up to 7 pairs, simple or occasionally forked. Lamina thinly herbaceous when dry, pale brown; rachis abaxially with sparse brown lanceolate scales and curly thin nodose hairs when young, then subglabrous. Sori elliptic or shortly linear, inframedial, close to midrib. Spores reniform in equatorial view, perispore with prominent, slightly rugate projections.

• Evergreen broad-leaved forests, beside streamlets; 1200–1900 m. Sichuan, Yunnan.

**3. *Cornopteris omeiensis*** Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 287. 1949 [*“omeigensis”*].

峨眉角蕨 e mei jiao jue

*Diplazium japonicum* (Thunberg) Beddome var. *nudisorum* C. Christensen.

Rhizome ascending; fronds caespitose. Fertile frond 60–70

cm; stipe yellow-brown at base, upward green-stramineous, 20–40 cm, ca. 3 mm in diam., base stout, with sparse brown, ovate or ovate-lanceolate, entire scales; lamina 1-pinnate below apex, ovate-oblong, as long as stipe, 15–25 cm wide, apex acuminate and pinnatilobate; pinnae up to 13 pairs, shortly stalked, subspreading or narrowly elliptic-lanceolate, straight or sickle-shaped, oblique, dentate, pinnatifid to pinnatilobate, or basal pinnae sometimes deeply pinnatifid, apex long acuminate; basal pinnae short, spreading or reflexed, narrowly elliptic-lanceolate, 7–12 × 2–4 cm; middle pinnae up to 16 cm; pinna lobes up to 15 pairs, subcontiguous, slightly ascending, margin shallowly serrate or crenate, apex rounded; veins visible on adaxial side, prominent on abaxial side, pinnate, veinlets up to 7 pairs, oblique, simple or forked, basal veinlets curved, ending below lobe margin. Lamina herbaceous when dry, gray-brown abaxially, brown-green adaxially, glabrous on both surfaces. Sori brown-red, shortly linear or elliptic, up to 6 pairs, medial; spores semicircular in equatorial view, perispore with prominent, rarely rugate projections.

• Forests on hillsides; 1100–2400 m. Guizhou, Sichuan.

**4. *Cornopteris latiloba*** Ching, Fl. Xizang. 1: 144. 1983.

阔片角蕨 kuo pian jiao jue

Plants summer-green. Rhizome ascending to erect, apex with brown broadly lanceolate scales; fronds caespitose. Fertile frond up to 110 cm; stipe brown, up to 50 cm, ca. 3.5 mm in diam., with sparse brown lanceolate scales, grooved above; lamina 1-pinnate below pinnatilobate apex, ovate, up to 60 cm, ca. 40 cm wide, apex shortly acuminate; pinnae ca. 10 pairs, lanceolate, up to 20 × 6 cm wide, slightly ascending, shortly stalked, base slightly narrowed, pinnatipartite to pinnatisect, apex acuminate; basal pinnae slightly shortened or not shortened; pinna lobes up to 14 pairs, elliptic or oblong, dentate, acroscopic base of upper pinnae narrower, longer than basisopic base, or equally long; veins prominent with 8–10 pairs of veinlets, oblique, bifurcate or trifurcate or pinnate, occasionally simple. Lamina thinly herbaceous when dry, brown-green on both surfaces, glabrous. Sori elliptic. Spores reniform in equatorial view, perispore prominent, with few rugate, granular projections.

• Mixed coniferous and broad-leaved forests; 2200–2400 m. Yunnan.

**5. *Cornopteris opaca*** (D. Don) Tagawa, Acta Phytotax. Geobot. 8: 92. 1939.

黑叶角蕨 hei ye jiao jue

*Hemionitis opaca* D. Don, Prodr. Fl. Nepal. 13. 1825; *Athyrium opacum* (D. Don) Copeland; *Diplazium opacum* (D. Don) Christ; *Dryopteris banksinensis* Hayata; *D. opaca* (D. Don) C. Christensen; *D. succulentipes* Hayata; *Gymnogramma obtusata* Blume; *G. opaca* (D. Don) Sprengel; *Leptogramma obtusata* (Blume) J. Smith; *L. opaca* (D. Don) Beddome;

*Nephrodium obtusatum* (Blume) Diels (1899), not C. Presl (1825); *Phegopteris obtusatum* (Blume) Christ; *P. opaca* (D. Don) Mettenius.

Plants evergreen. Rhizome short, ascending or erect, apex with brown, lanceolate or broadly lanceolate scales; fronds caespitose. Fertile frond up to 120 cm; stipe dark stramineous (often dark brown when dry), 20–50 cm, base with sparse scales, scales upward deciduous; lamina 1- or 2-pinnate, deltoid-ovate, 30–60 × 20–30 cm, base rounded-cuneate, apex acuminate; pinnae ca. 10 pairs, stalked (stalk up to 3 mm), subopposite, slightly ascending or sometimes subspreading; basal pinnae not shortened or slightly shortened, 10–20 × 4–15 cm, elliptic, base subtruncate, pinnatilobate to pinnate, apex long acuminate; pinnules up to 10 pairs, alternate, spreading, elliptic or elliptic-lanceolate, up to 9 × 2.5 cm, pinnatifid to pinnatisect, base truncate, sessile or subsessile, apex acuminate or obtuse; basal pinnules much shorter, apex rounded; pinna lobes subelliptic or rectangular, entire, subtruncate or rounded at apex; veins visible abaxially, veinlets simple or upper veinlets forked, ascending. Lamina herbaceous; rachis, costae, and costules abaxially with multicellular short nodose hairs, or glabrous, also with sparse linear, brown, entire scales. Sori brown, shortly linear or elliptic, medial or inframedial, 1–3 pairs per pinna lobe. Spores subreniform, perispore prominent, projections few rugate.  $x = 40$ .

Evergreen broad-leaved forests; 400–2300 m. Fujian, Guangxi, Jiangxi, Taiwan, Yunnan [Bhutan, India, Indonesia, Japan, Nepal, Vietnam].

*Cornopteris opaca* is variable in the shape and dissection of the fronds and differs from *C. decurrenti-alata* primarily in the rhizome habit.

Plants having a glabrous rachis, costa, and midribs, particularly in old fronds, have been named *Cornopteris opaca* f. *glabrescens* S. Kurata (J. Geobot. 12(2): 41. 1963; 变光黑叶角蕨 *bian guang hei ye jiao jue*): evergreen broad-leaved forests; 800–1800 m. Fujian, Guangxi, Taiwan, Yunnan [Indonesia, Japan, Vietnam].

**6. *Cornopteris decurrenti-alata*** (Hooker) Nakai, Bot. Mag. (Tokyo) 44: 8. 1930.

角蕨 *jiao jue*

*Gymnogramma decurrenti-alata* Hooker, Sp. Fil. 5: 142, t. 294. 1864; *Athyrium decurrenti-alatum* (Hooker) Copeland; *Cornopteris tsangii* Ching; *Diplazium decurrenti-alatum* (Hooker) C. Christensen; *D. hookerianum* Koidzumi; *Dryopteris decurrenti-alata* (Hooker) C. Christensen; *Leptogramma decurrenti-alata* (Hooker) J. Smith; *Nephrodium decurrenti-alatum* (Hooker) Diels; *Phegopteris decurrenti-alata* (Hooker) Christ.

Plants summer-green. Rhizome slender, creeping, dark brown, ca. 5 mm in diam., apex with brown-lanceolate scales; fronds approximate. Fertile frond up to 80 cm; stipe dark stramineous, up to 40 cm, base with scales, upward subglabrous, grooved on adaxial side; lamina 1- or 2-pinnate below apex, ovate-elliptic, up to 40 × 28 cm, apex acuminate; pinnae up to 10 pairs, ascending, distant, lanceolate, base subtruncate, nearly symmetrical, apex acuminate; lower pinnae larger, elliptic-lanceolate, up to 15 × 4 cm, pinnatisect or 1-pinnate; pinna lobes

or pinnules ovate or narrowly elliptic, up to 3 × 1 cm, margin pinnatilobate, sparsely dentate, or repand, apex obtuse; veins visible, veinlets simple or forked, ending into lobe margin. Lamina herbaceous, brown when dry, hairy or not. Sori shortly linear or narrowly elliptic, medial or inframedial. Spores semi-circular in equatorial view, perispore hyaline, with rugate, granular projections.  $x = 40$ .

Valley forests, beside shaded streamlets; 200–2800 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Henan, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, N India, Japan, Korea, Nepal].

*Cornopteris decurrenti-alata* is variable in the shape and dissection of fronds.

Plants having fronds with dense multicellular short nodose hairs on abaxial side of the rachis, costae, and midribs ( $n = 80$ ) have been named *Cornopteris decurrenti-alata* f. *pillosella* (H. Itô) W. M. Chu (Fl. Reipubl. Popularis Sin. 3(2): 358. 1999; *C. decurrenti-alata* var. *pillosella* H. Itô, Bot. Mag. (Tokyo) 52: 588. 1938; *Athyrium decurrenti-alatum* var. *pillosellum* (H. Itô) Ohwi; *A. unifurcatum* C. Christensen var. *harryanum* C. Christensen; *C. glandulosopilosa* S. F. Wu; *C. likiangensis* Ching; *C. musashiensis* Nakai; 毛叶角蕨 *mao ye jiao jue*): valley forests, beside shaded streamlets; 200–2800 m. Guizhou, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang [Japan].

**7. *Cornopteris christenseniana*** (Koidzumi) Tagawa, Acta Phytotax. Geobot. 2: 195. 1933.

尖羽角蕨 *jian yu jiao jue*

*Diplazium christensenianum* Koidzumi, Bot. Mag. (Tokyo) 38: 105. 1924; *Athyrium crenulatoserrulatum* Makino f. *hakonense* Makino; *A. hakonense* (Makino) C. Christensen; *Cornopteris hakonensis* (Makino) Nakai.

Plants summer-green. Rhizome creeping, apex with muddy-brown, entire, elliptic-lanceolate scales; fronds approximate. Fertile frond up to 90 cm; stipe pale green, slightly purple-red, up to 45 cm, scaly throughout with brown, entire lanceolate scales; lamina 2-pinnate below apex, deltoid-ovate, up to 45(–60) × 30(–45) cm, apex acuminate; pinnae up to 10 pairs, ascending; lower pinnae opposite or nearly so, elliptic-lanceolate, base truncate, apex acuminate; basal pinnae shortly stalked, other pinnae sessile; middle pinnae largest, up to 20 × 7 cm; pinnules up to 12 pairs, alternate, subspreading, sessile, lanceolate or ovate-lanceolate, middle pinnules up to 4 × 1.5 cm, base broadly cuneate, pinnatifid to pinnatisect, apex acuminate, shortly acuminate, or subrounded; pinnule lobes up to 10 pairs, subrectangular, ascending, slightly falcate, serrate or subentire, truncate or obtuse at apex; veins pinnate, veinlets 3–5 pairs, simple, ending inframarginally. Lamina thinly herbaceous, brown-green when dry, rachis, costae, and midribs abaxially with pale brown lanceolate entire scales and unicellular short hairs, rarely also 2- or 3-celled short nodose hairs. Sori narrowly elliptic, medial.

Forest wetlands beside cliffs; ca. 800 m. Zhejiang [Japan, S Korea].

**8. *Cornopteris major*** W. M. Chu, Acta Bot. Yunnan. 3: 348. 1981.

大叶角蕨 *da ye jiao jue*

Plants evergreen. Rhizome thick, creeping, ca. 3 cm in diam., apex with brown lanceolate scales; fronds approximate. Fertile frond up to 1.5 m; stipe green, shorter than lamina, up to 5 mm in diam., sparsely scaly, grooved on adaxial side; lamina 2-pinnate below apex, deltoid or ovate-deltoid, up to 90 × 80 cm, apex acuminate; pinnae ca. 11 pairs, alternate or subopposite, ascending, slightly asymmetrical with slightly broader basiscopic side, lower pinnae broadly elliptic-lanceolate, shortly stalked, basal pairs largest, up to 50 × 20 cm, with basal pinnules remarkably shortened; pinnules up to 10 pairs, alternate, spreading, slightly asymmetrical, lanceolate or falcate and lanceolate, up to 11 × 4 cm, base broadly cuneate or subtruncate, sessile, pinnatifid to pinnatisect, or 2-pinnate, apex acuminate or long acuminate, occasionally acute or rounded; basal acroscopic pinnules shorter, close to rachis, basal basiscopic pinnules oblique; pinnule lobes up to 10 pairs or more, alternate or subopposite, slightly ascending, elliptic, margin obtuse-crenate or pinnatilobate, apex rounded; veins somewhat visible abaxially, not prominent adaxially, pinnate with up to 8 pairs of veinlets, veinlets mostly forked or pinnate, rarely simple. Lamina thinly herbaceous when dry, dark colored, shiny adaxially, costae and midribs with thin multicellular hairs. Sori shortly linear or elliptic, up to 5 pairs per lobe, inframedial, close to midribs. Sori reniform in equatorial view, perispore prominent, with few rugate projections.

• Evergreen broad-leaved forests, beside streamlets; 2100–2600 m. SE to SW Yunnan.

*Cornopteris major* is similar to *C. pseudofluviialis* in gross morphology of frond, but it differs by the tall fertile fronds ca. 1.5 m, pinnules up to 10 × 3 cm, sori shortly linear or elliptic (not orbicular), and lamina abaxially with multicellular thin hairs, lacking glandular hairs.

**9. *Cornopteris pseudofluviialis*** Ching & W. M. Chu, Acta Bot. Yunnan. 3: 345. 1981.

滇南角蕨 dian nan jiao jue

Plants evergreen. Rhizome long creeping, up to 2 cm in diam., apex with sparse adpressed brown scales; fronds approximate. Fertile frond up to 1 m; stipe shiny, pale brown or gray-stramineous, shorter than lamina, 2–3 mm in diam. at base, grooved on adaxial side; lamina 2-pinnate with pinnatisect pinnules, or base almost 3-pinnate, broadly ovate-deltoid, up to 70 × 50 cm; pinnae ca. 12 pairs, alternate or subopposite, subspreading, slightly asymmetrical with broader basiscopic pinnules, basal pinnae largest, up to 40 × 15 cm, basal pinnules markedly shorter; pinnules up to 13 pairs, alternate, spreading, nearly symmetrical, lanceolate, up to 9 × 3 cm, base truncate, shortly stalked or adnate, pinnatisect close to costa, apex acuminate or acute (occasionally rounded); basal acroscopic pinnules smaller, close to rachis, basal basiscopic pinnules oblique, pinnule lobes ca. 5 pairs, elliptic-lanceolate, up to 1.5 cm × 5 mm, base adnate, pinnatifid, apex rounded; pinnule lobes of ordinary (non-basal) pinnules up to 10 pairs or more, elliptic or rectangular, margin shallowly lobate or crenate, apex rounded or truncate; veins visible abaxially, not prominent adaxially, veinlets up to 6 pairs, forked or simple. Lamina thinly herbaceous when dry, brown, glabrous adaxially; rachis, costae, and costules abaxially with short glandular hairs. Sori orbicular, subcostular,

1 or 2 pairs per lobe, or single. Spores nearly semicircular in equatorial view, perispore prominent, with few rugate projections.

• Evergreen broad-leaved forests, beside streamlets; 1500–2700 m. SE Yunnan (Wenshan, Xinping).

*Cornopteris pseudofluviialis* is very similar to *C. banajaoensis* in the lamina shape and dissection but differs by the rhizome long creeping and the rachis, costae, and costules abaxially with dense short glandular hairs.

**10. *Cornopteris banajaoensis*** (C. Christensen) K. Iwatsuki & M. G. Price, S. E. Asian Stud. 14: 564. 1977.

溪生角蕨 xi sheng jiao jue

*Dryopteris banajaoensis* C. Christensen, Index Filic., Suppl. 1906–1912: 30. 1913, based on *D. tenerrima* Copeland, Philipp. J. Sci. Bot. 4: 111. 1909, not Rosenstock (1906); *Athyrium fluviale* (Hayata) C. Christensen; *A. nudum* Copeland; *A. tagawai* C. Christensen; *Cornopteris fluvialis* (Hayata) Tagawa; *C. tashiroi* Tagawa; *D. athyriiformis* Rosenstock; *D. fluvialis* Hayata; *Phegopteris banajaoensis* (C. Christensen) Alderwerelt.

Plants evergreen. Rhizome ascending, apex with ovate-lanceolate entire brown scales; fronds caespitose. Fertile fronds up to 1.2 m; stipe green-stramineous, almost as long as lamina, 20–60 cm or longer, ca. 3 mm in diam., base swollen, 3-ridged in cross section, sparsely scaly; lamina 2-pinnate with pinnatisect pinnules, or nearly 3-pinnate, up to 65 × 50 cm, broadly ovate, ovate-deltoid, or deltoid; pinnae 10–12 pairs, opposite or subalternate, ascending, nearly symmetrical, lower pinnae broadly elliptic-lanceolate, stalked, basal pinnae up to 30 × 10 cm, basal pinnules markedly smaller; pinnules up to 13 pairs, alternate, spreading, nearly symmetrical, lanceolate or elliptic-lanceolate, up to 8 × 2.5 cm, base subtruncate, shortly stalked or adnate, pinnatisect close to costule, basal acroscopic lobes smaller, close to costa, basiscopic lobe oblique, apex acuminate or acute; pinnule lobes oblong or elliptic, slightly oblique, margin dentate, apex truncate or rounded; veins visible abaxially, not prominent adaxially, veinlets 5–7 pairs per lobe, simple or forked, ascending. Lamina thinly herbaceous when dry, brown abaxially, dark brown adaxially, glabrous on both surfaces. Sori orbicular or suborbicular, medial or inframedial, or subcostular, 3–5 pairs per lobe. Spores reniform in equatorial view, perispore prominent, few rugate, inconspicuously granular.  $2n = 80$ .

Wet forests; 800–2700 m. Taiwan [India (Sikkim), Japan, Nepal, Philippines].

The species epithet is sometimes misspelled as “*banahaensis*.”

**11. *Cornopteris badia*** Ching, Bull. Fan Mem. Inst. Biol., Bot. 11: 58. 1941.

复叶角蕨 fu ye jiao jue

Plants evergreen, tall. Rhizome ascending to erect, robust, up to 5 cm in diam. including remaining stipe bases, up to 40 cm tall, apex with adpressed, entire, brown, lanceolate scales; fronds caespitose. Fertile fronds up to 2 m; stipe brown-green, up to 1 m, up to 8 mm in diam., with sparse deciduous, entire, lanceolate scales, grooved adaxially; lamina 1–3-pinnate below apex, deltoid or ovate, nearly as long as stipe, up to 75 cm wide,

apex acuminate; pinnae up to 12 pairs, slightly ascending, lower pinnae opposite, with stalk up to 3.5 cm, costae up to 12 cm apart, upper pinnae alternate, with stalk up to 5 mm; basal 1 or 2 pairs of pinnae larger, elliptic-lanceolate, up to 45 × 20 cm, lower part 2-pinnate, apex pinnatisect, acuminate; pinnules up to 15 pairs or more, spreading or nearly so, linear-lanceolate or broadly linear-lanceolate, up to 10 × 3 cm, apex long acuminate, pinnatisect, or pinnatifid to pinnatisect, or pinnate, lower pinnules shortly stalked; secondary pinnules 1–5 pairs, lobes of secondary pinnules up to 10 pairs or more; secondary pinnules and lobes of secondary pinnules spreading, slightly oblique, or slightly falcate, ovate or elliptic-lanceolate, base broadly cuneate and adnate, pinnatifid, dentate, or crenate, apex rounded or subtruncate; lobes of secondary pinnules slightly ascending, up to 6 pairs, mostly subfalcate, rectangular, shallowly repand or slightly shallowly crenate or serrate, truncate at apex; veins visible abaxially, not prominent adaxially, 1–3 pairs per lobe, veinlets simple. Lamina herbaceous, green abaxially, dark brown or gray-brown adaxially when dry; rachis, costae, and costules abaxially with brown, entire, lanceolate or linear, small scales, later glabrous. Sori orbicular, sub-basal. Spores semicircular in equatorial view, perispore hyaline, with few rugate, vaguely granular projections.

Evergreen broad-leaved forests; 1400–2500 m. Yunnan (Gongshan, Jingdong, Yongde) [India, Nepal].

*Cornopteris badia* is the largest species with the most finely dissected lamina in the genus.

Plants having fronds with rachis, costae, and costules abaxially with sparse, brown, entire, lanceolate to linear, small scales and hyaline unicellular glandular hairs, and sharply serrate pinnule lobes have been named *Cornopteris badia* f. *quadripinnatifida* (M. Kato) W. M. Chu (Fl. Reipubl. Popularis Sin. 3(2): 365. 1999; *C. quadripinnatifida* M. Kato, Acta Phytotax. Geobot. 30(4–6): 114. 1979; *C. badia* var. *pubescens* Z. R. Wang; 毛复叶角蕨 *mao fu ye jiao jue*): evergreen broad-leaved forests; 1400–2500 m. Yunnan [India, Nepal].

**12. *Cornopteris crenuloserrulata*** (Makino) Nakai, Bot. Mag. (Tokyo) 45: 95. 1931.

细齿角蕨 *xi chi jiao jue*

*Phegopteris crenuloserrulata* Makino, Bot. Mag. (Tokyo) 17: 78. 1903; *Athyrium austro-ussuriense* (Komarov) Fomin; *A. crenuloserrulatum* Makino; *A. koryoense* C. Christensen; *Cornopteris coreana* Nakai; *C. crenuloserrulata* f. *coreana* (Nakai) H. Itô; *Dryopteris austro-ussuriensis* Komarov; *D. crenuloserrulata* (Makino) C. Christensen; *Neoathyrium crenuloserrulatum* (Makino) Ching & Z. R. Wang; *Phegopteris austro-ussuriensis* (Komarov) Komarov & Alissova; *Pseudathyrium crenuloserrulatum* (Makino) Nakai.

Plants terrestrial, medium-sized. Rhizome moderately stout, creeping, apex sparsely scaly; scales brownish, ovate-lanceolate, membranous, large, up to 1 cm or longer. Fronds distant; stipe nearly as long as or slightly longer than lamina, 40–60 cm, basal part moderately stout with pneumatophores on lateral ridges, base not beak-shaped, up to 7–9 mm in diam., scaly like rhizome apex; lamina 3-pinnatifid, deltoid-ovate to ovate-oblong, 25–70 × 20–60 cm, base broadly cuneate or somewhat cordate, apex acuminate; pinnae 10–15 pairs, broadly lanceolate or oblong-lanceolate, lower pinnae with stalks 2–10 mm, subopposite, ascending; basal 2 pairs of pinnae largest, 10–32 × 4–8 cm, base slightly narrowed, broadly cuneate or subtruncate, apex acuminate; upper pinnae gradually smaller, lanceolate, alternate, subsessile or sessile; pinnules 8–20 pairs, catadromous, lanceolate or oblong-lanceolate, 1–4 cm × 5–15 mm, base broadly cuneate, subsessile, apex acuminate; lower pinnules subopposite; upper pinnules alternate, spreading or slightly ascending; ultimate segments 5–10 pairs, oblong, base adnate to narrow costular wing, crenulate at margin, apex obtuse-rounded. Veins inconspicuous adaxially, visible abaxially, pinnate, midrib slightly tortuous, veinlets simple or forked. Lamina papery when dried, greenish brown adaxially, green abaxially; fleshy slender hornlike processes with scaly apices present in adaxial groove of costules at bases of costules; rachis, costae, and costules abaxially with pallid unicellular short hairs and pale brown multicellular long hairs. Sori orbicular or elliptic, exindusiate, abaxial, medial. Spores bilateral, perispore with rugate processes.  $2n = 80^*$ .

Subalpine mixed forests, grasslands; 800–1000 m. Heilongjiang, Henan, Jilin, Liaoning, Shaanxi [Japan, Korea, E Russia].

### 3. ANISOCAMPIUM C. Presl, Epimel. Bot. 58. 1851.

安蕨属 *an jue shu*

Wang Zhongren (王中仁); Masahiro Kato

*Kuniwatsukia* Pichi Sermolli; *Microchlaena* Ching (1938), not Wight & Arnott (1833).

Plants terrestrial, small to medium-sized. Rhizomes long creeping, erect, or shortly creeping with ascending apex, clothed with brown lanceolate or linear scales. Fronds distant or caespitose; stipe usually stramineous, long, with sparse scales at base, upper part glabrate, grooved adaxially, groove open to rachis groove; lamina pinnate, oblong-lanceolate, ovate-oblong, or deltoid-ovate; pinnae pinnatifid at apex or terminal pinna similar to lateral pinnae; basal pinnae opposite or subopposite, shortly stalked; upper pinnae alternate, falcate or ascending, lanceolate, margin shallowly lobed, segments toothed, acuminate. Veins pinnate, lateral veins 3–5 pairs, simple or occasionally forked, free or connected to form 1 or 2 pairs of rhomboid areoles. Lamina papery when dried, glabrate adaxially, costae and midribs abaxially with brown linear-lanceolate small scales and short pale hairs. Sori orbicular, medial or subbasal on veins; indusia small, orbicular-reniform, membranous, ciliate at margin, fugacious. Spores bilateral, perispore surface with lophate ridges.  $x = 40$ .

Four species: tropical and subtropical regions of SE Asia and temperate areas of E Asia; four species in China.

A recent molecular and systematic study shows that *Anisocampium* includes *Kuniwatsukia* and *Athyrium niponicum* and is basal in the *Athyrium* complex (Liu et al. Taxon 60: 824–828. 2011).

- 1a. Lamina pinnate, apex of lamina pinnatifid, not similar to lateral pinnae.  
 2a. Lamina pinnate throughout; pinnae usually shallowly lobed; sori orbicular ..... 1. *A. sheareri*  
 2b. Lamina bipinnate; pinnules free, lobed; sori oblong, hooked, J-shaped, or horseshoe-shaped ..... 2. *A. niponicum*  
 1b. Lamina terminated by a pinna similar or subsimilar to lateral pinnae.  
 3a. Pinnae up to 7 pairs, lanceolate, base cuneate or rounded; veins anastomosing ..... 3. *A. cumingianum*  
 3b. Pinnae 10 pairs or more, linear, base truncate; veins free ..... 4. *A. cuspidatum*

**1. *Anisocampium sheareri* (Baker) Ching in Y. T. Hsieh, Acta Bot. Yunnan. 7: 314. 1985.**

华东安蕨 hua dong an jue

*Nephrodium sheareri* Baker, J. Bot. 13: 200. 1875; *Aspidium otarioides* Christ; *Athyrium sheareri* (Baker) Ching; *Dryopteris otarioides* (Christ) C. Christensen; *D. polypodiiforme* (Makino) C. Christensen; *D. sheareri* (Baker) C. Christensen; *D. subsagenioides* Christ; *N. isolatum* Baker; *N. polypodiiforme* Makino.

Rhizomes long creeping, with sparse brownish lanceolate scales. Fronds approximate or distant; fronds 25–60 cm; stipe upward stramineous (occasionally pale red-purple), 15–30 cm, base ca. 2 mm in diam., sparsely scaly, upper part glabrate; lamina pinnate, ovate-oblong or ovate-triangular, 15–30 × 12–18 cm at middle, papery when dried, base subtruncate or rounded-cuneate, apex acuminate and pinnatifid; lateral pinnae 2–7 pairs, falcate, lanceolate, 6–10 × 1.5–2 cm, base rounded, often cuneate on acroscopic side in basal 1 or 2 pairs of pinnae, pinnatilobate to pinnatisect, apex long acuminate; segments broadly orbicular or oblong, margin long toothed and cartilaginous. Veins free, pinnate, lateral veins 3 or 4 pairs, simple or occasionally forked, ending in teeth, basal pair of veins reaching lobe sinuses. Lamina glabrate adaxially, costae and costules abaxially with brownish small scales and pallid short hairs. Sori 3 or 4 pairs per segment, orbicular; indusia brown, orbicular-reniform, membranous, ciliate at margin, fugacious. Spore surface with lophate ridges.  $2n = 160$ , 120 (3× apomictic).

Valley forests, streamsides, shaded mountain slopes; sea level to 1900 m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan (Hualian), Yunnan, Zhejiang [Japan, S Korea].

**2. *Anisocampium niponicum* (Mettenius) Yea C. Liu, W. L. Chiou & M. Kato, Taxon 60: 828. 2011.**

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*Asplenium niponicum* Mettenius, Ann. Mus. Bot. Lugduno-Batavi 2: 240. 1865; *A. niponicum* var. *longipes* Franchet & Savatier; *A. niponicum* var. *minus* Franchet & Savatier; *A. niponicum* var. *uropterum* (Miquel) Franchet & Savatier; *A. uropterum* Miquel; *Athyrium biondii* Christ; *A. fissum* Christ; *A. matsumurae* Christ ex Matsumura; *A. niponicum* (Mettenius) Hance; *A. niponicum* var. *pachyphlebium* (C. Christensen) Kitagawa; *A. pachyphlebium* C. Christensen; *A. sylvestrii* Christ; *A. uropterum* (Miquel) C. Christensen; *A. yunnanense* Christ.

Plants summer-green. Rhizomes shortly creeping, ascending, densely clothed with brownish, narrowly lanceolate scales at apex and stipe bases. Fronds caespitose; fertile fronds (25–)30–75(–120) cm; stipe blackish brown at base, upward stramineous, 10–35(–50) cm, base (1.5–)2–3(–5) mm in diam., with sparse small scales; scales pale brown, lanceolate, entire; lamina 2- or 3-pinnate, ovate-oblong, (15–)23–30(–70) × (11–)15–25(–50) cm at middle, broadly rounded at base, abruptly narrowed at apex; pinnae under abruptly narrowed apex 5–7(–14) pairs, alternate, ascending, with stalk (3–15 mm), slightly curved upward; basal pair slightly longer and larger, oblong-lanceolate, (5–)7–15(–25) × (2–)2.5–6(–12) cm at middle, broadly cuneate or rounded at base, apex abruptly narrowed, long acuminate, somewhat caudate; middle pinnae lanceolate, pinnate to 2-pinnate; pinnules (8–)12–15 pairs, alternate, ascending or spreading, shortly stalked or sessile, usually broadly lanceolate or oblong-lanceolate, sometimes lanceolate, 1–4(–6) × 1–2 cm, inequilateral at base, acroscopic side subtruncate, auriculate, parallel to costae, basiscopic side cuneate, dentate or pinnatifid almost cut to wings of costules, apex acuminate; segments 8–10 pairs, lanceolate, oblong, or linear-lanceolate, deeply serrate at margin, acute at apex. Veins visible abaxially, pinnate in segments, lateral veins 4 or 5 pairs, oblique, simple. Lamina herbaceous or thinly papery when dried, pale green or yellow-green, glabrate on both surfaces; rachis and costae on abaxial surface pale purplish red, with sparse brownish linear small scales. Sori oblong, hooked, J-shaped, or horseshoe-shaped, 4–12 pairs per ultimate segment; indusia similar to sori in shape, brown, membranous, somewhat erose at margin, persistent or partly caducous. Perispore surface with prominent low folds.  $2n = 80$ .

Forests, streamsides, shaded wet mountain slopes, shrubby and grassy slopes; near sea level to 2600 m. Anhui, Chongqing, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [India, Japan, Korea, Myanmar, Nepal, Vietnam].

*Athyrium niponicum* f. *cristato-flabellatum* (Makino) Namekata & Kurata (Enum. Jap. Pterid. 279, 338. 1961; *A. niponicum* var. *cristato-flabellatum* Makino, J. Jap. Bot. 1: 6. 1916; *A. niponicum* monst. *cristato-flabellatum* Nakaike; 鸡冠蹄盖蕨 ji guan ti gai jue) is a malformed plant, with the pinnae or segments narrowed to flattened cristate apices. It is cultivated in Shandong (Qingdao).

**3. *Anisocampium cumingianum* C. Presl, Epimel. Bot. 59. 1851.**

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*Aspidium otaria* Kunze ex Mettenius; *Athyrium cumingianum* (C. Presl) Ching; *A. otaria* (Kunze ex Mettenius) Posthu-

mus; *Dryopteris otaria* (Kunze ex Mettenius) Kuntze; *Nephrodium otarium* (Kunze ex Mettenius) Baker.

Rhizomes short, erect, densely clothed with brown lanceolate scales at apex. Fronds caespitose; fronds 27–70 cm; stipe upward stramineous, 12–45 cm, base 2–2.5 mm in diam., densely scaly, upper part glabrate; lamina imparipinnate or nearly so, broadly ovate or oblong, 15–25 × ca. 10 cm at middle, thinly papery when dried, base subtruncate or rounded-cuneate, apex acuminate; terminal pinna similar to lateral pinnae, lateral pinnae 4–8 pairs, stalked, falcate, lanceolate, 6–10 × 1.5–2 cm, base rounded-cuneate, margin shallowly lobed or serrate, apex acuminate; segments triangular, with several sharp teeth at apex; veins free, pinnate in segment, lateral veins 4 or 5 pairs, simple, reaching teeth, basal 1 or 2 pairs of veins reaching segment sinuses, often connecting to form rhomboid areoles. Lamina glabrate adaxially, costae and midribs abaxially with sparse brown small scales and pale short glandular hairs. Sori 3 or 4 (or 5) pairs per segment, orbicular, inframedial; indusia brown, orbicular-reniform, membranous, ciliate at margin, fugacious. Perispore with lophate ridges, sometimes connected and reticulate or ornate.  $2n = 80, 160$ .

Damp areas in evergreen forests, limestone rocks; 400–1000 m. S and SW Taiwan (Pingdong, Tainan), S Yunnan [S India, Indonesia (Java), Laos, S Myanmar, Philippines, Sri Lanka].

**4. *Anisocampium cuspidatum*** (Beddome) Yea C. Liu, W. L. Chiou & M. Kato, *Taxon* 60: 829. 2011.

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*Lastrea cuspidata* Beddome, *Ferns Brit. India*, t. 118. 1870, based on *Aspidium cuspidatum* Mettenius, *Abh. Senckenberg. Naturf. Ges.* 2: 376. 1858, not Desvaux (1827); *A. yunnanense* Christ; *Athyrium cuspidatum* (Beddome) M. Kato; *Dryopteris elongata* Kuntze; *D. khasiana* C. Christensen; *D. trinidadensis* (Jenman) C. Christensen; *D. yunnanensis* (Christ) Copeland; *Kuniwatsukia cuspidata* (Beddome) Pichi Sermolli; *L. elongata* Beddome ex C. B. Clarke; *Microchaena cuspi-*

*data* (Beddome) Ching; *M. yunnanensis* (Christ) Ching; *Nephrodium cuspidatum* Baker (1867), not C. Presl (1825); *Phegopteris elongata* J. Smith (1875), not E. Fournier (1872); *Polypodium elongatum* Wallich ex Hooker (1862), not Aiton (1789), nor Desvaux (1827), nor Goldmann (1843); *P. trinidadensis* Jenman.

Plants terrestrial, medium-sized. Rhizomes short or shortly creeping with ascending apex, woody, densely clothed with brown linear scales at apex. Fronds caespitose, with radial phyllotaxis; fronds up to 1 m; stipe upward pale purple or brownish, 30–65 cm, base up to 5 mm in diam., triangular in cross section, sparsely scaly, upper part glabrate; lamina imparipinnate, oblong-lanceolate, 35–70 × 16–30 cm, base rounded-cuneate, apex acuminate; lateral pinnae 7–23 pairs, alternate, stalked, ascending, lanceolate, 12–18 × 1.5–2 cm, rounded-cuneate or inequilaterally cuneate at base, incised-serrulate or sharply serrate with beaklike tips at margin, also with few small teeth, apex long acuminate; terminal pinna similar to lateral pinnae, slightly larger, usually with lower part shallowly lobed and segments obtuse-rounded and minutely toothed. Veins free, visible on surfaces, lateral veins pinnate, 3–6 pairs, simple, catadromous, except basal basisopic veins branched directly from costa, not reaching sinuses between teeth, acroscopic veins branched from base of lateral veins, ending halfway. Lamina papery when dry, dark green, adaxially glabrate, costae occasionally with few brown small scales abaxially; costae grooved adaxially, protuberant abaxially. Sori dense, cinnamon-colored, small, orbicular, abaxial near base or in proximal, occasionally medial places of veins; indusia brown, small, orbicular-reniform, thinly membranous, lacerate as ciliate at margin, fugacious. Spore bilateral, perispore with lophate ridges.  $2n = 80$ .

Damp areas in evergreen broad-leaved forests, among shrubs; 500–1800(–2000) m. Guangxi, Guizhou, SE Xizang, SE Yunnan [Bhutan, W Himalaya, N India, N Myanmar, Nepal, N Thailand].

Hooker and Baker (*Syn. Fil.* 260. 1867) thought that the type specimen collected from the Kew Garden originated from Sri Lanka, but C. B. Clarke (*Rev. Ferns N. India*, 513. 1880) disagreed.

#### 4. *ATHYRIUM* Roth, *Tent. Fl. Germ.* 3: 31, 58. 1799.

蹄盖蕨属 ti gai jue shu

Wang Zhongren (王中仁); Masahiro Kato

*Pseudocystopteris* Ching.

Plants terrestrial, medium-sized. Rhizomes short, mostly erect, occasionally creeping or ascending, rarely long creeping; fronds caespitose, rarely approximate or distant. Stipe grooved abaxially, terete adaxially, often shortly glandular hairy in groove, base often swollen, with uniseriate tuberculate pneumathodes on lateral sides, narrowed toward very base, sometimes without pneumathodes, not narrowed to base, with vascular bundles 2, upward connected abaxially into U-shaped single bundle in section, scaly at base; scales red-brown, brown, or blackish brown, ovate-lanceolate, linear-subulate, or linear-lanceolate, entire, membranous, basifixed; lamina ovate, oblong, or broadly lanceolate, 1–3-pinnate; lamina segments inequilateral at base; groove of rachis and costae continuous to grooves of costae and costules, respectively; spines at base of costae, costules, and midribs on adaxial side present or absent, spines continuous from ridges on both sides of groove. Veins free, forked or pinnate, extending to tooth tips at lamina margin. Lamina usually herbaceous when dried, in a few cases papery or leathery, usually glabrate, rarely scaly or hairy, or shortly glandular hairy adaxially. Sori orbicular, orbicular-reniform, horseshoe-shaped, J-shaped, oblong, or shortly linear, abaxial, lateral to or crossing over veins; indusia brown, orbicular-reniform, horseshoe-shaped, J-shaped, lunate, oblong, or shortly linear, membranous, erose or ciliate, rarely entire at margin, usually persistent, rarely exindusiate or indusia undeveloped. Spores bilateral, elliptic in polar view, bean-shaped in equatorial view, and perispore surface with or without folds.  $x = 40$ .

About 220 species: distributed mainly in the temperate zone and subtropical mountain forests; 123 species (probably more plus a number of hybrids) (69 endemic) in China.

The distribution center is located in the mountainous areas of SE China.

*Athyrium* is one of the largest genera of the pteridophytes and one of the taxonomically most difficult genera. Molecular data shows *Athyrium* as defined here is not monophyletic; *Athyrium niponicum* is transferred to *Anisocampium*, while *Pseudocystopteris* is nested within *Athyrium*. Hybridization makes the taxonomy of this genus more difficult. More than 60 hybrids have been known in Japan, and many additional hybrids are possible in China, requiring further analysis.

The following species, distributed in Taiwan, could not be treated here because no material was seen by the present authors: *Athyrium puncticaule* (Blume) T. Moore (Index Fil. 186. 1860; *Aspidium puncticaule* Blume, Enum. Pl. Javae 2: 159. 1828), *Athyrium leiopodum* (Hayata) Tagawa (Acta Phytotax. Geobot. 2(3): 195. 1933; *Diplazium leiopodum* Hayata, Icon. Pl. Formosan. 4: 217. 1914), and *A. tenuicaule* (Hayata) Tagawa (Acta Phytotax. Geobot. 2(3): 195. 1933; *Diplazium tenuicaule* Hayata, Icon. Pl. Formosan. 4: 220. 1914), treated by Knapp as a synonym of *A. leiopodum* (Ferns Fern Allies Taiwan, 980. 2011). For more information, see Liu and Fraser-Jenkins (Taiwania 51: 293–297. 2006), Liu et al. (Fern Fl. Taiwan Athyrium, 26, 42. 2009), and Knapp (loc. cit.: 129–130, 439).

In addition, eleven uncertain taxa, not included in the following key, are listed at the end of the account.

- 1a. Sori small, orbicular-reniform.
- 2a. Plants medium-sized to large; fronds usually more than 60–70 cm, up to 2–3 m, all pinnae stalked ..... 117. *A. atkinsonii*
- 2b. Plants small to medium-sized; fronds usually less than 60–70 cm, second basal pair of pinnae and all upper pinnae subsessile or very shortly stalked.
- 3a. Lamina triangular; basal pinnae largest, narrowly elliptic to elliptic-oblong with lower pinnules gradually shorter to base, prominently narrowed at base, pinnules of upper pinnae often catadromous; mostly in mountains below 3000 m.
- 4a. Rachis and costae glabrate abaxially, pinnules ± rounded at base, distant from costae, teeth at segment margin long, pointed ..... 118. *A. spinulosum*
- 4b. Rachis and costae ± glandular hairy abaxially, pinnules subtruncate at base, often close to costae, teeth short and narrow ..... 119. *A. subtriangulare*
- 3b. Lamina ovate to oblanceolate; basal pinnae ± shorter than upper, ovate to oblong-lanceolate, rarely subauriculate, not gradually shortened toward base, at most 1 or 2 basal pairs of pinnules slightly shortened, pinnules or segments of all pinnae anadromous or subopposite.
- 5a. Lamina ovate to ovate-oblong, usually 2- or 3-pinnate; pinnules inequilateral at base, shortly stalked; rachis and costae without long multicellular hairs.
- 6a. Fronds less than 35 cm; ultimate segments approximate, teeth at segment margin short ..... 120. *A. schizochlamys*
- 6b. Fronds up to 55 cm; ultimate segments separate, teeth at segment margin long, thin ..... 121. *A. atunzeense*
- 5b. Lamina oblanceolate or ovate-oblong, 2-pinnatifid to 2-pinnate; segments adnate to costae by narrow wing, if bipinnate then pinnules subequilateral at base, sessile; rachis, costae, and veins with sparse long multicellular hairs.
- 7a. Lamina oblanceolate, many pairs of lower pinnae gradually shorter than upper pinnae ..... 122. *A. davidii*
- 7b. Lamina ovate-oblong, basal 2 pairs of pinnae slightly shortened ..... 123. *A. repens*
- 1b. Sori prominent, elongate, horseshoe-shaped, or J-shaped.
- 8a. Sori orbicular or elliptic, exindusiate or indusia caducous; perispore with folds.
- 9a. Stipe and rachis dark brown, throughout with dense castaneous-black or dark brown, ovate-lanceolate scales and fibrous scales; basal pinnae tapering to base; pinna apex obtuse; stipe much shorter than lamina ..... 1. *A. wallichianum*
- 9b. Stipe and rachis stramineous or pale purplish red, scales dense, brown at base; basal pairs of pinnae slightly abbreviated; stipe slightly shorter than lamina; pinna apex acuminate.
- 10a. Lamina 1-pinnate, pinnae pinnatilobate to pinnatifid, occasionally 2-pinnate; pinnae sessile or subsessile (stalk less than 3 mm); teeth at lobe margin short and pointing outward ..... 2. *A. dissitifolium*
- 10b. Lamina 2-pinnate; pinnae prominently stalked (stalk up to 10 mm or more); teeth at lobe margin long and ascending ..... 3. *A. exindusiatum*
- 8b. Sori elliptic, shortly linear, J-shaped, horseshoe-shaped, or reniform; indusia persistent, rarely incomplete but visible, at least when young; perispore with or without folds.
- 11a. Rhizomes long or shortly creeping with fronds distant or approximate, or erect.
- 12a. Rhizomes long creeping; costae and costules with prominent spines at base on adaxial side.
- 13a. Plants medium-sized, more than 20 cm tall; lamina 3-pinnate or more divided; sori not close to costae or costules, indusia not overlaying midribs and veins; perispore with folds ..... 4. *A. pectinatum*
- 13b. Plants small, less than 20 cm tall; lamina 1-pinnate, pinnae pinnatifid; sori close to costae or costules, indusia often overlaying costae or costules; perispore without folds ..... 99. *A. chingianum*
- 12b. Rhizomes creeping or erect; costae and costules without spines at base adaxially; perispore with folds.

- 14a. Rhizomes long creeping; fronds distant.
- 15a. Lamina subdimorphic, stipe of sterile frond shorter than lamina, but stipe of fertile frond much longer than lamina; lamina deltoid-ovate; pinnae 3–5 pairs; basal pinnae not abbreviated ..... 5. *A. ruilicola*
- 15b. Lamina monomorphic, stipe shorter than lamina or equal; lamina ovate-oblong; pinnae 15–20 pairs; basal pair of pinnae abbreviated.
- 16a. Lamina 2-pinnate, adaxial surface glabrate; teeth not long apiculate ..... 6. *A. biserrulatum*
- 16b. Lamina 3-pinnate, adaxial surface pubescent; teeth long apiculate ..... 7. *A. wumonshanicum*
- 14b. Rhizomes shortly creeping (occasionally long creeping); fronds approximate, or rhizome erect.
- 17a. Lamina ovate to narrowly ovate, apex cuspidate; pinnae stalked; stipe only slightly shorter than lamina; scales at stipe base pale brown; sori shortly linear, oblong, or narrowly J-shaped.
- 18a. Pinnae usually 1-pinnate or more dissected; pinnules ovate, oblong-lanceolate, or falcate-lanceolate, shallowly lobed to pinnatifid, basal pinnules usually shortly stalked ..... *A. niponicum* (see *Anisocampium niponicum*, p. 448)
- 18b. Pinnae usually pinnatifid to pinnatisect; lobes falcate-lanceolate, at most shallowly lobed, decurrent to broad wings of costa on basicopic side ..... 8. *A. brevisorum*
- 17b. Lamina lanceolate, oblong-lanceolate, or oblanceolate, apex acuminate; pinnae sessile or occasionally shortly stalked (stalk up to 5 mm); stipe much shorter than lamina; scales at stipe base red-brown or castaneous; sori suborbicular, elliptic, reniform, or shortly J-shaped.
- 19a. Indusia pale brown, entire; basal pinnae not shortened or nearly so; rhizome erect.
- 20a. Scales at stipe base yellow-brown; lamina pinnate with pinnae pinnatifid or 2-pinnate with pinnules pinnatifid; pinnae narrowly lanceolate ..... 9. *A. yokoscense*
- 20b. Scales at stipe base red-brown, central part black-brown; lamina pinnate, pinnae pinnatifid to pinnatifid, broadly ovate ..... 10. *A. fauriei*
- 19b. Indusia pallid, margin ciliate; many basal pinnae gradually shortened to base or only 1 or 2 pairs of basal pinnae prominently shortened; rhizome shortly creeping.
- 21a. Teeth at lamina margin obtuse ..... 11. *A. fallaciosum*
- 21b. Teeth at lamina margin sharp and long.
- 22a. Rachis and costae glabrate abaxially ..... 12. *A. rupicola*
- 22b. Rachis and costae pubescent abaxially ..... 13. *A. glandulosum*
- 11b. Rhizomes erect or ascending; fronds caespitose.
- 23a. Costae (or costules and midribs) without spines at base on adaxial side, at most larger plants rarely with extremely short processes in distal part of costa; perispore with or without folds.
- 24a. Pinnae prominently broadened at base, inequilateral, auriculate at acroscopic base, usually cuneate basicopically; in pinnate or more divided lamina, all lobes or pinnules anadromous; costae without spines on adaxial side; perispore with folds (rarely without folds).
- 25a. Fertile fronds less than 10 cm; perispore without folds ..... 14. *A. minimum*
- 25b. Fertile fronds more than 10 cm; perispore with folds.
- 26a. Lamina pinnate, pinnae repand or shallowly deltoid-lobed, occasionally acroscopic basal lobes of basal pinnae pinnatisect; rachis glandular pubescent.
- 27a. Pinna obtuse at apex, basal acroscopic auricles entire or slightly repand to dentate, rachis with sparse black or brown glandular hairs ..... 15. *A. nakanoi*
- 27b. Pinna acute at apex, basal acroscopic auricles denticulate at apex, rachis with sparse brown glandular hairs ..... 16. *A. zhenfengense*
- 26b. Lamina pinnate to 2-pinnate or more divided, if pinnate then lobes of pinnae not deltoid; rachis without glandular hairs (occasionally with pale brown, short unicellular hairs).
- 28a. Lamina ovate to ovate-triangular, basal pinnae largest, narrowly ovate, basal 1 or 2 pairs of pinnules of basal pinnae slightly shortened; ultimate pinnules or lobes obtuse ..... 17. *A. bucahwangense*
- 28b. Lamina narrowly lanceolate to ovate-lanceolate, basal pinnae slightly shortened, deltoid-ovate to deltoid-lanceolate, basal pair of pinnules of basal pinnae largest; ultimate pinnules or lobes acute or rounded.
- 29a. Rachis without glandular hairs on adaxial side ..... 18. *A. erythropodum*
- 29b. Rachis glandular pubescent adaxially.
- 30a. Lamina thickly papery or thinly leathery, dark green, surface shiny; indusia small, partly fugacious when mature ..... 19. *A. drepanopterum*
- 30b. Lamina papery or herbaceous, green, surface not shiny; indusia prominent, persistent.
- 31a. Lamina 2- or 3-pinnate; stipe pale purplish red, scales at base reddish brown; pinnae and ultimate pinnules acute at apex; sori less than 1 mm in diam. .... 20. *A. fimbriatum*

- 31b. Lamina 1- or 2-pinnate; stipe stramineous, scales at base brown or dark brown; pinnae and ultimate lobes rounded at apex; sori 1–2 mm in diam.
- 32a. Lamina usually lanceolate, pinnate, at most 2-pinnate at base, but free pinnules not more than 5 pairs ..... 21. *A. anisopterum*
- 32b. Lamina usually ovate-lanceolate, 2-pinnate, free pinnules of middle pinnae more than 10 pairs ..... 22. *A. foliolosum*
- 24b. Pinnae narrowed at base, not or slightly broadened, equilateral or subequilateral; at least pinnules or lobes of upper pinnae catadromous or opposite; costae of larger plants rarely with very short processes adaxially; perispore without folds.
- 33a. Lamina densely pubescent on adaxial surface.
- 34a. Rachis and costae pubescent on abaxial side; pinna lobes obtuse at apex ..... 23. *A. sericellum*
- 34b. Rachis and costae glabrate on abaxial side; pinna lobes rounded at apex ..... 24. *A. suprapubescens*
- 33b. Lamina glabrate.
- 35a. Basal pinnae prominently constricted at base; sori mostly shortly linear; rachis and costae glabrate or with short straight glandular hairs abaxially.
- 36a. Lamina deltoid-ovate, apex cuspidate; basal several pairs of pinnae subopposite, basispic lobes of basal pinnae longer than acroscopic ones ..... 25. *A. hainanense*
- 36b. Lamina lanceolate or ovate-oblong, apex acuminate; pinnae alternate, basispic lobes of basal pinnae nearly as long as acroscopic ones.
- 37a. *Indusia* poorly developed, visible only when young; teeth at lobe margin cuspidate ..... 26. *A. pachyphyllum*
- 37b. *Indusia* well developed, persistent; teeth at lobe margin not cuspidate ..... 27. *A. wangii*
- 35b. Basal pinnae slightly broadened or slightly constricted at base; sori mostly reniform, horseshoe-shaped, J-shaped, or oblong; rachis and costae with sparse squarrose-glandular hairs abaxially.
- 38a. Lamina broadly ovate or ovate, basal 1 or 2 pairs of pinnae slightly shortened or not shortened.
- 39a. Scales at stipe base black, shiny ..... 28. *A. melanolepis*
- 39b. Scales at stipe base brown or dark brown, not shiny.
- 40a. Plants up to 120 cm; lamina herbaceous, stipe and rachis stramineous or pale purplish red, not shiny ..... 29. *A. brevifrons*
- 40b. Plants to 65 cm; lamina thinly herbaceous, stipe and rachis pale reddish, shiny ..... 30. *A. rubripes*
- 38b. Lamina narrowly ovate, elliptic-lanceolate, or oblanceolate, more than 2 or 3 pairs of basal pinnae gradually shortened.
- 41a. Lamina narrowly ovate, basal 2 or 3 pairs of pinnae shortened, but basal pinnae not shortened as auricles ..... 31. *A. sinense*
- 41b. Lamina elliptic-lanceolate or oblanceolate, more than 4 pairs of basal pinnae gradually shortened, basal pinnae often shortened as auricles.
- 42a. Scales at stipe base lanceolate or linear-lanceolate, less than 1.5 mm wide; lamina pinnate, pinnae pinnatifid, lobes serrate, lateral veins usually simple ..... 32. *A. attenuatum*
- 42b. Scales at stipe base ovate or deltoid-ovate, more than 3–5 mm wide; lamina usually 2-pinnate, pinnules shallowly lobed or biserrate, lateral veins usually 2–4-furcate.
- 43a. Lamina black when dried; scales at stipe base castaneous at middle, brown in marginal part; pinnule rounded-truncate at apex ..... 33. *A. tarulakaense*
- 43b. Lamina not black when dried; scales at stipe base brown or dark brown; pinnule obtuse at apex.
- 44a. Pinnae deltoid-ovate or deltoid-lanceolate, less than 3–4 cm, approximate ..... 34. *A. contingens*
- 44b. Pinnae linear-lanceolate, more than 4 cm, spaced apart from each other.
- 45a. Pinnae shortly stalked, slightly constricted toward base, pinnules up to 2.5–3 cm ..... 35. *A. nudifrons*
- 45b. Pinnae sessile, not constricted toward base, pinnules usually less than 2.5–3 cm.
- 46a. Middle pinnae ca. 1 cm wide, separated from each other by space more than width of pinna ..... 36. *A. nephrodioides*
- 46b. Middle pinnae more than 1 cm wide, separated from each other by space much less than width of pinna.
- 47a. Pinnae 3–6 × less than 1.8 cm, prominently ascending ..... 37. *A. adscendens*
- 47b. Pinnae up to 16–18 × up to 3 cm, spreading or slightly ascending ..... 38. *A. dentigerum*
- 23b. Costae (or also costules and midribs) with long or short spines at base on adaxial side; perispore without folds.
- 48a. Lamina pinnate, oblanceolate, pinnae pinnatifid to pinnatifid, many pairs of basal pinnae gradually shortened, basal pinnae often auricles ..... 39. *A. mehrae*

- 48b. Lamina 1–3-pinnate, not oblanceolate, basal pinnae not shortened, or at most 1 to several pairs slightly shortened, basal pinnae never auricles.
- 49a. Lamina narrowly lanceolate, pinnae more than 20–25 pairs.
- 50a. Lamina usually less than 35 cm, 1- or 2-pinnate, lobe margin dentate, costae with short spines adaxially ..... 40. *A. multipinnum*
- 50b. Lamina up to 35 cm or more, 2-pinnate, lobe margin long serrulate, costae with long spines adaxially ..... 41. *A. elongatum*
- 49b. Lamina broader, not narrowly lanceolate, pinnae less than 20–25 pairs.
- 51a. Indusia various, J-shaped, horseshoe-shaped, reniform, elliptic, or shortly linear; scales at stipe base often yellow-brown, brown, or dark brown.
- 52a. Pinnules or lobes of upper pinnae anadromous, occasionally catadromous or subopposite; rachis and costae stramineous, rarely pale purplish red, glabrate or sparsely pubescent on abaxial side; margin of narrow wings along costae or sinus between lobes glabrate.
- 53a. Pinnules or lobes of upper pinnae opposite or subopposite.
- 54a. Pinnules or lobes downward reflexed or subspreading ..... 42. *A. oppositipennum*
- 54b. Pinnules or lobes spreading ..... 43. *A. crassipes*
- 53b. Pinnules or lobes of upper pinnae anadromous, alternate, or only basal pair subopposite.
- 55a. Pinnae (especially also lamina tip) or pinnules ascending or at most subspreading.
- 56a. Lower pinnae alternate, at most basal pinnae subopposite; rachis and costae pale purplish red, spines prominent on adaxial side, but costules without spines ..... 44. *A. tripinnatum*
- 56b. Basal pinnae to several pairs of lower pinnae opposite or subopposite; rachis and costae stramineous, with very short spines adaxially, costules also with spines.
- 57a. Basal pinnules subopposite, rachis and costae sparsely pubescent abaxially ..... 45. *A. deltoidofrons*
- 57b. Basal pinnules anadromous, rachis and costae glabrate abaxially ..... 46. *A. delicatulum*
- 55b. Pinnae (especially also lamina tip) or pinnules downward reflexed.
- 58a. Lamina pinnate, pinnae at most pinnatipartite, sessile, downward reflexed, upper pinnae spreading ..... 47. *A. reflexipinnum*
- 58b. Lamina 1- or 2-pinnate, pinnae shortly stalked, usually spreading or ascending, distal pinnae downward reflexed; pinnules pinnatisect, reflexed downward or spreading.
- 59a. Sori horseshoe-shaped; pinnules lanceolate, subsessile ..... 48. *A. devolii*
- 59b. Sori oblong or J-shaped; pinnules ovate-deltoid or oblong, prominently stalked or adnate to narrow wing of costa.
- 60a. Pinnules ovate-deltoid, acute at apex, prominently stalked (stalk ca. 1 mm) ..... 49. *A. baishanzuense*
- 60b. Pinnules oblong, rounded-obtuse at apex, adnate to narrow wing of costa ..... 50. *A. maoshanense*
- 52b. Pinnules or lobes of upper pinnae catadromous or subopposite; rachis and costae usually pale purplish red, occasionally stramineous, pubescent on abaxial side; margin of narrow wings of costa or sinus between lobes sparsely pubescent or glabrate.
- 61a. Indusia usually reniform, orbicular-reniform, or elliptic; lamina broadly ovate, apex acuminate, basal pinnae largest; scales yellow-brown ..... 51. *A. omeiense*
- 61b. Indusia usually oblong, J-shaped, or horseshoe-shaped; lamina usually oblong-ovate, apex cuspidate or acuminate, basal pinnae subequal to second basal pinnae or slightly larger; scales brown or dark brown.
- 62a. Pinnae prominently stalked, stalk usually more than 2 mm, alternate, basal pinnae subopposite; margin of narrow wings of costa or sinus between lobes glabrate or sparsely pubescent; indusia subentire or erose.
- 63a. Margin of narrow wings of costae sparsely pubescent, costae densely pubescent abaxially.
- 64a. Adaxial surface of lamina and lobe margin sparsely pubescent; pinnules narrowly deltoid to deltoid-oblong, acute at apex ..... 57. *A. ludingense*
- 64b. Adaxial surface of lamina and lobe margin glabrate; pinnules oblong to deltoid-ovate, obtuse at apex ..... 58. *A. hirtirachis*
- 63b. Margin of narrow wings of costae glabrate, rachis and costae glabrate or sparsely pubescent.
- 65a. Pinnules oblong, rounded-obtuse at apex ..... 52. *A. intermixtum*
- 65b. Pinnules ovate to oblong-lanceolate, acute at apex.
- 66a. Lamina apex usually acuminate; rachis and costae glabrate on abaxial side; pinnules of middle and basal pinnae pinnatipartite to pinnatisect.
- 67a. Scales pale brown, linear-lanceolate; costae pale purplish red on abaxial side ..... 53. *A. costulalisorum*
- 67b. Scales dark brown, ovate to ovate-lanceolate; costae stramineous ..... 54. *A. dentilobum*

- 66b. Lamina apex often cuspidate; rachis and costae sparsely pubescent abaxially; pinnules of middle and basal pinnae pinnatifid to pinnatifid.
- 68a. Costae pale purplish red; lamina thinly herbaceous, apex cuspidate prominently ..... 55. *A. vidalii*
- 68b. Costae stramineous; lamina papery, apex cuspidate often not prominently ..... 56. *A. mackimmonii*
- 62b. Pinnae usually sessile, occasionally shortly stalked, stalk less than 2 mm, basal 3 or more pairs of pinnae often opposite or subopposite; margin of narrow wings of costa or sinus between lobes usually sparsely pubescent, occasionally glabrate; indusia usually ciliate, occasionally lacerate or erose.
- 69a. Rachis and costae stramineous, with dense unicellular straight hairs on abaxial side, with very short spines on adaxial side; midribs without spines ..... 59. *A. himalaicum*
- 69b. Rachis and costae usually pale purplish red, occasionally stramineous, sparsely pubescent or glabrate abaxially, with long or short spines adaxially; costules or midribs with or without spines.
- 70a. Spines on adaxial surface of costae very short, but if long then costules or midribs without spines.
- 71a. Plants less than 30 cm tall; pinnae less than 5 cm, pinnatifid; rachis and costae pale purplish red or stramineous; margin of narrow wings of costae sparsely pubescent.
- 72a. Basal pinnae prominently shortened; spines on adaxial surface of costae very short; rachis and costae stramineous; adaxial surface of lamina glabrate ..... 60. *A. emeicola*
- 72b. Basal pinnae not shortened; spines on adaxial surface of costae sharp and long; rachis brown-stramineous, costae pale purplish red abaxially; adaxial surface of lamina with sparse pallid short hairs ..... 61. *A. bomicola*
- 71b. Plants more than 30 cm tall; pinnae more than 7 cm, pinnate; rachis and costae stramineous; margin of narrow wings of costae sparsely pubescent or glabrate.
- 73a. Spines on adaxial surface of costae sharp and long; margin of narrow wings of costae glabrate ..... 62. *A. flabellulatum*
- 73b. Spines on adaxial surface of costae very short; margin of narrow wings of costae sparsely hairy.
- 74a. Plants less than 50 cm tall; pinnules oblong, ca. 7 mm, apex rounded, margin crenate ..... 63. *A. daxianglingense*
- 74b. Plants to 1 m tall; pinnules broadly lanceolate, 22–27 mm, apex obtuse, margin incised.
- 75a. Middle pinnae more than 20 cm; pinnules more than 20 pairs, oblong-lanceolate or oblong-ovate ..... 64. *A. obtusilimbum*
- 75b. Middle pinnae less than 12 cm; pinnules ca. 14 pairs, deltoid-ovate or broadly deltoid-lanceolate ..... 65. *A. baopingense*
- 70b. Spines on adaxial surface of costae long, narrowly deltoid; if lamina 2-pinnate or more dissected then costules or midribs also spinose.
- 76a. Margin of narrow wings of costae and rachis glabrate.
- 77a. Lamina thinly herbaceous, teeth at lobe margin long and ascending, sori 2–4 pairs per pinnule ..... 66. *A. jinshajiangense*
- 77b. Lamina papery or firm-herbaceous, lobe margin dentate, sori 4–7 pairs per pinnule ..... 67. *A. interjectum*
- 76b. Margin of narrow wings of costae and rachis ± with unicellular short hairs.
- 78a. Adaxial surface of lamina with unicellular short hairs ..... 68. *A. suprapuberulum*
- 78b. Adaxial surface of lamina glabrate.
- 79a. Pinnae less than 1 cm wide, apex rounded-truncate; scales at stipe base black in center, sharply with narrow pale brown margin ..... 69. *A. zayuense*
- 79b. Pinnae usually more than 2 cm wide, apex obtuse; scales at stipe base dark brown in center, gradually paler toward margin.
- 80a. Basal pinnules often reflexed ..... 70. *A. lineare*
- 80b. Pinnules spreading or ascending.
- 81a. Lamina 2-pinnate with pinnules pinnatifid to 3-pinnate with secondary pinnules pinnatifid; basal pinnae much larger than upper pinnae, oblong-ovate; costae and costules with short spines on adaxial side ..... 71. *A. chungtienense*
- 81b. Lamina 1-pinnate with pinnae pinnatifid to 2-pinnate with pinnules pinnatifid; basal pinnae equal to upper pinnae or slightly shorter, narrowly lanceolate or narrowly oblanceolate; only in large pinnae costules with spines adaxially.

- 82a. Base of middle pinnae inequilateral; teeth at pinnule margin or lobe margin sharp and long ..... 72. *A. austro-orientale*
- 82b. Base of middle pinnae subequilateral; teeth at pinnule margin or lobe margin short ..... 73. *A. dubium*
- 51b. Indusia usually shortly linear or oblong; scales at stipe base often black or dark brown.
- 83a. Costae and costules with long spines adaxially, ultimate midribs often also with spines.
- 84a. Lamina 3-pinnate or more divided; secondary pinnules prominently stalked; rachis and costae glabrate abaxially.
- 85a. Lamina deltoid or ovate-deltoid; ultimate lobes broad, suboblong, usually more than 2–3 mm wide ..... 96. *A. adpressum*
- 85b. Lamina elliptic; ultimate lobes slender and long, linear or narrowly subulate, usually ca. 1 mm wide.
- 86a. Ultimate lobes linear, ascending; sori costular, straight ..... 97. *A. rhachidosorum*
- 86b. Ultimate lobes narrowly subulate, spreading; sori subcostular, often curved ..... 98. *A. araiostegioides*
- 84b. Lamina 1- or 2-pinnate with pinnules at most pinnatifid; rachis and costae pubescent or glabrate abaxially.
- 87a. Sori oblong or shortly linear, straight, close to midribs, often partly overlaying them when mature; rachis and costae glabrate abaxially, at most costae slightly pubescent at base.
- 88a. Fronds less than 25 cm; lamina narrowly deltoid or deltoid-ovate, glabrous or glandular hairy on adaxial surface.
- 89a. Rhizome creeping; lamina glabrous adaxially ..... 99. *A. chingianum*
- 89b. Rhizome erect; lamina glandular hairy adaxially.
- 90a. Lamina deltoid, basal pinnae not shortened; pinna lobes subentire; sori close to costa ..... 100. *A. supraspinescens*
- 90b. Lamina ovate-deltoid, basal pinnae slightly shortened; pinnules crenate or serrate-lobed; sori distant from costa ..... 101. *A. medogense*
- 88b. Fronds more than 30 cm; lamina broadly ovate to linear-lanceolate; lamina adaxial surface glabrate.
- 91a. Lamina pinnate; pinnae deltoid-lanceolate, less than 3.5 cm, at most pinnatisect, pinna lobes approximate ..... 102. *A. yui*
- 91b. Lamina 2-pinnate; pinnae lanceolate or linear-lanceolate, 5–20 cm, pinnules separate from each other.
- 92a. Lamina ovate to oblong-lanceolate; pinnule lobes subentire or only slightly serrulate at margin ..... 103. *A. fangii*
- 92b. Lamina broadly ovate to ovate; pinnule lobes with prominently long or short teeth at margin.
- 93a. Pinnae 13–16 pairs; pinnules oblong; rachis and costae glabrate abaxially ..... 104. *A. nyalamense*
- 93b. Pinnae 6 or 7 pairs; pinnules obovate or oblong; rachis and costae densely pubescent abaxially ..... 105. *A. yuanyangense*
- 87b. Sori curved or straight, not close to midribs, not overlaying them when mature; rachis and costae pubescent abaxially, rarely glabrate.
- 94a. Lamina lanceolate to linear-lanceolate; pinnae usually more than 18 pairs; rachis usually with bulbils below apex, occasionally without bulbils.
- 95a. Lamina narrowly lanceolate to linear-lanceolate; many basal pinnae shortened; pinnae 3–4 cm, sessile; pinna lobes less than 10 pairs, minutely toothed at margin; bulbils usually large ..... 106. *A. clarkei*
- 95b. Lamina lanceolate to narrowly lanceolate; only 1 or 2 pairs of basal pinnae slightly shortened; pinnae 6–11 cm, usually shortly stalked; pinna lobes more than 10 pairs, biserrate or lobed at margin; bulbils small.
- 96a. Pinnules deltoid–broadly lanceolate; lobes minutely toothed at margin ..... 107. *A. viviparum*
- 96b. Pinnules ovate-oblong; lobes prominently toothed, teeth ca. 1 mm ..... 108. *A. strigillosum*
- 94b. Lamina broadly ovate, ovate, or lanceolate; pinnae less than 15 pairs; rachis usually without bulbils below apex, occasionally bulbiferous.
- 97a. Plants less than 30 cm tall; lamina lanceolate, less than 6 cm wide; pinnae narrow and small, less than 1 cm wide; sori close to midribs ..... 109. *A. nigripes*
- 97b. Plants usually more than 30 cm tall; lamina broadly ovate or ovate, more than 6 cm wide; pinnae more than 1 cm wide; sori medial or inframedial.

- 98a. Pinnules pinnatifid to pinnatifid, rarely pinnatifid, apex obtuse, margin crenate; sori straight; lamina papery when dry.
- 99a. Lamina oblong-ovate; basal several pairs of pinnae opposite or subopposite; stipe and rachis stramineous ..... 110. *A. guangnanense*
- 99b. Lamina subdeltoid; basal pinnae subopposite, most other pinnae alternate; stipe and rachis usually pale purplish red ..... 111. *A. silvicola*
- 98b. Pinnules pinnatifid to pinnatisect, apex acute or obtuse, margin with sharp teeth; sori curved and straight or straight; lamina herbaceous when dried.
- 100a. Lamina ovate to narrowly ovate, occasionally lanceolate; pinnules or lobes separate from each other; pinnules oblong-ovate, inequilateral; sori straight, curved or variously shaped; rachis often bearing bulbils below apex.
- 101a. Pinnules of middle pinnae anadromous ..... 112. *A. cryptogrammoides*
- 101b. Pinnules of middle pinnae subopposite ..... 113. *A. iseanum*
- 100b. Lamina broadly ovate or ovate; pinnules or lobes approximate; pinnules oblong-ovate to narrowly deltoid-ovate, subequilateral; sori straight, rarely curved; rachis without bulbils below apex.
- 102a. Stipe and rachis pale purplish red, fragile; costae densely pubescent on abaxial side ..... 114. *A. imbricatum*
- 102b. Stipe and rachis stramineous, tough; costae glabrate abaxially.
- 103a. Stipe usually longer than lamina; lamina ovate, apex cuspidate; pinnae less than 10 pairs ..... 115. *A. xichouense*
- 103b. Stipe usually shorter than lamina; lamina oblong, apex acuminate; pinnae ca. 13 pairs ..... 116. *A. nanyueense*
- 83b. Costae with subulate, short spines on adaxial side; costules or midribs without spines, occasionally with very short spines.
- 104a. Lamina broadly ovate or ovate, apex often cuspidate, occasionally narrowly ovate, apex shortly acuminate; pinnae usually prominently stalked (stalk usually more than 2–3 mm).
- 105a. Pinnules of basal 2 or 3 pairs of pinnae anadromous, pinnae prominently stalked (stalk 3–5 mm); rachis and costae glabrate on abaxial side ..... 74. *A. clivicola*
- 105b. Pinnules of basal pinnae anadromous, pinnules of other pinnae subopposite or catadromous, pinnae shortly stalked; rachis and costae pubescent on abaxial side, rarely glabrate.
- 106a. Pinnules shallowly lobed, lobes up to 1 mm, or bidentate ..... 75. *A. infrapuberulum*
- 106b. Pinnules subentire, or serrate or lobed.
- 107a. Pinnules lanceolate to narrowly lanceolate, 3 or more  $\times$  as long as wide; sori subparallel to midrib; indusia erose ..... 76. *A. criticum*
- 107b. Pinnules deltoid, oblong-ovate, or ovate, occasionally narrowly ovate, less than 3  $\times$  as long as wide; sori not parallel to midrib; indusia entire or subentire.
- 108a. Lamina narrowly deltoid-ovate, narrowly ovate or ovate, pinnae 7 pairs or more except pinnae of cuspidate apex; pinnules narrow, usually less than 5 mm wide at middle, subentire; pinna rachis sparsely pubescent on abaxial side.
- 109a. Lamina ovate-oblong, cuspidate at apex; pinnae up to 18 cm, pinnules more than 10 pairs ..... 77. *A. brevistipes*
- 109b. Lamina narrowly deltoid-ovate, acuminate at apex; pinnae 5–11 cm, pinnules less than 10 pairs ..... 78. *A. kenzo-satakei*
- 108b. Lamina deltoid or deltoid-ovate, pinnae ca. 5 pairs below cuspidate apex; pinnules usually more than 5 mm wide at middle, serrate; costae densely pubescent on abaxial side.
- 110a. Base of basal pinnae broadened with basal pinnules largest; pinnules auriculate at base on both sides ..... 79. *A. longius*
- 110b. Lower pinnules of basal pinnae shortened; pinnules auriculate only at acroscopic base.
- 111a. Pinnules of middle pinnae ascending, oblong, serrulate at margin ..... 80. *A. wardii*
- 111b. Pinnules of middle pinnae broadly deltoid-lanceolate, shallowly lobed to pinnatifid ..... 81. *A. venulosum*
- 104b. Lamina oblong-ovate or lanceolate, occasionally ovate, acuminate at apex, occasionally cuspidate; pinnae usually sessile, or shortly stalked (stalk less than 2 mm).
- 112a. Pinnules or pinnule lobes rounded-obtuse or truncate at apex, margin rounded lobed or crenate; sori usually medial ..... 82. *A. christensenii*

- 112b. Pinnules or pinnule lobes acute or obtuse at apex, lobed or toothed at margin, not crenate; sori usually close to costule.
- 113a. Basal pinnules overlaying rachis.
- 114a. Pinnae acuminate at apex; pinnules obtuse at apex, teeth at margin spreading ..... 83. *A. delavayi*
- 114b. Pinnae caudate-acuminate at apex; pinnules acute or obtuse at apex, teeth at margin oblique.
- 115a. Pinnae 14–16 cm, caudate or long acuminate at apex; pinnules shortly acuminate, long auriculate at acroscopic base, midrib without spines on adaxial side ..... 84. *A. caudiforme*
- 115b. Pinnae 10–12 cm, shortly caudate at apex; pinnules acute, shortly auriculate at acroscopic base, midrib with spines on adaxial side ..... 85. *A. subrigescens*
- 113b. Basal pinnules not overlaying rachis.
- 116a. Scales at stipe base ovate-lanceolate or lanceolate; pinnules of upper pinnae anadromous or subopposite; sori ca. 1 mm, close to midrib, almost parallel to midrib ..... 86. *A. decorum*
- 116b. Scales at stipe base linear to linear-lanceolate; pinnules of upper pinnae catadromous or subopposite; sori more than 1.5 mm, ascending to midrib.
- 117a. Pinnae often shortly stalked; pinnules narrowly oblong, broadly cuneate at base; costae and distal part of rachis with very short spines adaxially ..... 87. *A. uniforme*
- 117b. Pinnae sessile or very shortly stalked; pinnules not narrowly oblong, cuneate at basisopic base, truncate and parallel to costa at acroscopic base; spines of costae and distal part of rachis on adaxial surface prominent.
- 118a. Lamina narrowly ovate or lanceolate, acuminate at apex.
- 119a. Costules with prominent spines on adaxial side.
- 120a. Rachis and costae shiny, glabrate abaxially; pinnules and lobes usually obtuse at apex, almost not lobed, minutely toothed at margin ..... 88. *A. roseum*
- 120b. Rachis and costae densely pubescent abaxially; pinnules and lobes usually rounded-obtuse at apex, shallowly lobed or prominently serrate at margin ..... 89. *A. mengtzeense*
- 119b. Costules without or with very short spines adaxially.
- 121a. Stipe, rachis, and costae pale purplish red; pinnae shortly stalked (stalk 1–3 mm) or subsessile ..... 90. *A. epirachis*
- 121b. Stipe, rachis, and costae stramineous; pinnae sessile ..... 91. *A. pubicostatum*
- 118b. Lamina ovate or deltoid-ovate, occasionally narrowly ovate, slightly cuspidate or shortly acuminate at apex.
- 122a. Rachis and costae glabrate abaxially; pinnae sessile.
- 123a. Basal pinnae narrowly lanceolate, acroscopic pinnules subequal to basisopic pinnules ..... 92. *A. otophorum*
- 123b. Basal pinnae ovate-lanceolate, basisopic pinnules longer than acroscopic pinnules ..... 93. *A. kuratae*
- 122b. Rachis and costae pubescent abaxially; pinnae shortly stalked.
- 124a. Rachis and costae with short spines on adaxial side, sparsely glandular pubescent abaxially; pinnules separate, short and obtuse at apex ..... 94. *A. arisanense*
- 124b. Rachis and costae with long spines adaxially, with dense, pale brown, short glandular hairs abaxially; pinnules dense, acute at apex ..... 95. *A. caudatum*

**1. *Athyrium wallichianum*** Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 497. 1938.

黑秆蹄盖蕨 *hei gan ti gai jue*

*Aspidium brunonianum* Wallich ex Mettenius; *Dryopteris brunoniana* (Wallich ex Mettenius) Kuntze; *Lastrea brunoniana* C. Presl; *Nephrodium brunonianum* Hooker.

Rhizomes short, ascending, apex along with stipes densely scaly; scales brown or somewhat chestnut-black, shiny, ovate-lanceolate or fibriform. Fronds caespitose; fertile fronds (14–) 40–60 cm; stipe usually (4–)5–10(–15) cm, (1–)3–4 mm in diam., stipes and rachises blackish brown; lamina pinnate, ob-lanceolate, (10–)20–50 × (3–)5–7 cm at middle, narrowed

toward base, base 2–2.5 cm wide, apex obtuse; pinnae (12–) 20–30 pairs, pinnatilobate to pinnatipartite, lower pinnae opposite, upper pinnae alternate, approximate, slightly ascending, sessile, lower (2–)6–10 pairs of pinnae gradually shortened; basal pinnae ovate-triangular, ca. 1 cm; middle pinnae oblong, 2–3.5 × 1–1.5 cm, equilateral, subtruncate, sessile or adnate, pinnatipartite, apex obtuse-rounded and shortly serrate; pinna segments 6–8 pairs, spreading, approximate, ovate, basal segments slightly larger, 4–5 mm long and wide, often revolute when dried, bidentate, teeth triangular, acute at apex, spreading. Veins visible abaxially, pinnate in segments, 3 or 4 pairs, mostly simple, extending into teeth. Lamina thickly papery when dried, brown, glabrate, with dense red-brown or chestnut-black, lanceolate or linear scales only on rachis. Sori orbicular or broadly

ovate, abaxial on acroscopic veins (often on both veins of basal acroscopic forked veins), 2–4 pairs per segment, median, exindusiate. Perispore surface with folds, obscurely granular.

Rock crevices in forests, alpine shrub meadows; 3500–4800 m. Sichuan, SE Xizang, NW Yunnan [Bhutan, N India, Kashmir, N Myanmar, Nepal, N Pakistan].

**2. *Athyrium dissitifolium*** (Baker) C. Christensen, Contr. U.S. Natl. Herb. 26: 296. 1931.

疏叶蹄盖蕨 *shu ye ti gai jue*

Rhizomes, shortly creeping or ascending, densely scaly at apex and stipe bases; scales brown, linear-lanceolate, fibri-form at apex. Fronds caespitose; fertile fronds 20–65 cm; stipe stramineous, (5–)20–30 cm, up to 2.5 mm in diam.; lamina pinnate-pinnatifid to 2-pinnate, broadly lanceolate, 15–40 × 5–12 cm, base as wide as above, apex long acuminate; pinnae 12–25 pairs, alternate, subspreading, subsessile, lanceolate, 2.5–14 × 0.7–4 cm, base truncate, pinnatifid to pinnate, apex long acuminate; pinnules or pinna segments ca. 12 pairs, alternate, approximate, oblong to broadly lanceolate, 0.5–2 × 2–5 mm, margin entire or serrate, apex obtuse, obtusely pointed, or acute. Veins inconspicuous adaxially, visible abaxially, pinnate, ca. 7 pairs, oblique, simple. Lamina thickly papery when dried, greenish brown, glabrate on both surfaces; rachis and costae on abaxial surface stramineous, glabrate. Sori orbicular or elliptic, supramedial, 5 or 6 pairs per pinnule or segment, exindusiate. Perispore surface with prominent folds.  $2n = ca. 80$ .

Forests, among shrubs at roadsides, common; 600–2700 m. Guangxi, Guizhou, Hunan, Sichuan, Yunnan [Bhutan, N India, Myanmar, Nepal, Thailand, Vietnam].

*Dryopteris aristulata* Rosenstock (Repert. Spec. Nov. Regni Veg. 13: 132. 1914), described from Guizhou, was treated as a synonym of *Athyrium dissitifolium* by P. S. Wang & X. Y. Wang (Pterid. Fl. Guizhou, 161. 2001).

- 1a. Pinnules acute at apex; lamina 2-pinnate ..... 2c. var. *kulhaitense*  
 1b. Pinnules obtuse or obtusely pointed at apex.  
 2a. Lamina 2-pinnatifid or 2-pinnate, pinna segments or pinnules obtuse at apex ..... 2a. var. *dissitifolium*  
 2b. Lamina 2-pinnate, pinnules obtusely pointed at apex ..... 2b. var. *funebre*

**2a. *Athyrium dissitifolium* var. *dissitifolium***

疏叶蹄盖蕨(原变种) *shu ye ti gai jue (yuan bian zhong)*

*Polypodium dissitifolium* Baker, Bull. Misc. Inform. Kew 1895: 54. 1895; *Athyrium drepanopterum* (Kunze) A. Braun ex Milde var. *brevicaudatum* Christ; *A. fasciculatum* Handel-Mazzetti; *Dryopteris apicidens* (Baker) C. Christensen; *D. cristulata* Rosenstock; *D. dissitifolia* (Baker) C. Christensen; *D. incrassata* (Christ) C. Christensen; *Phegopteris incrassata* Christ; *Polypodium apicidens* Baker.

Fronds with less dissected (2-pinnatifid or 2-pinnate) lamina with obtuse pinna segments.

Forests, among shrubs at roadsides, common; 600–2700 m. Guangxi, Guizhou, Hunan, Sichuan, Yunnan [Bhutan, N India, Myanmar, Nepal, Thailand, Vietnam].

**2b. *Athyrium dissitifolium* var. *funebre*** (Christ) Ching & Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 124. 1999.

二回疏叶蹄盖蕨 *er hui shu ye ti gai jue*

*Athyrium drepanopterum* var. *funebre* Christ, Notul. Syst. (Paris) 1: 46. 1909.

Fronds with 2-pinnate lamina with pinnules obtusely pointed at apex.

- Mixed forest margins; ca. 2300 m. Yunnan (Kunming, Xi Shan).

**2c. *Athyrium dissitifolium* var. *kulhaitense*** (W. S. Atkinson ex C. B. Clarke) Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 22. 1986.

库尔海蹄盖蕨 *ku er hai ti gai jue*

*Asplenium oxyphyllum* Wallich ex Hooker var. *kulhaitense* W. S. Atkinson ex C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 494. 1880.

Lamina 2-pinnate; pinnae stalked; pinnules broadly lanceolate, inequilaterally cuneate at base, shallowly lobed or serrate at margin, acute at apex.

- Forests; 1300–2100 m. SW Yunnan [N India, Myanmar, Nepal].

**3. *Athyrium exindusiatum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(2): 102. 1986.

无盖蹄盖蕨 *wu gai ti gai jue*

Fertile fronds up to 1 m; stipe upward stramineous, ca. 50 cm, 3–4 mm in diam., base clothed with brownish, lanceolate large scales, upward glabrate; lamina 2-pinnate, oblong, ca. 65 × 20–30 cm, base as wide as above, apex long acuminate; pinnae 20–22 pairs, alternate, ascending, shortly stalked (stalk ca. 1.4 mm); basal pinnae not shortened and not narrowed toward base, lanceolate, (15–)25–28 × 5–8 cm, base rounded-cuneate, pinnate-pinnatifid, apex long acuminate; pinnules ca. 25 pairs, alternate, ascending, subfalcate-lanceolate, 3.5–4 cm × 8–10 mm at base, base inequilateral, acroscopic side truncate, somewhat auriculate, parallel to costae, basicopic side cuneate, adnate to costa, pinnatifid to pinnatifid (to 2/3 to costule), apex acuminate; pinnule segments 8 or 9 pairs, oblong, basicopic basal segments smaller, long toothed, apex often deltoid; upper pinnae lanceolate, acroscopic base truncate, parallel to rachis, basicopic base broadly cuneate, sessile, slightly curved upward, margin biserrate, apex long acuminate. Veins inconspicuous adaxially, visible abaxially, pinnate in segments, 3 or 4 pairs, oblique, simple. Lamina papery when dried, glabrate, dark green adaxially, pale green abaxially. Rachis and costae stramineous, glabrate abaxially, with very short spines on adaxial surface. Sori orbicular, abaxial on veins, 1–3 pairs per segment, exindusiate. Perispore surface with prominent folds.

Grassy areas in forests; 1000–2300 m. Xizang, Yunnan [India, Myanmar, Nepal].

**4. *Athyrium pectinatum*** (Wallich ex Mettenius) T. Moore, Index Fil. 186. 1860.

篦齿蹄盖蕨 bi chi ti gai jue

*Asplenium pectinatum* Wallich ex Mettenius, Abh. Senckenberg. Naturf. Ges. 3: 241. 1859; *A. filix-femina* (Linnaeus) Bernhardt var. *pectinatum* Wallich ex C. B. Clarke; *Athyrium filix-femina* (Linnaeus) Roth subsp. *pectinatum* (Wallich ex Mettenius) Á. Löve & D. Löve; *A. filix-femina* var. *pectinatum* (Wallich ex Mettenius) Beddome.

Rhizomes slender, long creeping, apex ascending, densely clothed with dark brown, lanceolate scales. Fronds approximate; fertile fronds 30–55 cm; stipe brown-stramineous, 15–25 cm, 1–2 mm in diam., base similarly scaly, upward glabrate; lamina 3-pinnate to 3-pinnate-pinnatifid, oblong-lanceolate, 15–35 × 8–25 cm at middle, base slightly narrowed, apex caudate-acuminate; pinnae ca. 20 pairs, lower pinnae opposite; upper pinnae subopposite, ascending, shortly stalked (stalk ca. 1.5 mm) or subsessile; basal pinnae slightly shortened, lower pinnae slightly shortened; middle pinnae deltoid-lanceolate, 10–15 × ca. 3.5 cm at base, base truncate, parallel to rachis, 2-pinnate, apex acuminate; pinnules ca. 20 pairs, basal pinnules opposite, upper pinnules alternate, spreading, separate from each other, broadly lanceolate, up to 2.5 cm × 8–10 mm at base, base equilateral, rounded-truncate, pinnate, apex acute or acuminate; ultimate pinnules 8 or 9 pairs, lower pinnules opposite; upper pinnules alternate, subspreading or ascending, linear, 4–6 × ca. 2 mm, base decurrent and adnate to wing of costule, dissected, apex obtuse; segments 3 or 4, teethlike, ascending. Veins inconspicuous adaxially, visible abaxially, pinnate in ultimate pinnules, lateral veins 3 or 4 pairs, oblique, simple, only 1 vein per tooth. Lamina submembranous when dried, yellow-green, glabrate; rachis, costae, costules (or midribs) stramineous, glabrate, with needlelike spines on adaxial side. Sori small, elliptic, 3 or 4 pairs per ultimate pinnule, 1 sorus per segment; indusia oblong, brown, membranous, erose at margin, persistent. Perispore surface with prominent folds.  $2n = 80$ .

Coniferous forests; ca. 2100 m. SE Xizang [Bhutan, N India, Kashmir, Nepal].

**5. *Athyrium ruilicola*** W. M. Chu, Acta Bot. Yunnan., Suppl. 5: 41. 1992 [*"ruilicolum"*].

瑞丽蹄盖蕨 rui li ti gai jue

Rhizomes creeping, densely clothed with brown, lanceolate scales. Fronds approximate; fertile fronds 23–40 cm; stipe brown at base, upward stramineous, 16–26 cm, 0.5–1.5 mm in diam., base with sparse dark brown lanceolate scales, upward glabrate; lamina 2-pinnate, deltoid-ovate, 8–22 × 3.5–8 cm; free pinnae 3–6 pairs, basal pinnae not shortened or slightly longer, subopposite, shortly stalked, subspreading or slightly ascending, ovate, 1.5–5.5 cm; middle pinnae ovate-oblong, 1.5–4.5 × 1–2 cm, base ± rounded, auriculate at acroscopic side, very shortly stalked, oblique, pinnate, apex acuminate or acute, alternate; pinnules or pinna segments 3–5 pairs, anadromous, deltoid-oblong, 1–10 × 2–7 mm, margin shallowly toothed, apex obtuse; free pinnules subequilateral, segments on acroscopic side often auriculate and parallel to costa, basicopic side broadly cuneate,

slightly decurrent and adnate to wing of costa. Veins visible on both surfaces, pinnate in pinnules, lateral veins 3–6 pairs, simple or forked. Lamina thinly herbaceous when dried, yellow-green, glabrate; rachis and costae stramineous, glabrate abaxially. Sori oblong, J-shaped, or horseshoe-shaped across basal acroscopic veins, biseriate along both sides of costule; indusia large, similar to sori, pallid, membranous, ciliate at margin, persistent. Perispore surface with folds.

• 1300–1400 m. Yunnan.

*Athyrium ruilicola* is similar to *A. biserrulatum* but differs by the fronds narrower, subdimorphic, stipes of sterile fronds shorter than lamina, stipes of fertile fronds longer than lamina, lateral pinnae 3–5 pairs, and basal pinnae not shortened or slightly longer.

**6. *Athyrium biserrulatum*** Christ, Bull. Acad. Int. Géogr. Bot. 17: 135–136. 1907.

苍山蹄盖蕨 cang shan ti gai jue

*Asplenium filix-femina* (Linnaeus) Bernhardt var. *polyspora* C. B. Clarke; *Athyrium filix-femina* (Linnaeus) Roth var. *polysporum* (C. B. Clarke) Beddome; *A. polysporum* (C. B. Clarke) Ching ex Mehra & Bir.

Rhizomes slender, long creeping, densely clothed with brownish, lanceolate scales. Fronds distant; fertile fronds 50–65 cm; stipe brown at base, upward stramineous, 15–20 cm, 1.5–2 mm in diam., base with sparse dark brown lanceolate scales, upward glabrate; lamina 2-pinnate, oblong, 30–45 × 14–18 cm; pinnae 15–20 pairs, basal 2 or 3 (or 4) pairs of pinnae gradually shortened, opposite or subopposite, subspreading or slightly drooping, basal pinnae triangular, ca. 2.5 cm; middle pinnae lanceolate, 8–10 × ca. 3 cm, base ± rounded, shortly stalked, pinnate, apex acuminate, pinnae alternate, ascending; pinnules 10–12 pairs, deltoid-oblong, 1–1.5 cm × 5–7 mm, base somewhat inequilateral, acroscopic side often auriculate and parallel to costa, basicopic side broadly cuneate, slightly decurrent, apex rounded and toothed; basal pinnules separated widely from each other; upper pinnules approximate, adnate to wing of costa, shallowly lobed; pinnule segments with spinelike teeth at apex. Veins visible adaxially, inconspicuous abaxially, pinnate in pinnules, lateral veins ca. 6 pairs, simple or forked. Lamina thinly herbaceous when dried, pale green or dark green, glabrate; abaxial surface of rachis and costae stramineous, with pallid short hairs. Sori oblong, J-shaped, or horseshoe-shaped, on basal acroscopic veins, biseriate along both sides of costule (often 2–4 in basal acroscopic segment); indusia pallid, large, oblong, J-shaped, or horseshoe-shaped, membranous, margin ciliate, persistent. Perispore with folds connected into large areoles.  $2n = 80$ .

Forests, forest margins; 2000–3000 m. W Guizhou, Sichuan, SE Xizang, C and NW Yunnan [Bhutan, N India, Myanmar, Nepal, Pakistan].

*Athyrium biserrulatum* is very similar to African (Ethiopian) *A. schimperi* Mougeot ex Fee; whether they are species or subspecies requires further analysis.

**7. *Athyrium wumonshanicum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 20. 1986.

乌蒙山蹄盖蕨 wu meng shan ti gai jue

Rhizomes slender, long creeping, clothed with brown, narrowly lanceolate scales at apex and stipe bases. Fronds approximate; fertile fronds up to 60 cm; stipe brown at base, upward stramineous, ca. 17 cm, ca. 2 mm in diam. at base, upward glabrate; lamina 3-pinnate, ovate-oblong, ca. 40 × 16 cm at middle, base hardly narrowed, apex acuminate; pinnae ca. 14 pairs, opposite, ascending, shortly stalked (stalk ca. 2.5 mm), basal pinnae hardly shortened; second basal pair of pinnae oblong-lanceolate, up to 13 × ca. 5 cm, base subtruncate, 2-pinnate, apex acuminate; pinnules ca. 12 pairs, alternate, subspreading, sessile, oblong-lanceolate, up to 2.5 × ca. 1 cm, base rounded-cuneate, slightly decurrent and ± adnate to wing of costa, pinnatifid, almost cut to costules, apex acuminate; secondary pinnules 5 or 6 pairs, ascending, oblong-lanceolate, basal secondary pinnules up to 7 × ca. 3 mm, upper pinnules gradually shortened, margin toothed, apex acute and with 3 or 4 long spinelike teeth. Veins thick, slightly impressed adaxially, protuberant abaxially, pinnate in secondary pinnule, lateral veins 4 pairs, oblique, simple. Lamina herbaceous when dried, pale green, with sparse pale hairs adaxially, abaxial side of costae and costules with sparse short hairs. Sori large, oblong, 2–6 sori per secondary pinnule; indusia pale brown, large, oblong or J-shaped, membranous, margin unequally toothed, persistent. Perispore surface prominently with folds.

- About 1800 m. N Yunnan (Luquan, Wumeng Shan).

*Athyrium wumonshanicum* is similar to *A. biserrulatum* in the frond shape. However, its lamina is 3-pinnate, with short hairs on the adaxial side, and with aristate teeth on the margin.

**8. *Athyrium brevisorum*** (Wallich ex Hooker) T. Moore, Index Fil. 117. 1859.

中緬蹄蓋蕨 *zhong mian ti gai jue*

*Asplenium brevisorum* Wallich ex Hooker, Sp. Fil. 3: 229. 1860.

Rhizomes shortly creeping, ascending. Fronds caespitose; fertile fronds 80–90 cm; stipe brown at base, upward stramineous, 45–55 cm, 2–3 mm in diam., base with sparse brown, lanceolate or linear-lanceolate scales, upward glabrate; lamina 2-pinnate, ovate or oblong-ovate, 35–45 cm, up to 25 cm wide at middle, base not narrowed, apex abruptly narrowed; pinnae ca. 12 pairs, alternate, ascending, with stalk 4–8 mm; basal pinnae not shortened, lanceolate, ca. 19 × 3–4 cm, base rounded-truncate, acroscopic side parallel to rachis, basispic side narrowly cuneate, pinnate, apex long acuminate; pinnules 16–18 pairs, ascending, lanceolate, 2–3 cm × ca. 8 mm at middle, base adnate to costa, margin dentate (sometimes basal pinnules shallowly lobed, with 2 or 3 small teeth at apex of segments), apex acuminate; lamina apex abruptly narrowed like lateral pinna, pinnatifid. Veins visible on both surfaces, pinnate in pinnules, lateral veins forked. Lamina herbaceous when dried, pale yellow-brown, rachis and costae abaxially with sparse pallid unicellular glandular hairs. Sori shortly linear or J-shaped, 8–10 pairs per pinnule (if pinnules pinnatifid then 2 or 3 pairs per pinnule segment); indusia pale brown, large, shortly linear or J-shaped, membranous, margin slightly erose, persistent. Perispore surface with prominent folds.

Forests; 800–1500 m. W Yunnan (Yingjiang Valley) [Myanmar, Nepal, Pakistan].

**9. *Athyrium yokoscense*** (Franchet & Savatier) Christ, Bull. Herb. Boissier 4: 668. 1896.

禾秆蹄蓋蕨 *he gan ti gai jue*

*Asplenium yokoscense* Franchet & Savatier, Enum. Pl. Jap. 2: 225. 1877; *Aspidium subspinulosum* Christ; *Athyrium coreanum* Christ, p.p.; *A. demissum* Christ; *A. flaccidum* Christ; *A. pachysorum* Christ; *Dryopteris subspinulosa* (Christ) C. Christensen.

Rhizomes short, stout, erect, densely clothed with yellow-brown, narrowly lanceolate scales at apex. Fronds caespitose; fertile fronds (30–)40–60 cm; stipe dark brown at base, upward stramineous, (10–)12–20(–25) cm, ca. 2.5 mm in diam., base densely scaly, upward glabrate; lamina pinnate-pinnatifid to 2-pinnate with pinnules shallowly lobed, oblong-lanceolate, 18–45 × (8–)11–15 cm, base not narrowed, apex acuminate; pinnae 12–18 pairs, lower pinnae subopposite, upper pinnae alternate, spreading or slightly ascending, sessile, lanceolate; middle pinnae (3.5–)7–9 × (1.2–)1.5–2 cm, base truncate on acroscopic side, cuneate on basispic side, pinnate, apex long acuminate; pinnules ca. 12 pairs, oblong-lanceolate, up to 1 cm × ca. 5 mm, acroscopic base auriculate, basispic base decurrent and often adnate to wing of costa, margin shallowly lobed or dentate, apex acute; pinnule segments with 2 or 3 short teeth at apex. Veins visible abaxially, pinnate in pinnules, lateral veins forked. Rachis and costae abaxially stramineous, with sparse brownish, lanceolate small scales, with short thick spines on adaxial side at base of costae or costules. Sori orbicular or elliptic, medial; indusia brownish, elliptic, J-shaped, or horse-shoe-shaped, membranous, entire, persistent. Perispore surface with prominent folds.  $2n = 80$ .

Rock crevices in forests; 100–2400 m. Anhui, Chongqing, NE Guizhou, Heilongjiang, Henan, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Shandong, Zhejiang [Japan, Korea, E Russia].

*Athyrium yokoscense* var. *kirisimaense* (Tagawa) Li & J. Z. Wang was recorded in the key to the flora of NE China (in Fu Peiyun, Clav. Pl. Chin. Bor.-Orient. 36. 1995). It differs from var. *yokoscense* by the lamina 1-pinnate to 2-pinnate-pinnatifid, most pinnules stalked, and scales on rhizomes lanceolate to ovate-lanceolate. Further investigations are necessary to understand the infraspecific variation.

**10. *Athyrium fauriei*** (Christ) Makino, Bot. Mag. (Tokyo) 17: 160. 1903.

佛瑞蹄蓋蕨 *fo rui ti gai jue*

*Nephrodium fauriei* Christ, Bull. Herb. Boissier 4: 671. 1896; *Aspidium fauriei* Christ; *Athyrium yokoscense* Christ var. *fauriei* (Christ) Tagawa.

Rhizomes short, stout, erect. Scales at stipe base reddish-brown, blackish brown in center. Plants similar to *Athyrium yokoscense*, but lamina pinnate; pinnae broader and larger, pinnatifid to pinnatifid, broadly ovate, sparsely short hairy only at base. Rachis subglabrate. Indusia pale brown, large, entire.

China [Japan, Philippines].

**11. *Athyrium fallaciosum*** Milde, Fil. Eur. 6: 54. 1867.麦秆蹄盖蕨 *mai gan ti gai jue*

*Asplenium mongolicum* Franchet; *Athyrium mongolicum* (Franchet) Diels; *A. mongolicum* var. *purdomii* C. Christensen; *Nephrodium mongolicum* (Franchet) Baker.

Rhizomes shortly creeping, ascending at apex, densely clothed with dark brown, subulate-lanceolate scales. Fronds caespitose; fertile fronds 30–50 cm; stipe brown at base, upward stramineous, 5–7 cm, 1–2 mm in diam., base slightly swollen, densely scaly, upward gradually becoming glabrate; lamina pinnate, suboblanceolate, 25–40 × 6–8 cm, base narrowed, apex acuminate; pinnae pinnatipartite, 20–24 pairs, lower 6 or 7 pairs of pinnae gradually shortened into triangular, auriculate small lobes, subopposite, sessile, spreading or slightly inclined, basal pinnae 1–1.2 cm × ca. 7 mm; middle pinnae broadly lanceolate, 3–4 × 1.2–1.5 cm at base, base truncate, sessile, pinnatipartite to costa, apex obtuse or acute, spreading, slightly curved; pinna segments ca. 8 pairs, basal acroscopic segments larger, oblong, 7–8 × ca. 5 mm, margin dentate, apex obtuse-rounded and crenate; upper segments shorter, approximate. Veins visible on both surfaces, pinnate in segments, lateral veins 3 or 4 pairs, simple, occasionally forked. Lamina herbaceous when dried, green or greenish brown, glabrate; rachis stramineous, occasionally with brown lanceolate scales. Sori large, mostly orbicular-reniform or horseshoe-shaped, 2 or 3 pairs per segment; indusia pallid, large, orbicular-reniform or horseshoe-shaped, membranous, margin ciliate or erose, persistent. Perispore with low folds.  $2n = 80^*$ .

Valleys, forests, wet rock crevices; 1200–2200 m. Gansu, Hebei, Heilongjiang, Henan, Hubei, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shanxi, N Sichuan [Korea].

**12. *Athyrium rupicola*** (Edgeworth ex C. Hope) C. Christensen, Index Filic. 145. 1906.岩生蹄盖蕨 *yan sheng ti gai jue*

*Asplenium rupicola* Edgeworth ex C. Hope, J. Bombay Nat. Hist. Soc. 12: 531. 1899; *A. filix-femina* (Linnaeus) Bernhardi subvar. *elongata* C. B. Clarke ex Blanford.

Rhizomes shortly creeping, apex ascending, densely clothed with chestnut-colored or dark brown, narrowly subulate-lanceolate, fibriform-tipped scales. Fronds caespitose; fertile fronds 25–55 cm; stipe brown at base, upward stramineous, 5–15 cm, 1.2–2.5 mm in diam., base densely clothed with similar scales as those on rhizomes, upward glabrate; lamina pinnate, narrowly or broadly lanceolate, 20–35 × 5–8.5 cm, base gradually narrowed, apex acuminate; pinnae pinnatipartite, 20–30 pairs, many lower pairs of pinnae gradually shortened into triangular auricles, ca. 1 cm, subopposite, slightly inclined; middle pinnae narrowly deltoid-lanceolate or broadly lanceolate, 2.5–4 cm × 8–16 mm, base truncate, sessile, pinnatipartite to narrow wing of costa, apex acuminate, subopposite or alternate, spreading or slightly curved upward; pinnules 8–12 pairs, basal acroscopic pinnules larger, other pinnules oblong, 4–5 × 1.5–3 mm, adnate to narrow wing of costa, margin serrate or biserrate, apex obtuse or acute. Veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins ca. 6 pairs,

simple or forked. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae on abaxial surface stramineous, glabrate, or occasionally with few brownish, fibrous scales. Sori orbicular, abaxial on acroscopic veins, 2–5 pairs per pinnule; indusia pale brown, large, orbicular-reniform or subovate, erose at margin, persistent. Perispore with prominent folds, surface granular.  $2n = 80$ .

Valley forests, rock crevices, damp areas at roadsides; 1800–3800 m. Sichuan, SE Xizang, Yunnan [Bhutan, India, Kashmir, Nepal, N Pakistan].

**13. *Athyrium glandulosum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 19. 1986.腺毛蹄盖蕨 *xian mao ti gai jue*

Rhizomes short, erect or ascending, densely clothed with red-brown, narrowly lanceolate scales at apex and stipe bases. Fronds caespitose; fertile fronds ca. 50 cm; stipe dull brown at base, upward brownish stramineous, 14–16 cm, ca. 2 mm in diam. at base, upward glabrate; lamina pinnate-pinnatifid, lanceolate, 30–35 cm, ca. 6 cm wide at middle, gradually narrowed toward base, acuminate at apex; pinnae ca. 25 pairs, alternate, ascending, sessile, 4 or 5 lower pairs of pinnae gradually shortened, inclined, basal pinnae ca. 1 cm; middle pinnae falcate-lanceolate, 3–4 × 1.2–1.8 cm at base, base subtruncate, slightly auriculate on acroscopic side, pinnatipartite nearly to costae, apex acuminate; segments ca. 10 pairs, slightly ascending, approximate, oblong-lanceolate, 7–8 × ca. 2 mm, base decurrent to narrow costal wing, with up to 4 or 5 pairs of lobes or dentate, apex acute. Veins visible on both surfaces, pinnate in pinnules, lateral veins 4 or 5 pairs, very oblique, simple or forked. Lamina herbaceous when dried, brown, glabrate on both surfaces; rachis and costae brown-stramineous abaxially, with dense pale, short glandular hairs. Sori orbicular, medial, 4 or 5 pairs per pinnule; indusia pale, large, broadly ovate, membranous, suberose at margin, persistent. Perispore surface with prominent folds.

• Forest margins, shrub groves; 1500–3500 m. Sichuan, NW Yunnan.

*Athyrium glandulosum* is quite similar to *A. rupicola* in the frond shape but differs by the rachis and costae with dense, pale, short glandular hairs abaxially and by the middle pinnae falcate-lanceolate.

**14. *Athyrium minimum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(3): 151. 1986.小蹄盖蕨 *xiao ti gai jue*

Rhizomes short, small, erect, with sparse brownish, lanceolate scales at apex and stipe bases. Fronds caespitose; fertile fronds ca. 10 cm; stipe stramineous, 2–3 cm, ca. 0.5 mm in diam.; lamina pinnate, lanceolate, 4–6 × 1–1.5 cm, base hardly narrowed, apex acuminate; pinnae stalked (stalk ca. 1 mm), pinnatifid, spreading or ascending; basal pinnae slightly shortened, subovate or ovate-triangular, reflexed; middle pinnae unequally ovate or rhomboid, 8–10 × 3.5–4 mm, base inequilateral, auriculate at acroscopic side (auricle free, broadly ovate or oblong, with triangular teeth at margin), broadly cuneate at basisopic base, pinnatipartite nearly to costae, apex obtuse; pinna segments small, 2 pairs, obovate or oblong, apex with 1 or 2 sharp

teeth. Veins visible abaxially, pinnate in segments, lateral veins forked, with 1 veinlet per tooth. Lamina papery when dried, glabrate, dark brown adaxially, pale brown abaxially; rachis and costae stramineous abaxially, occasionally with 1 or 2 brownish, linear small scales. Sori J-shaped or horseshoe-shaped, 1 per segment, but sometimes 2 on auriculate lobes; indusia brownish, J-shaped or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds.

- Valley forests, wet places, grasslands, by rocks or on rocky walls, near streamlets, under *Miscanthus floridulus*; 800–1000 m. N Taiwan (Taibei area).

**15. *Athyrium nakanoi*** Makino, Bot. Mag. (Tokyo) 23: 247. 1909.

红苞蹄盖蕨 hong bao ti gai jue

*Asplenium macrocarpum* (Blume) Hooker var. *unipinnatum* C. B. Clarke; *Athyrium macrocarpum* (Blume) Beddome var. *unipinnatum* (C. B. Clarke) Beddome; *A. obtusifolium* Rosenstock; *A. tenuissimum* Kodama; *Nephrolepis tenuissima* Hayata.

Plants evergreen. Rhizomes erect or shortly ascending, clothed with dark brown, lanceolate scales at apices and stipe bases. Fronds caespitose; fertile fronds (10–)30–38(–50) cm; stipe dark brown at base, upward stramineous, 8–14(–18) cm, 1–1.5 mm in diam. at base, clothed with blackish brown short glandular hairs and brown small scales; lamina pinnate, lanceolate, (7–)22–28(–32) × (2.5–)3–4.5(–7) cm, base slightly narrowed, apex acuminate; pinnae 16–18 pairs, alternate, subspreading, stalked (stalk ca. 1 mm), basal 1 or 2 pairs of pinnae slightly shortened, inclined or recurved; middle pinnae oblong, (1–)2–2.5(–3.5) cm × (5–)6–7(–12) mm, base extremely inequilateral, prominently auriculate on acroscopic side, shortly toothed, obtuse at apex, auricles lingulate-oblong or subtriangular, 4–7 mm, cuneate on basicopic side of pinna, margin deltoid-lobed or repand-toothed, entire or somewhat repand to dentate, apex obtuse. Veins inconspicuous adaxially, visible abaxially, pinnate in pinnae, lateral veins 8–10 pairs, usually forked, but pinnate in auriculate lobes. Lamina papery when dried, yellowish brown or greenish brown, glabrate on both surfaces; rachis stramineous, with sparse blackish brown or dark brown short glandular hairs. Sori large, mostly horseshoe-shaped or orbicular-reniform, sometimes J-shaped at pinna apex, suprasedial on acroscopic veins, biseriate along both sides of costa, frequently 2–5 in auriculate lobes; indusia brown, large, horseshoe-shaped or orbicular-reniform, sometimes J-shaped, membranous, erose at margin, persistent. Perispore with few folds, slightly spinulose on surface.  $2n = 160$ .

Evergreen broad-leaved forests, shrub groves, on rocks, stream-sides in valleys; 1300–3400 m. Taiwan, SE Xizang, Yunnan [Bhutan, N India, Japan, Nepal].

**16. *Athyrium zhenfengense*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(3): 151. 1986.

贞丰蹄盖蕨 zhen feng ti gai jue

Rhizomes short, stout, erect, clothed with brown, lanceolate scales at apex and stipe bases. Fronds caespitose; fertile

fronds 20–25 cm; stipe brown at base, upward brown-stramineous, 6–10 cm, 1–1.5 mm in diam. at base, upward with sparse small scales and brownish short glandular hairs; lamina pinnate, lanceolate, 14–17 × 3–4 cm at middle, base not narrowed, apex acuminate, slightly caudate; pinnae 13–15 pairs, alternate, ascending, with stalk 1–1.5 mm, basal 1 or 2 pairs of pinnae falcate-oblong, similar to upper pinnae; middle pinnae 2–2.5 cm × 6–8 mm, apex shortly acute and shortly toothed, base markedly inequilateral, auriculate on acroscopic side, parallel to rachis, auricles 6–7 × ca. 3 mm, basicopic side of pinnae cuneate, cut into triangular teeth at margin, apex rounded and with few small teeth. Veins visible adaxially, clearly visible abaxially, pinnate or 2- or 3-forked on auricles or segments, simple. Lamina papery when dried, glabrate, brown adaxially, yellow-green abaxially; rachis brown-stramineous, with sparse brownish small scales and short glandular hairs. Sori sub-orbicular, inframedial on acroscopic veins, 1–3 sori per segment, often 2 or 3 pairs in auriculate lobes; indusia dark brown, J-shaped or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface with prominent folds.

- Valley forests; 1500–1600 m. SW Guizhou (Zhenfeng).

*Athyrium zhenfengense* is very similar to *A. nakanoi* but differs by the pinnae acute at apex, auriculate lobes with small teeth at apex, and short glandular hairs on rachis brown, not blackish or dark brown.

**17. *Athyrium bucahwangense*** Ching in C. Y. Wu, Fl. Xizang. 1: 132. 1983.

圆果蹄盖蕨 yuan guo ti gai jue

Rhizomes short, stout, ascending, apex clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds 20–80 cm; stipe brown, up to 25 cm, 2.5–3 mm in diam., base scaly, upward glabrate; lamina 2-pinnate to 3-pinnate-pinnatifid, ovate-triangular, ca. 35 × 30 cm at base, base broadly ovate, apex shortly acuminate; pinnae 10–12 pairs, alternate, ascending, stalked (stalk 5–12 mm), basal 2 or 3 pairs of pinnae equal in size, oblong-lanceolate, 15–16 × 5–8 cm, base equilateral, truncate, 2-pinnate-pinnatifid, apex long acuminate; pinnules ca. 15 pairs, alternate, spreading, stalked (stalk 1–2 mm), deltoid-lanceolate, middle pinnules 2.3–4 × 1.4–2 cm, base inequilateral, auriculate on acroscopic side, cuneate on basicopic side, pinnate, apex obtuse; secondary pinnules 7 or 8 pairs, basal acroscopic one larger, ovate, 8–9 mm, pinnatifid; others oblong, ca. 4 × 1.5–2.5 mm, subentire or slightly toothed, obtuse-rounded at apex; segments entire or sparsely crenulate with 1 or 2 teeth; upper pinnae gradually narrower, lower pinnules not shortened; distal pinnae lanceolate, auriculate at acroscopic base. Veins ± visible adaxially, clearly visible abaxially, pinnate on ultimate pinnules, lateral veins simple or forked on basal acroscopic side. Lamina herbaceous when dried, blackish brown adaxially, pale brown abaxially; rachis and costae brown, glabrate. Sori small, orbicular, on top of basal acroscopic veinlets in segments or suprasedial on acroscopic veins, 1 sorus per segment; indusia brown, orbicular-reniform, elliptic or horseshoe-shaped, membranous, entire, persistent. Perispore surface with few folds.

- Coniferous forests, shrub groves; 1900–3800 m. SE Xizang, NW Yunnan.

**18. *Athyrium erythropodum*** Hayata, Icon. Pl. Formosan. 4: 233. 1914.

红柄蹄盖蕨 hong bing ti gai jue

Rhizomes moderately stout, erect, clothed with pale brown lanceolate scales at apex. Fronds caespitose; fertile fronds ca. 70 cm; stipe (8–)15–40 cm, 1–2 mm in diam., base with sparse lanceolate scales; lamina 2-pinnate, ovate-lanceolate, 25–35 × 10–23 cm, base rounded, apex somewhat abruptly narrowed and acuminate; pinnae ca. 8 pairs, ovate-lanceolate, 10–15 × 2.5–5 cm, with stalk 5–7 mm, basal pinnae subopposite, upper pinnae alternate, ascending, basal pinnae equal to second basal pinnae, base subrounded, equilateral, apex long acuminate; pinnules pinnatifid, ca. 12 pairs, sessile, separated by uniform space, ascending, deltoid-oblong, ca. 3 cm × 7 mm, base slightly auriculate on acroscopic side, parallel to costae, cuneate on basiscopic side, pinnatifid almost to costules, apex shortly acuminate; pinnule segments ca. 6 pairs, oblong, oblique; basal acroscopic segments slightly larger, oblong, ca. 8 × 3 mm, apex acute; veins pinnate in segments, simple, sometimes forked at basal large segments. Lamina herbaceous when dried, rachis on adaxial surface without spines. Sori oblong, sometimes hooked, sitting on acroscopic veins in segments, 1–3 sori per segment; indusia oblong or hooked, membranous, somewhat erose at margin, persistent.

Forests; 1500–2200 m. Taiwan [Philippines].

**19. *Athyrium drepanopterum*** (Kunze) A. Braun ex Milde, Fil. Eur. 49. 1867.

多变蹄盖蕨 duo bian ti gai jue

*Polypodium drepanopterum* Kunze, Linnaea 23: 278, 318. 1850 [*"drepanopteron"*]; *Aspidium drepanopterum* (Kunze) A. Braun ex Mettenius [*"drepanopteron"*]; *A. drepanopterum* var. *decompositum* Christ; *A. eburneum* Wallich ex Kunze; *Asplenium drepanopterum* (Kunze) A. Braun; *A. eburneum* J. Smith; *A. oxyphyllum* Wallich ex Hooker (1860), not J. Smith (1841); *Athyrium eburneum* J. Smith [*"eburnum"*]; *A. micans* Tagawa; *A. mupinense* Christ; *A. niponicum* (Mettenius) Hance var. *elatus* Christ; *A. oxyphyllum* T. Moore ex Beddome; *A. takeoi* (Hayata) Tagawa; *A. veitchii* Christ; ?*A. woodsioides* Christ; *Dryopteris takeoi* Hayata.

Rhizomes short, ascending, apex densely clothed with brown subulate lanceolate scales. Fronds caespitose; fertile fronds (10–)25–90 cm; stipe blackish brown at base, upward stramineous, (2.5–)10–30 cm, 1.5–3 mm in diam., base similarly densely scaly; lamina pinnate or 2-pinnate, oblong-lanceolate, (10–)17–55 × 5–30 cm at middle, apex acuminate; pinnae ca. 16 pairs, alternate, with stalk 1–4 mm, basal pinnae not shortened, spreading, middle pinnae oblong-lanceolate or broadly lanceolate, base inequilateral, auriculate on acroscopic side, parallel to rachis, rounded-truncate on basiscopic side, pinnate to pinnate-pinnatifid, apex acuminate or long acuminate; pinnules pinnatisect, 6–10 pairs, alternate, ascending, approximate or separated by narrow space; basal acroscopic pinnules largest, deltoid-oblong, pinnatifid or pinnatifid; other pinnules oblong or oblong-lanceolate, 7–15 × 3–7 mm at base, base inequilateral, auriculate on acroscopic side,

parallel to costa, adnate to costa, margin subentire or pinnatisect nearly to costule, apex acute and shortly toothed; pinnule segments oblong, 5–6 × 2–3 mm, with 1 or 2 small teeth, acute at apex; veins inconspicuous, lateral veins pinnate, simple. Lamina subherbaceous when dried, glabrate, dark green, shiny adaxially. Sori suborbicular or orbicular-reniform, abaxial, medial on acroscopic veins, 1–5 pairs per segment; indusia brown, small, orbicular-reniform or horseshoe-shaped, membranous, erose at margin, often partly fugacious. Perispore surface prominently with low folds.  $2n = 80, 160$ .

Valleys, forests, wet granite crevices; 700–2500 m. Guizhou, W Sichuan, Taiwan, Xizang, C Yunnan [Bhutan, N India, Myanmar, Nepal, Philippines, Vietnam].

*Athyrium drepanopterum* is very similar to *A. dissitifolium* var. *kulhaitense* but differs by the lamina adaxially shiny and sori indusiate.

**20. *Athyrium fimbriatum*** Hooker ex T. Moore, Index Fil. 185. 1860.

喜马拉雅蹄盖蕨 xi ma la ya ti gai jue

*Asplenium fimbriatum* Hooker, Sp. Fil. 3: 234. 1859–1860, not Kunze (1844).

Rhizomes short, stout, erect, apex densely clothed with dull brown or red-brown, linear-lanceolate scales. Fronds caespitose; fertile fronds (25–)60–80(–130) cm; stipe often pale purplish red, (10–)20–25(–40) cm, (1–)2–3.5(–8) mm in diam., base similarly densely scaly; lamina pinnate, oblong or oblong-lanceolate, (15–)40–50(–80) × (4–)15–30(–40) cm, base ± rounded, apex long acuminate; pinnae pinnatisect to 3-pinnate with secondary pinnules pinnatifid; pinnae 10–12(–20) pairs, alternate, ascending or slightly curved, with stalk 5–10 mm, lower 1 or 2 pairs of pinnae slightly or hardly shortened, middle pinnae lanceolate, 15–30 × 2–3(–10) cm, base inequilateral, auriculate and parallel to rachis on acroscopic side, truncate on basiscopic base, 2-pinnate, apex acuminate, caudate; pinnules 12–14(–22) pairs, alternate, anadromous, ascending, shortly stalked; basal acroscopic pinnules larger, subdeltoid-lanceolate, ca. 3 cm, base parallel to costa; other pinnules oblong-lanceolate, 1.2–2.5 cm × 8–12 mm, base inequilateral, auriculate on acroscopic side and parallel to costa, narrowly cuneate on basiscopic base, pinnatifid nearly to costule, apex shortly acuminate; secondary pinnules 4 or 5 pairs, oblong, 5–6 × 2–3 mm, entire or shortly toothed, apex obtuse, connate to each other by narrow costular wing; veins pinnate in secondary pinnule, lateral veins simple. Lamina papery when dried, pale greenish brown, glabrate; rachis, costae, and costules often pale purplish red, with lanceolate or fibrous scales on abaxial surface. Sori elliptic and horseshoe-shaped, rarely J-shaped, medial on acroscopic veins, 1–3 sori per pinnule, often 3 pairs in basal acroscopic pinnule; indusia brown, large, elliptic and horseshoe-shaped, rarely J-shaped, membranous, erose at margin, persistent. Perispore with few folds.  $2n = 80$ .

Mixed forests; 1600–3800 m. Hunan, Sichuan, SE Xizang, Yunnan [N India, N Myanmar, Nepal].

The epithet was first used in "*Aspidium fimbriatum* Wallich" (Numer. List, no. 339. 1829, nom. nud.), itself a later homonym of *A. fimbriatum* Willdenow (1810).

**21. *Athyrium anisopterum*** Christ, Bull. Herb. Boissier 6: 962. 1898.

宿蹄盖蕨 *su ti gai jue*

*Aspidium fauriei* (Christ) Christ var. *elatius* Christ; *Athyrium kumaonicum* Punetha; ?*A. woodsioides* Christ; *Dryopteris thysanocarpa* Hayata.

Rhizomes short, stout, erect, apex densely clothed with dark brown linear-lanceolate scales. Fronds caespitose; fertile fronds 15–55 cm; stipe brown at base, upward stramineous, 20–25 cm, 1.5–2 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate, pinnate-pinnatifid at middle, upward pinnatifid, narrowly lanceolate, 25–35 × 9–12 cm, base slightly broadened, apex acuminate; pinnae 10–12 pairs, alternate, ascending, with stalk 1–2.5 mm, basal pinnae narrowly subtriangular, 4.5–5 × ca. 2 cm, base inequilateral, auriculate on acroscopic base, cuneate on basispic base, pinnate, apex shortly acute or acute; pinnules ca. 6 pairs, approximate, ascending; basal acroscopic pinnules largest, broadly ovate, ca. 1.5 cm, base subrounded, shallowly pinnatilobate, apex obtuse; pinnule segments entire, other pinnules similar to each other; upper pinnules gradually smaller, connate to each other by narrow wing, subentire; veins visible abaxially, pinnate in pinnules, simple. Lamina herbaceous when dried, yellow-greenish brown, glabrate; rachis and costae abaxially with sparse brown linear-lanceolate scales. Sori large, horseshoe-shaped or J-shaped, uniseriate on each side of midrib, close to costule; indusia pale brown, large, horseshoe-shaped or J-shaped, membranous, erose at margin, persistent. Perispore hyaline, with few folds.  $2n = 80$ , 160.

Rock crevices in forests, damp areas at streamsides; 1100–2500 m. Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan [India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam].

*"Athyrium thysanocarpum"* (Hayata, Icon. Pl. Formosan. 4: 160. 1914) belongs here but was merely cited as a synonym and was not therefore validly published (*Melbourne Code*, Art. 36.1(c)).

**22. *Athyrium foliolosum*** T. Moore ex R. Sim, Priced Cat. Ferns 6: 22. 1859.

大盖蹄盖蕨 *da gai ti gai jue*

*Asplenium fimbriatum* Kunze var. *foliosum* C. B. Clarke; *A. foliosum* (C. B. Clarke) C. Hope; *Athyrium austroyunnanense* Ching; *A. fimbriatum* Hooker ex T. Moore var. *foliosum* (C. B. Clarke) Beddome; *A. submacrocarpum* Ching & S. K. Wu.

Rhizomes short, erect, apex densely clothed with dark brown, lanceolate or narrowly lanceolate scales. Fronds caespitose; fertile fronds 50–75 cm; stipe dark brown at base, upward stramineous, 22–23 cm, 1.2–2 mm in diam., base similarly scaly, upward sparsely scaly, scales small or glabrate; lamina pinnate to 2-pinnate, oblong-lanceolate or broadly lanceolate, 30–56 × 7–26 cm, base gradually narrowed, apex long acuminate; pinnae 15–18 pairs, alternate, ascending or subspreading, slightly falcate, stalked (stalk 2.5–3 mm), 3 or 4 pairs of lower pinnae gradually shortened; basal pinnae narrowly ovate, 1.4–9 cm, pinnatifid; middle pinnae broadly lan-

ceolate, somewhat falcate, 5–15 cm, base broadened, base inequilateral or subequilateral, subtruncate, auriculate, often overlapping rachis on acroscopic side, narrowly cuneate on basispic base, pinnate, apex long acuminate; pinnules 8–15 pairs, alternate, ascending or subspreading, subsessile; basal acroscopic pinnules largest, ovate-oblong, up to 1.3–2.5 × 0.6–1.2 cm, base equilateral, ± rounded, adnate to costa, or inequilateral, truncate, auriculate on acroscopic side, narrowly cuneate on basispic side, pinnatilobate to pinnatifid, apex obtuse-acute or acute; pinnule segments 4–6 pairs, ascending, deltoid-oblong, subentire, apex obtuse or acute, with 3 or 4 crenations; upper pinnules reduced, 5–10 mm, usually decurrent and connate to wings of costa, sinuate or crenate at margin; veins somewhat visible adaxially, visible abaxially, pinnate in pinnules, lateral veins simple or forked. Lamina herbaceous or nearly papery when dried, glabrate, dark green adaxially, green abaxially; rachis and costae abaxially stramineous or slightly brownish, with sparse short hairs. Sori large, orbicular or rotund, 1 or 2 sori per segment, medial or inframedial; indusia large, mostly horseshoe-shaped or J-shaped, distal indusia pale brown, oblong, membranous, slightly ciliate or subentire at margin, persistent. Perispore hyaline, with few folds.  $2n = 80$ , 160.

Evergreen broad-leaved forests, rock crevices on mountain slopes; 1700–2900 m. Taiwan, SE Xizang, Yunnan [Bhutan, N India, Myanmar, Nepal].

Liu et al. (Fern Fl. Taiwan, 50. 2009) argue that *Athyrium foliolosum* does not occur in Taiwan, where it is replaced by the similar *A. tripinnatum*.

The specific epithet was based on *"Asplenium foliolosum"* (Wallich, Numer. List, no. 2205. 1830), which is a nomen nudum and was not therefore validly published (*Melbourne Code*, Art. 38.1(a)). Wallich's no. 2205 included several specimens with different collection details. Some, with purplish rachises and small indusia, match *Athyrium fimbriatum*, whereas others, with stramineous rachises and large indusia, belong to *A. foliolosum*. *"Aspidium squarrosus"* (Wallich, Numer. List, no. 356. 1829), not D. Don (1825), is another nomen nudum that belongs here.

**23. *Athyrium sericellum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 17. 1986.

绢毛蹄盖蕨 *juan mao ti gai jue*

Rhizomes short, erect, apex densely clothed with thick, lanceolate, brown scales. Fronds caespitose; fertile fronds 34–42 cm; stipe stramineous, up to 14 cm, ca. 2 mm in diam., base similarly densely scaly, upward glabrate; lamina 2-pinnate, broadly lanceolate, 20–28 × 8–11 cm at middle, base slightly narrowed, apex acuminate and toothed; pinnae 14–18 pairs, lower pinnae opposite; upper pinnae alternate, spreading, subsessile, 1 or 2 pairs of lower pinnae slightly shortened, 3.5–5 cm, slightly reflexed; middle pinnae lanceolate, 5–6.5 × 1.2–1.5 cm, base equilateral, subtruncate or rounded-truncate, broadened, pinnatifid 1/2–2/3 to costa or almost to costa, apex acuminate; pinna segments ca. 13 pairs, approximate, slightly ascending, oblong, ca. 7 × 3.7 mm, decurrent to wing of costa, margin toothed ca. 1/2 from costa and upward, apex obtuse; veins visible abaxially, pinnate in segments, lateral veins ca. 5 pairs, simple. Lamina papery when dried, brown-green, densely sericeous adaxially, abaxially glabrate except

costae densely sericeous. Rachis stramineous, grooved adaxially, densely pilose. Sori oblong, basal acroscopic ones often horseshoe-shaped, inframedial; indusia brownish, oblong or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

- Shrubby woods; ca. 1700 m. Chongqing (Jinfo Shan).

**24. *Athyrium suprapubescens*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 10. 1986 [*“suprapubescense”*].

上毛蹄盖蕨 shang mao ti gai jue

Rhizomes short, erect, apex densely clothed with dark brown, linear-lanceolate scales. Fronds caespitose; fertile fronds ca. 35 cm; stipe blackish brown at base, upward stramineous, ca. 12 cm, ca. 2.5 mm in diam., base similarly scaly, upward glabrate; lamina nearly 2-pinnate, oblong-lanceolate, up to 25 × ca. 12 cm at middle, base not narrowed, apex acuminate; pinnae ca. 16 pairs, lower pinnae subopposite; upper pinnae alternate, spreading, sessile, basal pair slightly shortened, narrowed toward base; middle pinnae falcate-lanceolate, up to 7 × ca. 1.5 cm at base, base equilateral, truncate, pinnatifid almost to costa, apex acuminate; pinnules ca. 15 pairs, alternate, approximate, spreading, decurrent to wing of costa; lower pinnae suboblong, ca. 8 × 4–5 mm, base slightly decurrent on basiscopic side, margin subentire, apex broadly rounded and with small teeth; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins ca. 5 pairs, usually simple, basal acroscopic veins often forked. Lamina papery when dried, greenish brown, densely pubescent with brown short hairs on adaxial surface, glabrate abaxially. Rachis stramineous, grooved and with dense pallid short hairs adaxially, costae pale purplish red, glabrate abaxially. Sori oblong, on basal acroscopic veins, 3 or 4 pairs per pinnule, biseriate on both sides of costule, inframedial; indusia brownish, oblong, membranous, entire, persistent. Perispore surface without folds.

- Forests; 1800–1900 m. N Guizhou, SW Sichuan.

**25. *Athyrium hainanense*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(2): 101. 1986.

海南蹄盖蕨 hai nan ti gai jue

Rhizomes ascending, apex densely clothed with dark brown, linear-lanceolate scales. Fronds caespitose; fertile fronds (30–)40–50 cm; stipe blackish brown at base, upward stramineous, 25–30 cm, ca. 3.5 mm in diam., base similarly scaly, slightly swollen, but not sharpened toward very base, upward glabrate; lamina 2-pinnate, deltoid-ovate, 16–24 × 12–20 cm at base, base almost not narrowed, rounded-truncate, apex abruptly narrowed; pinnae under abruptly narrowed apex 6 or 7 pairs, opposite or subopposite, slightly ascending, with short stalk ca. 1.5 mm or sessile; basal pinnae slightly shortened, oblong-lanceolate, up to 13 × ca. 4.5 cm, base abruptly narrowed, pinnate, apex acuminate; pinnules ca. 14 pairs, basal pinnae subopposite, upper pinnae alternate, spreading, approximate; basal 1 or 2 pairs of pinnules free, others adnate to costa; basal third to fifth basiscopic pinnules longest, oblong-lanceolate, ca. 2.8 cm × 8 mm at middle, pinnatifid, apex acute or obtuse-rounded; pinnule segments toothed at margin, acroscopic pinnules slightly shorter, narrowly oblong, ca. 1.5 cm × 5 mm at middle, apex obtuse-rounded; second basal pinnae slightly

longer than basal pinnae; third basal pinnae subequal to basal pinnae, but broader, not narrowed at base; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 10–13 pairs, basal veins forked, upper veins simple, but pinnate in basal acroscopic pinnule segments. Lamina thickly papery when dried, brown-green, glabrate on both surfaces; rachis and costae abaxially brown-stramineous, with dense brownish short glandular hairs. Sori oblong, on basal acroscopic veins, only 1 per segment, biseriate on both sides of midrib, single, occasionally double, inframedial; indusia brown, similar to sori in shape, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.

- Forests on mountain slopes; 1500–1800 m. Hainan (Wuzhi Shan).

**26. *Athyrium pachyphyllum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(2): 102. 1986.

裸囊蹄盖蕨 luo nang ti gai jue

*Athyrium xiangxiense* S. F. Wu.

Rhizomes short, erect or ascending, apex densely scaly; scales red-brown, linear-lanceolate, apex fibriform. Fronds caespitose; fertile fronds (20–)35–78 cm; stipe brown at base, upward stramineous, shiny, (8–)15–30 cm, (1–)2–2.5 mm in diam., base similarly densely scaly, upward glabrate; lamina pinnate, oblong-lanceolate, (12–)20–35 × (3.5–)7–9 cm, base slightly narrowed, apex acuminate; pinnae (7 or)8–12 pairs, alternate, ascending, subsessile, basal 1 or 2 pairs of pinnae slightly shortened, base slightly narrowed; middle pinnae oblong-lanceolate, (1.8–)5.5–6 × 1.5–2 cm, base subequilateral, rounded-truncate, broadened, pinnatifid to 1/2–2/3, apex shortly acuminate; pinna segments 10–12 pairs, basal segments subopposite, upper segments alternate, approximate, slightly ascending, oblong, 3–4 × 2.5–3 mm, minutely toothed, apex obtuse-rounded; veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 3 or 4 pairs, oblique, simple. Lamina papery when dried, brown, glabrate, rachis stramineous, rachis and costae with sparse brownish short glandular hairs abaxially. Sori shortly linear or oblong, occasionally J-shaped or elliptical, 2 or 3 pairs per segment; indusia degenerate. Perispore surface without folds, with granular ornamentation.

- Evergreen broad-leaved forests; 400–1500 m. N Guangxi, S Guizhou, Hunan, SE Yunnan.

*Athyrium pachyphyllum* is very similar to *A. wangii* in frond morphology. However, *A. pachyphyllum* is different from *A. wangii* by the nearly exindusiate mature sori (it was incorrectly described as “exindusiate” by the original author).

**27. *Athyrium wangii*** Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 279. 1949.

启无蹄盖蕨 qi wu ti gai jue

Rhizomes short, erect, apex densely clothed with dark brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 30–55 cm; stipe stramineous, 15–20 cm, 2–3 mm in diam., base similarly scaly, upward glabrate; lamina oblong-lanceolate, 20–35 × 7–14 cm, pinnate or pinnate-pinnatifid, apex pinnatifid-acuminate; pinnae 8–14 pairs, alternate, shortly stalked, lanceolate, 3.5–8 × ca. 1.5 cm at middle, base rounded-truncate, slightly inequilateral, ± adnate to costa, slightly decurrent, pin-

natipartite to 1/2–1/3, apex acuminate; pinna segments 10–15 pairs, densely closed, ascending, oblong, 3–4(–8) × 2.5–4 mm, margin toothed, apex obtuse; veins visible abaxially, inconspicuous adaxially, pinnate in segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina papery when dried, greenish brown, glabrate; rachis and costae on abaxial side with sparse brownish glandular hairs. Sori shortly linear, sometimes J-shaped, rarely horseshoe-shaped, 2–5 pairs per segment, medial; indusia shortly linear, J-shaped, rarely horseshoe-shaped, thickly membranous, entire, persistent. Perispore surface without folds.

- Evergreen forests; 1000–1500 m. Hainan, S Yunnan.

**28. *Athyrium melanolepis*** (Franchet & Savatier) Christ, Bull. Herb. Boissier 4: 668. 1896.

黑鳞蹄盖蕨 hei lin ti gai jue

*Asplenium melanolepis* Franchet & Savatier, Enum. Pl. Jap. 2: 226, 625. 1879; *Athyrium filix-femina* (Linnaeus) Roth subsp. *melanolepis* (Franchet & Savatier) Á. Löve & D. Löve; *A. filix-femina* var. *melanolepis* (Franchet & Savatier) Makino; *A. filix-femina* var. *nigropaleaceum* Makino.

Rhizomes erect or ascending. Fronds caespitose; fertile fronds 70–100 cm; stipe blackish brown at base, upward stramineous, 25–35 cm, base ca. 4 mm in diam., densely clothed with black, lanceolate thickly membranous scales, upward with sparse black, shiny, ovate-lanceolate thickly membranous scales; lamina 2-pinnate-pinnatifid, oblong, 60–65 × 20–25 cm at middle, base gradually narrowed, apex acuminate; pinnae ca. 22 pairs, basal pinnae subopposite, upper pinnae alternate, ascending, subsessile, basal 2–6 pairs of pinnae gradually shortened, basal pinnae 4–5 cm; middle pinnae linear-lanceolate, 17–19 × 2.5–3 cm, base equilateral, rounded-truncate, pinnate-pinnatifid, apex long acuminate; pinnules ca. 22 pairs, subopposite, subspreading, broadly lanceolate, 1.2–1.5 cm × ca. 4 mm at base, base rounded-cuneate, slightly adnate to costa, pinnatifid to 2/3, apex acute; pinnule segments rectangular, oblique, apex obtuse-rounded and with 3–5 teeth; veins inconspicuous adaxially, visible abaxially, 1 or 2 pairs per segment, simple. Lamina herbaceous when dried, pale greenish brown, glabrate on both surfaces; rachis and costae on abaxial surface stramineous, rarely with brown lanceolate small scales. Sori oblong or J-shaped, inframedial, on basal acroscopic veins (but often 2 or 3 in basal pinnule segments), 5–7 pairs per pinnule, biseriate on both sides of costules; indusia brown, oblong or J-shaped, membranous, somewhat erose-like at margin, persistent. Perispore surface without folds.  $2n = 80$ .

Forests, rare. Heilongjiang, Jilin [Japan, Korea].

**29. *Athyrium brevifrons*** Nakai ex Tagawa, Col. Illustr. Jap. Pteridoph. 180. 1959.

东北蹄盖蕨 dong bei ti gai jue

Based on *Athyrium filix-femina* (Linnaeus) Roth var. *longipes* Hara, Bot. Mag. (Tokyo) 48: 691. 1959; *A. acutidentatum* Ching; *A. changbaishanense* Ching & J. J. Chien; *A. dai-lingense* Ching; *A. hebeiense* Ching.

Rhizomes short, erect or ascending, apex densely clothed with dark brown, lanceolate, large scales. Fronds caespitose; fertile fronds 35–120 cm; stipe blackish brown at base, upward

stramineous or pale purplish red, 15–55 cm, base 2.5–4(–6) mm in diam., similarly densely scaly, upward glabrate, with sparse brownish small scales; lamina 2-pinnate, ovate to ovate-lanceolate, 20–65 × 20–35 cm at middle, base rounded-truncate and hardly narrowed, apex acuminate; pinnae 15–18 pairs, basal 1 or 2 pairs of pinnae opposite, upper pinnae alternate, ascending, subsessile or shortly stalked (stalk ca. 2 mm), 1 or 2 pairs of pinnae not or slightly shortened, 10–20 cm; middle pinnae lanceolate to linear-lanceolate, 12–20 × 3–6 cm, base subequilateral, truncate or rounded-cuneate on basisopic side, pinnate, apex long acuminate; pinnules 18–28 pairs, basal pinnules subopposite, broadly lanceolate; upper pinnules alternate, subspreading, subsessile, lanceolate to falcate-lanceolate, 1.5–3 cm × 5–9 mm at base, base subequilateral, slightly auriculate on acroscopic side, broadly cuneate on basisopic side, decurrent and slightly adnate to costae, pinnatifid to 1/2–2/3, apex acuminate or acute; pinnule segments 10–15 pairs, subtriangular, oblong, or lanceolate, oblique, toothed at apex and margin; veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 2–4 pairs, oblique, simple. Lamina thickly herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae brownish stramineous or pale purplish red, with sparse brownish, squarrose glandular hairs abaxially. Sori oblong, J-shaped, or horseshoe-shaped, inframedial on basal acroscopic veins, single per segment, often 2 or 3 pairs per basal large segments; indusia brownish, oblong, J-shaped, or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80^*$ .

Broad-leaved forests, mixed forests; 300–2100 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, N Shandong, Shanxi [Japan, Korea, E Russia].

*Athyrium brevifrons* is very close to *A. rubripes*, but their relationship is still in need of investigation.

The name "*Athyrium brevifrons* Naki" used for this taxon in FRPS (3(2): 162. 1999) was ascribed to Kitagawa (Rep. First Sci. Exped. Manchoukuo Sect. 4(2): 75. 1935), but that is a nomen nudum, as are most other citations given in FRPS. However, by including the valid taxon *A. filix-femina* (Linnaeus) Roth var. *longipes* as a synonym, Tagawa effectively validated the binomial *Athyrium brevifrons* Nakai ex Tagawa. The name *A. multidentatum* (Döll) Ching, based on *Aspidium filix-femina* Swartz var. *multidentatum* Döll, has been included within this taxon and would have priority, but Ching indicated that the inclusion was based on a misapplication of the name by Fomin (Fl. Sibir. Orient. Extremi 5: 108. 1930). Döll's protologue has not been seen, but if, as seems likely, it was based on European material Ching's interpretation would seem correct. "*Athyrium extensum*" (Ching in Y. L. Zhang et al., Sporae Pterid. Sin. 209. 1976) belongs here but was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**30. *Athyrium rubripes*** (Komarov) Komarov, Izv. Kievsk. Bot. Sada 13: 145. 1931.

黑龙江蹄盖蕨 hei long jiang ti gai jue

*Athyrium filix-femina* (Linnaeus) Roth var. *rubripes* Komarov, Izv. Imp. S.-Peterburgsk. Bot. Sada 16: 149. 1916.

Rhizomes short, stout, erect, apex clothed with dark brown, broadly lanceolate scales. Fronds caespitose; fertile fronds 50–65 cm; stipe blackish brown at base, upward pink,

shiny, 20–28 cm, base 1.5–2 mm in diam., similarly scaly, upward glabrate; lamina 2-pinnate, oblong-lanceolate, 30–40 × 12–14 cm at middle, base slightly narrowed, apex acuminate; pinnae ca. 15 pairs, subalternate, ascending, subsessile, basal 2 or 3 pairs of pinnae slightly shortened, basal pinnae ca. 3 cm; middle pinnae lanceolate, 8–10 × 1.7–2 cm, base truncate or narrowly cuneate on basiscopic side, pinnate, apex acuminate; pinnules 12–20 pairs, subopposite, subspreading, oblong, 8–12 × 3–4 mm, base subtruncate on acroscopic side, narrowly cuneate on basiscopic side, decurrent and adnate to wing of costa (sometimes basal 1 or 2 pairs of pinnules free), cut to 1/3, apex acute or obtuse; pinnule segments 5–7 pairs, suboblong, with 3 or 4 small teeth at apex; veins visible on both surfaces, costules impressed adaxially, protuberant abaxially, lateral veins 2- or 3-forked in segments, pinnate in basal acroscopic segments, single per tooth, extending to tooth tip. Lamina thinly herbaceous when dried, green or yellow-green, glabrate on both surfaces; rachis and costae stramineous, slightly pink, abaxially with sparse small scales and squarrose-glandular hairs. Sori oblong, 4 or 5 pairs per pinnule, inframedial, uniseriate on each side of midrib; indusia brownish, mostly oblong, occasionally J-shaped or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds.

Coniferous forests; ca. 800 m. NE Heilongjiang [E Russia].

**31. *Athyrium sinense*** Ruprecht, Dist. Crypt. Vasc. Ross. 41. 1845.

中华蹄盖蕨 *zhong hua ti gai jue*

*Athyrium brevifrons* Nakai ex Kitagawa var. *angustifrons* (Kodama) T. Mori; *A. huhsienense* Ching & Y. P. Hsu; *A. melanolepis* (Franchet & Savatier) Christ var. *angustifrons* Kodama; *A. shaanxiense* Ching & Y. T. Hsieh [*“shaanxiense”*].

Rhizomes short, erect, apex densely clothed with dark brown, ovate-lanceolate or lanceolate scales. Fronds caespitose; fertile fronds 35–92 cm; stipe blackish brown at base, upward stramineous, 10–26 cm, base 1.5–2 mm in diam., similarly densely scaly, upward with sparse small scales; lamina 2-pinnate, oblong-lanceolate, 25–65 × 15–25 cm, base slightly narrowed, apex shortly acuminate; pinnae ca. 15 pairs, basal pinnae subopposite, upper pinnae alternate, ascending, sessile, basal 2 or 3 pairs of pinnae slightly shortened; basal pinnae oblong-lanceolate, 7–12 × ca. 2.5 cm, base equilateral, truncate or ± rounded, pinnate, apex long acuminate; pinnules ca. 18 pairs, basal pinnules narrowly deltoid-oblong, 8–10 × 3–4 mm, base inequilateral, truncate on acroscopic side, basiscopic side broadly cuneate, decurrent and adnate to wing of costa, pinnatifid, apex obtuse; pinnule segments 4 or 5 pairs, ± rounded, margin with several short teeth; veins visible on both surfaces, pinnate in pinnules, lateral veins ca. 7 pairs, 3-forked or pinnate in basal segments, forked or simple in upper segments. Lamina herbaceous when dried, pale greenish brown, glabrate on both surfaces; rachis and costae stramineous, with sparse small scales and squarrose-glandular hairs abaxially. Sori mostly oblong, occasionally J-shaped or horseshoe-shaped, inframedial on basal acroscopic veins, 6 or 7 pairs per pinnule, uniseriate on each side of midrib; indusia brownish, oblong, occasionally J-shaped or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds.

• Mountain forests; 300–2600 m. SE Gansu, Hebei, W Henan, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi.

*Athyrium sinense* is very similar to *A. dentigerum* in frond morphology; it differs from *A. dentigerum* by the 2 or 3 (or 4) pairs of shortened basal pinnae.

*Athyrium filix-femina* (Linnaeus) Roth s.l. of China occurs widely from NE to SW China. In fact, it included *A. brevifrons*, *A. sinense*, and *A. dentigerum*. Mature plants of the three species differ morphologically and geographically. *Athyrium brevifrons* occurs in NE and N China; only the basal 1 or 2 pairs of pinnae are slightly shortened, and the stipes are relatively markedly long. *Athyrium dentigerum* occurs in SW China; its numerous lower pinnae are gradually shortened toward the base, and the stipes are very short. Qin Ling plants of *A. sinense* are morphologically and geographically intermediate between *A. brevifrons* and *A. dentigerum*: in *A. sinense* several pairs of pinnae are slightly shortened toward the base. The three are probably subspecies of one species, pending further analysis. All three species are different from European *A. filix-femina*.

**32. *Athyrium attenuatum*** (Wallich ex C. B. Clarke) Tagawa, Acta Phytotax. Geobot. 16: 177. 1956.

剑叶蹄盖蕨 *jian ye ti gai jue*

*Asplenium filix-femina* (Linnaeus) Bernhardt var. *attenuatum* Wallich ex C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 492. 1880; *Athyrium ensiferum* Ching & H. S. Kung; *A. filix-femina* (Linnaeus) Roth var. *attenuatum* (Wallich ex C. B. Clarke) Beddome.

Rhizomes short, erect, apex densely clothed with red-brown, broadly lanceolate scales. Fronds caespitose; fertile fronds 35–60 cm; stipe upward stramineous, 5–17 cm, base ca. 2 mm in diam., similarly densely scaly, upward glabrate; lamina pinnate or 2-pinnate, lanceolate, up to 44 × 7–9 cm at middle, base gradually narrowed, apex acuminate; pinnae ca. 30 pairs, alternate, spreading, sessile, 7 or 8 pairs of lower pinnae gradually shortened, basal pinnae ca. 1.2 cm, apex obtuse, slightly reflexed; middle pinnae longest, linear-lanceolate, up to 4.5 × ca. 1 cm, base subtruncate, slightly widened, pinnatifid almost to costae, apex acuminate; pinna segments ca. 14 pairs, subspreading, oblong, ca. 4.5 × 2.2 mm, basal segments slightly larger, connate to each other by narrow wing along costa, subentire at margin, apex obtuse and with 4 or 5 long teeth; veins visible abaxially, forked in segments. Lamina papery when dried, pale green, glabrate; rachis and costae stramineous abaxially, with very short subulate processes on adaxial side in upper part, squarrose-glandular hairs sparse abaxially. Sori oblong, basal acroscopic 2 or 3 pairs often horseshoe-shaped, 2 or 3 pairs per pinna segment; indusia brownish, oblong or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80$ .

Meadows on gentle mountain slopes; 2000–2400 m. W Sichuan, Yunnan [Afghanistan, Bhutan, N India, Kashmir, Nepal, Pakistan].

It remains to be clarified whether *Athyrium attenuatum* is distinct from *A. dentigerum* or its ecotype in alpine meadows.

**33. *Athyrium tarulakaense*** Ching, Acta Bot. Boreali-Occid. Sin. 6(1): 12. 1986.

察陇蹄盖蕨 *cha long ti gai jue*

Rhizomes ascending, apex densely scaly; scales chestnut-brown in center, brown at margin, lanceolate. Fronds caespitose; fertile fronds 60–70 cm; stipe blackish brown at base, upward brown-stramineous, 20–25 cm, base 5–6.5 mm in diam., similarly scaly, upward occasionally with small scales; lamina bipinnatifid, broadly lanceolate or oblong-lanceolate, 40–50 × 9–12 cm, base abruptly narrowed, apex acuminate; pinnae 20–22 pairs, subopposite or alternate, spreading or ascending, sessile, 3 or 4 pairs of lower pinnae gradually shortened; basal pinnae often deltoid-auriculate, 1–2 cm; middle pinnae lanceolate, 7–8 × ca. 1.5 cm, base truncate, pinnatifid nearly to costa, apex acuminate; pinnules or pinna segments 15–18 pairs, basal pinnules subopposite, upper pinnules alternate, spreading, narrowly oblong, 6–8 × ca. 3 mm, margin lobate, apex rounded and crenate; segments with inconspicuous teeth at apex; veins visible adaxially, clearly visible abaxially, pinnate in pinnules or pinna segments, lateral veins 4 or 5 pairs, simple. Lamina firmly papery when dried, brown, glabrate on both surfaces; rachis and costae on abaxial surface brown-stramineous, with sparse brown small scales and squarrose-glandular hairs. Sori oblong, occasionally J-shaped or horseshoe-shaped, inframedial on acroscopic veins, 2–5 pairs per pinnule or segment; indusia brownish, oblong, occasionally J-shaped or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

• Margins of coniferous forests, rock crevices in forests, rare; 2800–3400 m. NW Yunnan.

**34. *Athyrium contingens*** Ching & S. K. Wu in C. Y. Wu, Fl. Xizang. 1: 134. 1983.

短羽蹄盖蕨 *duan yu ti gai jue*

Rhizomes erect. Fronds caespitose; fertile fronds ca. 35 cm; stipe blackish brown at base, upward stramineous, up to 13 cm, ca. 2 mm in diam., base clothed with brown, narrowly ovate scales, upward glabrate; lamina pinnate or pinnate-pinnatifid, narrowly rhombic, 22–26 × 6.5–7 cm at middle, gradually narrowed toward both ends, apex acuminate; pinnae 24–26 pairs, alternate, spreading, sessile, lower 6 pairs of pinnae gradually shortened; basal pinnae oblong, less than 1 cm; middle pinnae broadly lanceolate, 11–13 × ca. 1 cm at middle, base equilateral, truncate, broadened, pinnatifid, apex shortly acuminate; pinna segments 12–14 pairs, spreading, approximate, oblong, ca. 5 × 2.5 mm, margin lobed or biserrate, apex rounded and with 2 or 3 small teeth; veins visible abaxially, pinnate in segments, lateral veins 3 or 4 pairs, forked or simple. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis stramineous, adaxial surface with short glandular hairs, costae pale purplish red, with squarrose-glandular hairs abaxially. Sori oblong, occasionally hooked, 3 or 4 in lower segments, 1 or 2 in upper segments, medial; indusia pallid, oblong, occasionally hooked, thinly membranous, ciliate at margin, persistent. Perispore surface without folds.

• Meadows at mountain summits, among rocks, streamsides in alpine mountains; 3100–4200 m. W Sichuan, Xizang.

*Athyrium contingens* is similar to *A. filix-femina* but differs by the lamina rhombic or elliptic, middle pinnae broadly lanceolate and approximate, and indusia pallid and thinly membranous.

**35. *Athyrium nudifrons*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(3): 158. 1986.

滇西蹄盖蕨 *dian xi ti gai jue*

Rhizomes short, erect or ascending. Fertile fronds up to 1.5 m; stipe chestnut-black at base, upward stramineous, 50–60 cm, ca. 4 cm in diam., base densely clothed with brown, lanceolate large scales, upward glabrate; lamina 2-pinnate-pinnatifid, oblong, up to 85 × 40–45 cm, base narrowed, apex long acuminate; pinnae ca. 25 pairs, lower pinnae subopposite, upper pinnae alternate, ascending, subsessile; basal 2 or 3 pairs of pinnae slightly shortened, basal pinnae ca. 9 × 2.5 cm; middle pinnae lanceolate, 23–28 × 5–6 cm at middle, base equilateral, truncate, pinnate-pinnatifid, apex long acuminate; pinnules 22–26 pairs, alternate, spreading, oblong-lanceolate, 2.5–3 cm × 8–10 mm at base, base subequilateral, ± decurrent and connate to each other by wing of costa, pinnatifid to 1/2, apex acute; pinnule segments 8 or 9 pairs, oblong, dentate at apex; veins visible adaxially, clearly visible abaxially, pinnate in segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina firmly herbaceous when dried, greenish brown adaxially, yellow-green abaxially, glabrate on both surfaces; rachis and costae abaxially stramineous, with sparse short hairs. Sori suborbicular or elliptic, inframedial on basal acroscopic veins, single per segment, often 2 or 3 in basal acroscopic larger segments, biseriate on both sides of costule, 6–10 pairs per pinnule; indusia pale brown, somewhat J-shaped or horseshoe-shaped, sometimes shortly linear, membranous, erose at margin, occasionally ciliate, persistent. Perispore surface without folds.

• In shrubs, streamsides, damp areas; ca. 3200 m. Yunnan.

**36. *Athyrium nephrodioides*** (Baker) Christ, Bull. Soc. Bot. France 52(Mém. 1): 47. 1905.

疏羽蹄盖蕨 *shu yu ti gai jue*

*Asplenium nephrodioides* Baker, J. Bot. 25: 170. 1887; *?Athyrium filix-femina* (Linnaeus) Roth var. *filipes* Christ.

Rhizomes short, erect, apex densely clothed with chestnut-brown, subulate-lanceolate scales. Fronds caespitose; fertile fronds 45–55 cm; stipe chestnut-black at base, upward brown-stramineous, 10–15 cm, base ca. 2.5 mm in diam., similarly densely scaly, upward glabrate; lamina bipinnatifid, linear-lanceolate, 35–55 × 11–14 cm, base narrowed, apex acuminate; pinnae 20–25 pairs, alternate, spreading or subsessile, widely separated from each other, sessile, lower 6 or 7 pairs of pinnae gradually shortened and narrowly triangular, basal pinnae 1.7–2 cm; middle pinnae linear-lanceolate, 6–9 × 1–1.2 cm, base subtruncate or slightly auriculate on basispic side, pinnatifid nearly to costae, apex long acuminate; pinna segments 20–25 pairs, basal segments opposite, upper segments alternate, subspreading, narrowly separated from each other, oblong, 4–6 × ca. 2 mm, apex obtuse or acute and toothed; veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 4 or 5 pairs, oblique, forked or simple. Lamina firmly papery when dried, yellowish brown, glabrate on both surfaces; rachis brown-stramineous, with sparse few small scales, costae with sparse squarrose-glandular hairs abaxially. Sori elliptic or orbicular, 3–5 pairs per segment, often borne in all segments;

indusia brownish, orbicular, J-shaped, or horseshoe-shaped, membranous, erose or ciliate at margin, partly caducous. Perispore surface without folds, but with granular ornamentation.

• Forests; 2500–3200 m. Gansu (Xinglong Shan), Hubei (Badong), Sichuan, Yunnan.

**37. *Athyrium adscendens*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(2): 100. 1986.

斜羽蹄盖蕨 xie yu ti gai jue

Rhizomes erect, apex densely clothed with dark brown, narrowly lanceolate scales. Fronds caespitose; fertile fronds 60–70 cm; stipe blackish brown at base, upward brown-stramineous, shiny, 18–27 cm, ca. 3 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate, lanceolate, 36–40 × 6–7 cm, base slightly narrowed, apex shortly acuminate; pinnae 20–25 pairs, alternate, ascending, sessile; basal 2 or 3 pairs of pinnae slightly shortened, broadly lanceolate, 3–5 cm; middle pinnae lanceolate, falcate, 5.5–6 × ca. 1.8 cm at base, base equilateral, truncate, pinnate, apex acuminate; pinnules ca. 16 pairs, spreading; basal pinnules slightly larger, narrowly oblong, 7–10 × ca. 3 mm, obtuse, with 2 or 3 short teeth at apex, subequilateral, decurrent and adnate to wing of costa; upper pinnules gradually reduced, somewhat auriculate on basal acroscopic side; veins visible abaxially, pinnate in pinnules, lateral veins 5 pairs, simple, sometimes lower veins forked. Lamina papery when dried, glabrate, dark brown adaxially, pale brown abaxially; rachis brown-stramineous, with squarrose-glandular hairs abaxially, costae brown, glabrate abaxially. Sori oblong, distal sori J-shaped or horseshoe-shaped, inframedial on acroscopic veins, 4–6 pairs per pinnule; indusia pale brown, oblong, J-shaped, or horseshoe-shaped, membranous, subentire, erose, or ciliate at margin, persistent. Perispore surface without folds, with granular ornamentation.

• Shrub groves, meadows; 3000–3200 m. W Sichuan (Daxiangling, Emei Shan).

**38. *Athyrium dentigerum*** (Wallich ex C. B. Clarke) Mehra & Bir, Amer. Fern J. 50: 279. 1960.

希陶蹄盖蕨 xi tao ti gai jue

*Asplenium filix-femina* (Linnaeus) Bernhardt var. *dentigerum* Wallich ex C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 491. 1880; *A. filix-femina* f. *dentigerum* (Wallich ex C. B. Clarke) C. Hope; *Athyrium attenuatum* (Wallich ex C. B. Clarke) Tagawa f. *dentigerum* (Wallich ex C. B. Clarke) Khullar & Fraser-Jenkins; *A. dentatum* Ching (1986), not A. Gray (1821); *A. filix-femina* (Linnaeus) Roth var. *dentigera* (Wallich ex C. B. Clarke) Beddome; *A. lancipinnulum* Ching; *A. leiboense* Ching & Y. T. Hsieh; *A. oblongum* Ching; *A. squamipes* Ching; *A. supranigrescens* Ching; *A. tsaii* Ching.

Rhizomes short, erect, apex densely clothed with brown, broadly lanceolate scales. Fronds caespitose; fertile fronds (30–)65–120 cm; stipe blackish brown at base, upward brown-stramineous, (5–)27–67 cm, (2.5–)6–7 mm in diam., base similarly scaly, upward with sparse smaller scales; lamina 2-pinnate, ovate-lanceolate or oblong-lanceolate, (25–)70–85 × (7–)20–28 cm at middle, base narrowed, apex acuminate; pinnae 18–25 pairs, alternate, ascending, shortly stalked or sessile, numerous

pairs of lower pinnae gradually shortened; middle pinnae lanceolate, (3.5–)16–18 × (1.2–)2.7–3 cm, base truncate, subequilateral, parallel to rachis on acroscopic side, narrowly cuneate on basisopic side, pinnatifid to pinnate, apex long acuminate; pinnules pinnatifid, 10–30 pairs, basal pinnules opposite, upper pinnules alternate, subspreading, narrowly lanceolate, 1.2–1.6 cm × 3–5 mm at middle, base subequilateral and rounded-truncate, decurrent and adnate to costa on basisopic side, pinnatifid to 1/2, apex acuminate; pinnule segments 6–8 pairs, subtriangular, approximate, oblique, with 2 or 3 short teeth at apex; veins visible on both surfaces, lateral veins 1 or 2 pairs per segment, simple. Lamina subpapery or herbaceous when dried, greenish brown adaxially, pale green abaxially, glabrate on both surfaces; rachis and costae brown-stramineous, with sparse small scales and squarrose-glandular hairs abaxially. Sori mostly oblong or elliptic, inframedial on acroscopic veins, 5–8 pairs per pinnule, biseriolate on both sides of costule; indusia brownish, oblong, J-shaped or horseshoe-shaped, membranous, erose or somewhat ciliate at margin, persistent. Perispore surface without folds.  $2n = 80$ .

Forests, grassy slopes on mountains; 2000–3000 m. SE Gansu, Guizhou, W Sichuan, Xizang, N Yunnan [N India, Myanmar].

“*Polypodium dentigerum*” (Wallich, Numer. List, no. 334. 1829) belongs here but is a nomen nudum and was not therefore validly published (*Melbourne Code*, Art. 38.1(a)).

**39. *Athyrium mehrae*** Bir, Nova Hedwigia 44: 165. 1962.

狭基蹄盖蕨 xia ji ti gai jue

*Athyrium stenopodium* Ching & S. K. Wu; *A. tibeticum* Ching.

Rhizomes erect, apex densely clothed with brown, lanceolate to broadly lanceolate scales. Fronds caespitose; fertile fronds (20–)35–48(–80) cm; stipe blackish brown at base, upward brown-stramineous, (3–)8–20 cm, base (1–)1.4–2(–5) mm in diam., similarly densely scaly, upward glabrate; lamina pinnate-pinnatifid, oblanceolate, (18–)26–38(–60) × (3.5–)5.5–7(–15) cm above middle, base gradually narrowed, apex acuminate; pinnae 25–30 pairs, alternate, subspreading, sessile, lower 6–9(–12) pairs of pinnae gradually shortened, basal pinnae often reduced to triangular auricles, 5–7(–20) mm, deflexed, middle pinnae lanceolate to broadly lanceolate, up to 3.5–6.5 × 1–1.4 cm, base broadened, equilateral, truncate or subcuneate, pinnatifid to 1 mm to winged costa, apex shortly acuminate to caudate-acuminate; pinna segments 10–12(–17) pairs, basal segments opposite, upper segments alternate, slightly ascending or subspreading, approximate, oblong to lanceolate, basal segments larger, 4–6 × 1.8–3 mm, dentate at margin, apex obtuse-rounded and toothed; veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 4 or 5 pairs, oblique, lower veins forked, upper veins simple, thin. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces, with subulate spines at base of pinnae and pinna segments on adaxial side. Sori small, orbicular, 1 or 2(or 3) per segment, inframedial on basal acroscopic veins, close to midrib; indusia brown, small, orbicular-reniform, membranous, entire or erose at margin, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80$ .

Forests, shrub meadows, on rocks of mountain slopes; 3100–4100 m. SE Xizang, Yunnan [India (Sikkim)].

J. Z. Wang and S. H. Li (in P. Y. Fu et al., *Clav. Pl. Chin. Bor.-Orient.* 35. 1995) considered that *Athyrium rupestre* Kodama occurs in Jilin. It is characterized by the perispore surface without folds and the pinnae pinnatifid to pinnatisect, less than 1 cm wide, and long acuminate. *Athyrium rupestre* is distributed in Hokkaido and N Honshu, Japan, and E Russia. If the identification by J. Z. Wang and S. H. Li (1995) is correct, the species should be new to China.

**40. *Athyrium multipinnum*** Y. T. Hsieh & Z. R. Wang, *Acta Bot. Boreal.-Occid. Sin.* 7(1): 55. 1987.

多羽蹄盖蕨 duo yu ti gai jue

Rhizomes erect, apex densely clothed with red-brown, ovate-lanceolate or linear-lanceolate scales. Fronds caespitose; fertile fronds 18–35 cm; stipe stramineous, 2–6.5 cm, 0.5–1.5 mm in diam., flattened when dried, base similarly scaly; lamina pinnate, linear-lanceolate or lanceolate, 13–26 × 2.8–5.2 cm, base slightly narrowed, apex long acuminate; pinnae 20–30 pairs, lower pinnae opposite, upper pinnae alternate, subspreading or ascending, sometimes falcate, sessile; basal 1 or 2 pairs of pinnae shortened, deltoid-ovate or ovate-oblong, ca. 1.4 cm × 8 mm, base truncate, pinnatifid or pinnatifid, apex obtuse-rounded; lobes 2 or 3 pairs, suboblong, with variably short broad teeth at margin; middle pinnae deltoid-lanceolate or narrowly oblong, 1.5–2.4 cm × 9–10 mm at middle, base inequilateral, truncate, auriculate on acroscopic side, parallel to rachis, narrowly cuneate on basicopic side, pinnatifid, apex obtuse-rounded or obtuse; pinna segments 5–8 pairs, oblong, with 4 or 5 teeth at acroscopic margin; veins visible on both surfaces, pinnate in segments, lateral veins 2 or 3 pairs, simple, 4 pairs in basal segments, and sometimes 2- or 3-forked. Lamina thinly herbaceous when dried, yellow-green, glabrate on both surfaces; rachis stramineous, slightly brownish, somewhat subulate spines at base of pinnae on adaxial side, costae concolorous with lamina, with short spines on adaxial side at base of distal pinna segments. Sori elliptic, J-shaped, or horseshoe-shaped, 1 per segment, often 3 in basal segments; indusia brownish, elliptic, J-shaped, or horseshoe-shaped, membranous, subentire, persistent. Perispore surface without folds, with granular ornamentation.

• Valley forests, streamsides, wet rock crevices; 100–1500 m. Guizhou, Hunan, Jiangxi, Zhejiang.

**41. *Athyrium elongatum*** Ching, *Acta Bot. Boreal.-Occid. Sin.* 6(2): 101. 1986.

长叶蹄盖蕨 chang ye ti gai jue

Rhizomes short, erect, apex densely clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds ca. 70 cm; stipe pale stramineous at base, upward dark stramineous, shiny, ca. 15 cm, ca. 3 mm in diam., base similarly scaly; lamina 2-pinnate, narrowly lanceolate, ca. 55 × 11 cm at middle, base slightly narrowed, apex caudate or long acuminate; pinnae ca. 45 pairs, lower pinnae opposite, upper pinnae alternate, approximate, spreading or ascending, sessile, lower pinnae slightly shortened, basal pinnae ca. 4 cm; middle pinnae larger, falcate-lanceolate, 6–8 × ca. 1.8 cm, base rounded-truncate, abutting against rachis on acroscopic side, pinnate, apex caudate-acumi-

nate; pinnules 10–12 pairs, lower pinnules opposite; upper pinnules alternate, ascending; basal pinnules largest, narrowly oblong, 8–9 × 5–6 mm, base somewhat cuneate, decurrent and adnate to wing of costules, pinnatifid, apex obtuse; segments with long acute teeth at apex; upper pinnae gradually smaller, approximate, base decurrent and adnate to wing of rachis, margin dentate, apex caudate. Veins pinnate in pinnules, lateral veins 3 or 4 pairs, oblique, lower veins 2- or 3-forked, upper veins simple. Lamina herbaceous when dried, nearly black adaxially, brown abaxially, glabrate on both surfaces; rachis and costae pale purplish red abaxially, ± hairy in adaxial groove, hairs brown short glandular hairs, spinose at base of costules on adaxial side. Sori shortly linear, 3 or 4 pairs per pinnule, borne on acroscopic veins, inframedial; indusia pale brown, shortly linear, membranous, subentire, persistent. Perispore surface without folds.

• On rocks in forests; 1000–1200 m. N Guangxi, Jiangxi.

**42. *Athyrium oppositipennum*** Hayata, *J. Coll. Sci. Imp. Univ. Tokyo* 30: 441. 1911.

对生蹄盖蕨 dui sheng ti gai jue

*Athyrium oppositipennum* var. *pubescens* (Tagawa) Yea C. Liu, W. L. Chiou & H. Y. Liu; *A. oreopteris* Copeland; *A. taiwanense* Tagawa; *A. taiwanense* var. *pubescens* Tagawa; *Dryopteris oppositipenna* (Hayata) Hayata.

Rhizomes short, erect, apex densely scaly; scales lanceolate, blackish brown in center, brown in marginal part. Fronds caespitose; fertile fronds 60–80 cm; stipe brown-stramineous at base, 30–40 cm, 3.5–5 mm in diam., base similarly scaly; lamina 2-pinnate, oblong or oblong-lanceolate, 35–45 × 20–25 cm, base not narrowed, apex acuminate; pinnae 12–15 pairs, basal pinnae opposite, upper pinnae alternate, subspreading, sessile; lower pinnae linear-lanceolate, 15–20 × 2–2.5 cm at middle, base truncate, slightly overlapping rachis, pinnate-pinnatifid, apex caudate; pinnules 26–35 pairs, opposite or subopposite, usually recurved or slightly spreading, distal pinnules ascending; middle pinnules linear-lanceolate, 11–15 × ca. 4 mm, base rounded-truncate and adnate to costae, somewhat auriculate on acroscopic side, somewhat decurrent on basicopic side, pinnatifid, apex acute or obtuse; pinnule segments ca. 5 pairs, subsquare, ascending, with 2–4 broadly triangular teeth at apex, usually basal acroscopic segments larger; veins somewhat visible adaxially, visible abaxially, pinnate in pinnules, lateral veins 6–9 pairs, oblique, often forked in upper segments. Lamina thickly papery when dried, dark brown adaxially, greenish brown abaxially, glabrate on both surfaces. Rachis and costae brownish stramineous, glabrate abaxially, with subulate spines at base of costae and costules on adaxial side. Sori elliptic, usually 1 per segment, biseriate on both sides of costule; indusia dark brown, elliptic, membranous, erose at margin. Perispore surface without folds.  $2n = 120^*$  (3× apomictic).

• Valley forests, bamboo grasslands, sometimes in shaded wet areas; 1800–3000 m. Taiwan.

**43. *Athyrium crassipes*** Ching, *Acta Bot. Boreal.-Occid. Sin.* 6(2): 103. 1986.

粗柄蹄盖蕨 cu bing ti gai jue

Rhizomes short, erect, apex densely clothed with red-brown, linear scales. Fronds caespitose; fertile fronds 62–68 cm; stipe blackish brown at base, upward brown-stramineous, 34–37 cm, 2.5–5 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate, ovate-oblong, 30–40 × 14–18 cm at middle, base rounded-cuneate, apex shortly acuminate; pinnae 14–16 pairs, alternate, ascending, with short stalk ca. 1.5 mm or sessile; basal pinnae not shortened, lanceolate, 13–15 × ca. 4 cm at middle, base narrowed, pinnate, apex acuminate; pinnules ca. 17 pairs, basal pinnules opposite, upper pinnules alternate, spreading, approximate, sessile, oblong, up to 2 cm × 7–8 mm at middle, base subequilateral, broadly cuneate, auriculate on acroscopic side, decurrent on basiscopic side, pinnatifid to 1/2, apex obtuse; pinnule segments 6–8 pairs, oblong, approximate, ascending, apex obtuse and with 2 or 3 teeth; second basal and upper pinnae similar to basal pinnae, gradually smaller, second basal pinnae ca. 3.2 cm wide at middle, base not narrowed, widest; veins inconspicuous adaxially, somewhat visible abaxially, pinnate in pinnule segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina firmly papery when dried, greenish brown, occasionally with short hairs adaxially, glabrate abaxially; rachis and costae abaxially stramineous, with sparse short hairs, with subulate short spines at base of costae and costules on adaxial side. Sori large, elliptic, 1 per segment, 7–9 pairs per pinnule, biseriolate on both sides of costule, inframedial; indusia brown, elliptic or horseshoe-shaped, thickly membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.

• Bamboo forests; 2200–2300 m. W Sichuan (Daxiangling, Niba Shan).

**44. *Athyrium tripinnatum*** Tagawa, Acta Phytotax. Geobot. 6: 163. 1937.

三回蹄盖蕨 san hui ti gai jue

Rhizomes short, stout, erect, apex densely clothed with brownish, subulate-lanceolate or lanceolate scales. Fronds caespitose; fertile fronds 37–70 cm; stipe slightly pale red-purple, 15–30 cm, base similarly scaly, 1.5–2 mm in diam., glabrate; lamina 2- or 3-pinnate, ovate-lanceolate, 24–50 × 10–25 cm, base slightly narrowed, apex long acuminate; pinnae 12–17 pairs, alternate, ascending, stalked (stalk ca. 3 mm); basal pinnae slightly shortened, deltoid-lanceolate, 5–7 × ca. 2.5 cm at base, base equilateral, broadly cuneate, pinnate or pinnate-pinnatisect, apex long acuminate, slightly caudate; ultimate pinnules pinnatifid; pinnules 10–15 pairs, basal pinnules opposite, upper pinnules alternate, spreading, shortly stalked or sessile, subrhomboid, ca. 1.4 cm × 7 mm at base, base inequilateral, somewhat auriculate on acroscopic side, cuneate on basiscopic side, free or decurrent and adnate to wing of costa, pinnatifid to pinnatisect, apex obtuse or acute with several small teeth; pinnule segments 3 or 4 pairs, basal acroscopic segments larger, oblong, with long teeth, obtuse at apex; middle pinnae longer, lanceolate, up to 15 × 4–4.5 cm at base, apex caudate-acuminate; veins visible on both surfaces, pinnate on segments, lateral veins simple, basal acroscopic veins often forked. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous, purplish

red, glabrate abaxially, with subulate short spines adaxially at base of costules. Sori mostly J-shaped, sometimes horseshoe-shaped or oblong, medial or inframedial on acroscopic veins, 1 or 2 pairs per segment; indusia pale brown, J-shaped, sometimes horseshoe-shaped or oblong, membranous, erose at margin or ciliate, persistent. Perispore surface without folds.

• Broad-leaved forests; 1600–2800 m. Taiwan.

According to C. M. Kuo (Taiwania 30: 65. 1985), *Athyrium tripinnatum* is conspecific with *A. foliolosum*.

**45. *Athyrium deltoifrons*** Makino, Bot. Mag. (Tokyo) 28: 178. 1914.

溪边蹄盖蕨 xi bian ti gai jue

Rhizomes short, erect, apex densely clothed with brownish, subulate lanceolate scales. Fronds caespitose; fertile fronds (35–)45–75(–95) cm; stipe brown at base, upward stramineous, slightly pale purplish red, 25–55 cm, 1.5–2.5 mm in diam., base scaly, upward glabrate; lamina 2-pinnate, broadly ovate or ovate-oblong, 45–70 × 30–55 cm at base, rarely much narrower, apex acuminate; pinnae 15–20 pairs, basal pinnae subopposite, upper pinnae alternate, ascending, with stalk 3–5 mm, basal 1 or 2 pairs of pinnae slightly shortened, base slightly narrowed; middle pinnae broadly lanceolate or linear-lanceolate, 25–35 × 2.5–5 cm, base truncate and parallel to rachis on acroscopic side, narrowly cuneate on basiscopic side, bipinnatifid, apex acuminate; pinnules pinnatifid, ca. 14 pairs, alternate, ascending, subsessile, lanceolate; basal pinnae shorter, 1.5–2.5 cm; middle pinnae up to 4 × 1.2 cm at base, base subequilateral, broadly cuneate, pinnatifid, apex acuminate; pinnule segments ca. 10 pairs, oblique, basal acroscopic segment larger, others 4–6 × ca. 2 mm, with short teeth, rarely apiculate and curved teeth, apex acute; veins inconspicuous adaxially, visible abaxially, pinnate in segments, simple or forked. Lamina herbaceous when dried or fragile, greenish brown or pale green, glabrate on both surfaces; rachis and costae abaxially stramineous, with sparse pallid short hairs, with short spines adaxially, costules also spiny. Sori horseshoe-shaped, oblong, or J-shaped, 1–5 per segment (usually to 7 in basal acroscopic segments); indusia pale brown, horseshoe-shaped, oblong, or J-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 240$ .

Valleys, damp areas, streamsides, wet grasslands; 800–2000 m. Fujian, Guizhou, Hunan, Jiangxi, Sichuan, Zhejiang [Japan, Korea].

- 1a. Lamina broadly ovate or ovate-oblong, herbaceous ..... 45a. var. *deltoifrons*  
 1b. Lamina slender, fragile ..... 45b. var. *gracillimum*

**45a. *Athyrium deltoifrons* var. *deltoifrons***

溪边蹄盖蕨(原变种) xi bian ti gai jue (yuan bian zhong)

*Athyrium acutissimum* Kodama; *A. filix-femina* (Linnaeus) Roth var. *deltoideum* Makino; *A. giganteum* de Vol; *A. jiulongshanense* Ching; *A. rotundilobum* Ching.

Lamina broadly ovate or ovate-oblong, herbaceous, with short teeth at segment margin.

Valleys, damp areas, streamsides, wet grasslands; 800–2000 m. Fujian, Guizhou, Hunan, Jiangxi, Sichuan, Zhejiang [Japan, Korea].

**45b. *Athyrium deltoideofrons* var. *gracillimum* (Ching) Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 186. 1999 [“*gracillimum*”].**

瘦叶蹄盖蕨 shou ye ti gai jue

*Athyrium gracillimum* Ching, Acta Bot. Boreal.-Occid. Sin. 6(3): 149. 1986.

Plants very slender and fragile; teeth on segment margin apiculate and curved upward.

- Valleys, damp areas. W Jiangxi (Mufushan, Xiushui).

**46. *Athyrium delicatulum* Ching & S. K. Wu in C. Y. Wu, Fl. Xizang. 1: 139. 1983.**

薄叶蹄盖蕨 bao ye ti gai jue

*Athyrium aridum* Ching; *A. austro-occidentale* Ching; *A. bambusicola* Ching; *A. filix-femina* (Linnaeus) Roth var. *deltoidea* Christ, p.p.; *A. filix-femina* var. *fissidens* Christ (1905), not Döll (1855); *A. nitidum* Ching; *A. oxyphyllum* (Wallich ex Hooker) T. Moore ex Beddome var. *funebre* Christ, p.p.; *A. praticola* Ching; *A. remotisorum* Ching & H. S. Kung; *A. remotum* Ching; *A. yaanense* Ching.

Fertile fronds 30–100 cm; stipe stramineous, shiny, slightly longer than lamina, ca. 2 mm in diam.; lamina bipinnatifid to tripinnatifid, ovate, up to 48 × 35 cm, base hardly narrowed, apex acuminate; pinnae ca. 12 pairs, basal pinnae opposite or subopposite, upper pinnae alternate, slightly ascending, with stalk 3–4 mm; basal pinnae broadly lanceolate, up to 15 cm × ca. 4 cm at middle, base slightly narrowed, pinnate (bipinnatifid), apex shortly acuminate; pinnules ca. 15 pairs, anadromous, alternate, separated from each other, spreading, shortly stalked (stalk 1–1.5 mm), ovate-oblong or oblong-lanceolate, 1.8–2.2 × 0.8–1.2 cm at base, base inequilateral, broadly cuneate, pinnatifid, apex obtuse; pinnule segments 5 or 6 pairs, slightly ascending, oblong, ca. 5 × 2.5 mm, margin dentate, apex obtuse-rounded; second basal and upper pinnae similar to basal pinnae, gradually shortened, base not narrowed or broadened; veins visible adaxially, clearly visible abaxially, pinnate in segments, lateral veins 3 or 4 pairs, oblique, simple. Lamina herbaceous when dried, dark green, glabrate on both surfaces; rachis and costae stramineous, glabrate abaxially, with spines adaxially in distal part of lamina and pinnae. Sori elliptic or orbicular, 3–5 in lower segments, 1 in upper segments; indusia brown, oblong, sometimes orbicular-reniform or J-shaped, membranous, erose and ciliate at margin, persistent. Perispore surface without folds, with granular ornamentation.

- Coniferous forests, bamboo forests; 700–3000 m. Chongqing, Guangxi, Guizhou, Sichuan, SE Xizang, Yunnan.

*Athyrium delicatulum* is very similar to *A. deltoideofrons* but differs by the pinnules prominently anadromous and glabrate.

**47. *Athyrium reflexipinum* Hayata, Icon. Pl. Formosan. 4: 234. 1914.**

逆叶蹄盖蕨 ni ye ti gai jue

Rhizomes short, stout, ascending or erect, apex densely scaly; scales dark brown, narrowly lanceolate, up to 7 mm, less than 1 mm wide; fronds caespitose. Fertile fronds 20–35 cm; stipe blackish brown at base, upward stramineous or purplish red, (5–)10–20 cm, 1–1.5 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate, lanceolate, (10–)15–18(–20) × (2–)4–5 cm, apex acuminate; pinnae 12–15 pairs, basal 1 or 2 pairs of pinnae hardly shortened, opposite, reflexed; middle pinnae lanceolate, (2–)2.5–3(–4) × 1–1.2 cm, base inequilateral, broadly cuneate, sessile, pinnate, apex shortly acuminate, pinnae alternate, spreading or slightly reflexed; pinnules 6–8 pairs, alternate, ascending; basal acroscopic pinnules prominently larger, oblong, 5–7 × 2–3 mm, adnate to costae or somewhat free, dentate at margin, apex obtuse-rounded and toothed; veins visible abaxially, pinnate in pinnules, lateral veins 3 or 4 pairs, forked, single per tooth. Lamina papery when dried, greenish brown, glabrate; rachis with sparse brown lanceolate small scales, stramineous. Sori oblong or shortly linear, inframedial on basal acroscopic veins, 1 per pinnule, often 2 pairs in basal acroscopic pinnule, on both sides of costule; indusia brown, suborbicular-reniform, J-shaped, or shortly linear, membranous, erose at margin, persistent. Perispore surface without folds.  $2n = 80, 160, 80$  ( $2 \times$  apomictic).

Coniferous forests, high mountain regions, wet areas; 2800–3500 m. Taiwan [Japan (Kyushu), Korea, Philippines].

**48. *Athyrium devolii* Ching, Sunyatsenia 3: 1. 1935.**

湿生蹄盖蕨 shi sheng ti gai jue

?*Athyrium filix-femina* (Linnaeus) Roth var. *filipes* Christ; *A. fujianense* Ching; *A. nanchuanense* Ching & Z. Y. Liu.

Rhizomes short, suberect, clothed with brownish, ovate-lanceolate scales. Fronds caespitose; fertile fronds 45–85 cm; stipe blackish brown at base, upward stramineous, 20–40 cm, 1–1.5 cm in diam., base sparsely scaly, upward glabrate; lamina 2-pinnate-pinnatifid, narrowly oblong, 25–45 × 16–25 cm, base not narrowed, apex acuminate; pinnae 12–15 pairs, subopposite, stalked (stalk ca. 1.5 mm), spreading or slightly ascending; basal pinnae slightly or hardly shortened, broadly lanceolate, 9–10 × ca. 1.5 cm; middle and upper pinnae broadly lanceolate, 10–12 × 2.5–3.5 cm, base truncate or sometimes slightly overlaying rachis on acroscopic side, pinnate-pinnatifid, apex acuminate; pinnules ca. 12 pairs, alternate, often reflexed, lanceolate, basal pinnules 1–1.5 cm × 5–6 mm, base inequilateral, truncate, parallel to rachis on acroscopic side, narrowly cuneate on basispic side, subsessile, pinnatifid to wing of costules, apex acuminate; pinnule segments 6–9 pairs, acroscopic segment usually larger than basispic segment, oblong, margin with irregular teeth, apex obtuse; veins visible abaxially, pinnate in pinnule segments; lateral veins 2 or 3 pairs, simple, extending to tooth tip. Lamina herbaceous when dried, pale green, glabrate. Sori orbicular or horseshoe-shaped, 1–3 per segment (often 2 or 3 pairs in basal segments); indusia pale brown, horseshoe-shaped, thickly membranous, ciliate at margin, persistent. Perispore surface without folds, with granular ornamentation.

- Sparse forests, streamsides, grassy damp areas; 500–2100 m. Chongqing, N Fujian, Guangxi, Guizhou, Jiangxi, Sichuan, Xizang, Yunnan, Zhejiang.

**49. *Athyrium baishanzuense*** Ching & Y. T. Hsieh, Acta Bot. Boreal.-Occid. Sin. 6(3): 157. 1986.

百山祖蹄盖蕨 bai shan zu ti gai jue

Fertile fronds 50–75 cm; stipe upward stramineous, 30–38 cm, ca. 1.5 mm in diam., base clothed with brownish, narrowly lanceolate scales, upward glabrate; lamina 2-pinnate, ovate-lanceolate, 32–42 × 16–20 cm, base slightly narrowed, apex acuminate; pinnae ca. 12 pairs, basal 1( or 2) pairs of pinnae subopposite, upper pinnae alternate, slightly ascending, with stalk ca. 3 mm; basal pinnae slightly shortened, 8–10 × 2.4–3 cm, base slightly narrowed; second basal pinnae lanceolate, 9–11 × 2.6–3.6 cm at base, base broadened, pinnate, apex caudate-acuminate; pinnules 9–12 pairs, alternate, stalked (stalk ca. 1 mm), anadromous, reflexed, ovate-triangular; basal acroscopic pinnules larger, 1.3–2 × 1–1.2 cm, base subequilateral, rounded-cuneate, pinnatifid nearly to costae, apex acute; pinnule segments 4–6 pairs, suboblong, ascending, with 2 or 3 teeth at apex; veins visible on both surfaces, pinnate in segments, 2 or 3 pairs, oblique, simple. Lamina herbaceous when dried, dark green, glabrate on both surfaces; rachis and costae stramineous, glabrate abaxially, very shortly spiny adaxially. Sori oblong or J-shaped, often covering entire surface of pinnules when mature; indusia brown, oblong or J-shaped, membranous, subentire or somewhat ciliate, persistent. Perispore surface without folds.

- Valley forests; ca. 1000 m. S Zhejiang (Baishanzu, Qingyuan).

*Athyrium baishanzuense* is very similar to *A. devolii* but differs by the pinnules ovate-triangular, acute at apex, pinnatifid nearly to costules, and prominently stalked (stalk ca. 1 mm).

**50. *Athyrium maoshanense*** Ching & P. S. Chiu, Acta Bot. Boreal.-Occid. Sin. 6(3): 157. 1986.

昂山蹄盖蕨 mao shan ti gai jue

Fertile fronds up to 68 cm; stipe upward brownish stramineous, ca. 30 cm, base ca. 2.5 mm in diam., clothed with brownish, lanceolate scales, upward glabrate; lamina 2-pinnate, ovate, up to 38 × ca. 26 cm, base slightly narrowed, apex abruptly narrowed; pinnae 9 pairs under abruptly narrowed apex, basal pinnae opposite or subopposite, upper pinnae alternate, subspreading, sessile; basal pinnae prominently shortened, 8–9 × ca. 2.8 cm, base narrowed; third to fifth pairs of pinnae subequal, lanceolate, up to 13 × 3.2 cm, base slightly narrowed, subequilateral, truncate, pinnate, apex acuminate; pinnules 15–16 pairs, alternate, reflexed, sessile, oblong, ca. 1.5 cm × 7–8 mm, base inequilateral, rounded-cuneate on acroscopic side, narrowly cuneate and decurrent on basicopic side, pinnatifid, with several triangular small teeth, apex obtuse-rounded; pinnule segments 4 or 5 pairs, with 2 or 3 short teeth at apex, basal acroscopic pinnules often overlaying rachis; veins inconspicuous adaxially, visible abaxially, pinnate per pinnule, basal acroscopic veins often pinnate, basicopic veins usually simple. Lamina herbaceous when dried, greenish brown adaxially, dark green abaxially, glabrate on both surfaces; rachis and costae brownish stramineous, glabrate abaxially, with short spines adaxially. Sori elliptic or J-shaped, 4 or 5 pairs per

pinnule, biseriate on both sides of costule; indusia brown, elliptic or J-shaped, membranous, ciliate at margin, persistent. Perispore surface without folds.

- Valley forests; ca. 1200 m. S Zhejiang (Longquan, Maoshan).

*Athyrium maoshanense* is very similar to *A. devolii* but differs by the pinnules oblong, rounded-obtuse at apex, connate to each other by a narrow wing, and sori mostly oblong, sometimes J-shaped.

**51. *Athyrium omeiense*** Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 282. 1949.

峨嵋蹄盖蕨 e mei ti gai jue

*Athyrium amplissimum* Ching, Boufford & K. H. Shing (1983), not (Baker) Holttum (1955); *A. filix-femina* (Linnaeus) Roth var. *flavicomma* Christ; *A. flavicomma* (Christ) Ching; *A. parapellucidum* Ching; *A. pellucidum* Ching.

Rhizomes short, stout, erect, apex densely scaly; scales brown or red-brown, shiny, linear, linear-lanceolate, or lanceolate. Fronds caespitose; fertile fronds 50–150 cm; stipe blackish brown at base, upward brown-stramineous, (20–)40–60 cm, 3–5 mm in diam., base similarly densely scaly; lamina 2- or 3-pinnate, oblong-ovate or broadly ovate, (24–)45–66 × (20–)30–40 cm, base not narrowed or slightly narrowed, rounded-cuneate, apex acuminate; pinnae 12–15 pairs, lower pinnae subopposite, upper pinnae alternate, slightly ascending, with stalk ca. 1 cm or subsessile; basal pinnae slightly larger than subbasal 2 or 3 pairs of pinnae, broadly lanceolate, 12–25 × (4–)6–10 cm, base slightly narrowed, apex acuminate; middle pinnae narrowly lanceolate, pinnate; pinnules pinnatifid to 2-pinnate; second basal and upper pinnae gradually shortened, not narrowed toward base; pinnules ca. 20 pairs, alternate; basal pinnules subopposite, ascending, lower 2 or 3 pairs of pinnae slightly shortened; middle pinnae longer, falcate-lanceolate, (1.5–)3.5–5 × (0.6–)1–1.2 cm, base equilateral, rounded-truncate, acroscopically close to costae, basicopically cuneate, or base inequilateral, truncate on acroscopic side, somewhat auriculate, cuneate on basicopic side, sessile or shortly stalked, pinnate or pinnatifid nearly to costules, apex acuminate or acute; pinnule segments (8–)12–15 pairs, oblique, basal segments larger, oblong or oblong-lanceolate, 6–9 × 1.5–2 mm, margin toothed or pinnatifid, apex acute, with few small teeth; segments dense, basal acroscopic and basicopic segments almost equal or acroscopic segments larger; veins visible abaxially, slightly visible adaxially, pinnate in segments, lateral veins 2–5 pairs, oblique, lower veins forked, upper veins simple. Lamina firmly herbaceous when dried, greenish brown, glabrate; rachis, costae, and costules brown-stramineous, with subulate spines on adaxial side at base of costa or costule, abaxially with sparse brownish lanceolate scales. Sori orbicular or horseshoe-shaped, 1–6 per segment, biseriate on both sides of costule; indusia brown, suborbicular-reniform or horseshoe-shaped, membranous, entire, persistent. Perispore surface without folds.

- Wet areas in forests, forest margins, streamsides, rock crevices; 900–3000 m. Chongqing, SE Gansu, NW Guizhou, NW Hubei, Hunan, Shaanxi, Sichuan, N Yunnan.

**52. *Athyrium intermixtum*** Ching & P. S. Chui, Acta Bot. Boreal.-Occid. Sin. 6(1): 21. 1986.

中间蹄盖蕨 *zhong jian ti gai jue*

Rhizomes erect, apex densely clothed with castaneous or brown, narrowly lanceolate scales. Fronds caespitose; fertile fronds 70–85 cm; stipe brown-stramineous at base, upward shiny, 28–33 cm, ca. 3 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate, ovate, 28–30 × 20–26 cm, base broadly cuneate, apex somewhat abruptly narrowed; pinnae ca. 13 pairs, basal 2(or 3) pairs of pinnae subopposite; upper pinnae alternate, ascending, stalked (stalk ca. 3 mm); lower 3 or 4 pairs of pinnae subequal, oblong-lanceolate, ca. 15 × 3–3.5 cm, base slightly narrowed, pinnate, apex shortly acuminate; upper pinnae gradually smaller; pinnules ca. 20 pairs, alternate, spreading, basal pinnules shortly stalked; upper pinnules sessile, oblong, ca. 1.8 cm × 6–8 mm, base broadly cuneate, auriculate on acroscopic side, pinnatifid, apex obtuse-rounded; pinnule segments 4–6 pairs, with 2 or 3 teeth at margin, apex subrounded; veins somewhat visible adaxially, visible abaxially, 2- or 3-forked in segments. Lamina herbaceous when dried, dark brown, glabrate on both surfaces; rachis and costae abaxially brown-stramineous, with sparse short glandular hairs, with subulate spines on adaxial side at base of costa or costule. Sori elliptic, inframedial on acroscopic veins, 4–6 pairs per pinnule, biseriate on both sides of costule; indusia brown, elliptic, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.

• Roadsides on mountain slopes; 900–1600 m. Anhui, Zhejiang.

**53. *Athyrium costulalisorum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 15. 1986.

川西蹄盖蕨 *chuan xi ti gai jue*

Rhizomes erect, apex densely clothed with brown, narrowly lanceolate scales. Fronds caespitose; fertile fronds up to 1.2 m; stipe blackish brown at base, upward brown-stramineous, shiny, ca. 40 cm, base ca. 5 mm in diam., similarly scaly, upward glabrate; lamina 2-pinnate, ovate-oblong, 50–60 × 18–20 cm, base narrowly cuneate, apex acuminate; pinnae more than 20 pairs, alternate, lower pinnae strongly ascending, upper pinnae ascending, subsessile or shortly stalked (stalk ca. 2 mm); basal pinnae larger, linear-lanceolate, up to 27 × ca. 5 cm at middle, base narrowed, pinnate, apex caudate-acuminate; second basal and upper pinnae similar to basal pinnae but gradually shortened, but not narrowed or broader at base; pinnules ca. 28 pairs, alternate, spreading or subspreading, lower pinnules gradually shortened, basal pinnules ca. 1.2 cm; middle pinnules broadly lanceolate, 2.4–3 cm × 9–12 mm at base, base broadened, subequilateral, broadly cuneate, subsessile, pinnatifid to 3/4 to costule, apex shortly acuminate; pinnule segments 8–10 pairs, slightly oblique, approximate, oblong, 2.5–3 × ca. 2 mm, margin entire or sparsely serrulate, apex obtuse-rounded, with 3–6 triangular teeth; veins visible on both surfaces, pinnate in segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina thickly papery when dried, grass-green, glabrate on both surfaces; rachis and costae abaxially stramineous, slightly pale purplish red, glabrate, with subulate spines on adaxial side at base of costa or costule, midribs of pinnules also

with subulate short spines. Sori elliptic, orbicular-reniform, J-shaped, or horseshoe-shaped, 1 per segment, 2–4 in basal segment, subcostular; indusia orange-brown, elliptic, orbicular-reniform, J-shaped, or horseshoe-shaped, membranous, somewhat erose at margin, persistent. Perispore surface without folds.

• Grassy mountain slopes; ca. 2800 m. W Sichuan (Baoping).

**54. *Athyrium dentilobum*** Ching & S. K. Wu in C. Y. Wu, Fl. Xizang, 1: 139. 1983.

齿尖蹄盖蕨 *chi jian ti gai jue*

Rhizomes short, erect, apex densely clothed with dark brown or blackish brown, shiny, broadly lanceolate scales. Fronds caespitose; fertile fronds ca. 60 cm; stipe blackish brown at base, upward pale green-stramineous, shiny, 30–35 cm, base ca. 1.5 mm in diam., similarly densely scaly, upward glabrate; lamina 2-pinnate, oblong, 28–30 × 18–22 cm, base not narrowed, broadly rounded, apex acuminate; pinnae ca. 12 pairs, alternate, ascending, with stalk up to 5 mm; basal pinnae narrowly oblong, up to 12 cm × ca. 5 cm, base subequilateral, rounded-cuneate, pinnate, apex long acuminate; pinnules ca. 12 pairs, alternate, anadromous, subspreading, separate from each other, lower pinnules shortly stalked (stalk ca. 1.5 mm), upper pinnules sessile; basal basispic pinnules longer, narrowly oblong, up to 3.5 × ca. 1.3 mm, base inequilateral, truncate and somewhat auriculate on acroscopic side, cuneate on basispic side, decurrent, pinnatifid, apex obtuse; pinnule segments 7 or 8 pairs, slightly oblique, approximate, narrowly oblong, basal acroscopic segments larger, nearly free, 7–8 × ca. 3 mm, pinnatifid, small segments with 2 or 3 teeth at apex; upper segments smaller, 5–6 × ca. 2 mm, obtuse-truncate and with 4–6 teeth at apex, margin subentire; other pinnules smaller, oblong or oblong-lanceolate, apex obtuse-rounded or acute; second basal pinnae slightly narrowed, ca. 4 cm wide at base; pinnules ca. 2 cm, base subequilateral, truncate on acroscopic side, cuneate on basispic side, pinnatifid, apex obtuse-rounded or acute; pinnule segments 4 or 5 pairs, oblong, truncate and with 4–6 teeth at apex; third basal and upper pinnae similar to second basal pinnae but gradually shortened; veins visible on both surfaces, pinnate in segments, lateral veins 2–4 pairs, simple. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous, glabrate abaxially, with subulate spines on adaxial side at base of costae or costules. Sori oblong, 1 per segment, 3–5 sori on basal acroscopic segments, costular; indusia brown, oblong, occasionally J-shaped, membranous, margin erose, persistent. Perispore surface without folds.

• Coniferous forests; ca. 2600 m. SE Xizang (Médog, Namjagbarwa).

**55. *Athyrium vidalii*** (Franchet & Savatier) Nakai, Bot. Mag. (Tokyo) 39: 110. 1925.

尖头蹄盖蕨 *jian tou ti gai jue*

Rhizomes short, erect, apex densely clothed with dark brown or red-brown, linear-lanceolate, fibriform-tipped scales. Fronds caespitose; stipe blackish brown at base, upward stramineous, as long as lamina, base densely scaly, upward glabrate; lamina 2-pinnate, narrowly ovate or deltoid-ovate, base

not narrowed, apex abruptly narrowed, long acuminate; pinnae 9–12 pairs, lower pinnae subopposite, upper pinnae alternate, ascending, stalked, lanceolate, middle pinnae 10–15 × 2–4 cm, base equilateral, rounded-truncate and slightly narrowed, pinnate, apex long acuminate, sometimes caudate; pinnules ca. 15 or 16 pairs, alternate, subspreading, sessile, lower pinnules oblong-lanceolate or oblong, 1.2–2.2 cm × 4–10 mm at middle, base inequilateral, truncate and auriculate on acroscopic side, cuneate on basispic side, margin often shallowly lobed or toothed, apex acute; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins ca. 7 pairs, oblique, lower veins forked, pinnate in auriculate lobes and segments. Lamina papery when dried, greenish brown, glabrate on both surfaces; rachis stramineous, sometimes pale purplish red, costae usually pale red-purple or brown-stramineous abaxially, glabrate or glandular hairy, with subulate spines on adaxial side at base of costae or costules. Sori oblong or shortly linear, 3–7 pairs per pinnule, biseriate on both sides of costule, inframedial; indusia brownish, oblong, sometimes J-shaped at pinnular base, membranous, margin entire or irregularly toothed, erose or occasionally ciliate, persistent. Perispore surface without folds.  $2n = 160$ .

Valley forests, damp areas at streamsides; 500–2700 m. Anhui, Chongqing, Fujian, Gansu, Guangxi, Guizhou, S Henan, Hubei, Hunan, W Jiangxi, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

- 1a. Pinnules oblong-lanceolate, 1.2–2 cm × 4–5 mm; costae usually pale red-purple abaxially, glabrate or hairy ..... 55a. var. *vidalii*  
 1b. Pinnules oblong, 2–2.2 × ca. 1 cm; costae brown-stramineous, slightly pale purplish red, with dense brown short glandular hairs abaxially ..... 55b. var. *amabile*

### 55a. *Athyrium vidalii* var. *vidalii*

尖头蹄盖蕨(原变种) jian tou ti gai jue (yuan bian zhong)

*Asplenium vidalii* Franchet & Savatier, Enum. Pl. Jap. 2: 229, 624. 1879; *Athyrium commixtum* Koidzumi; *A. glabrescens* Ching [“*glabrescens*”]; *A. kanghsienense* Ching & Y. P. Hsu; *A. mabianense* Ching & Y. T. Hsieh; *A. neowardii* Ching; *A. taipaihanense* Ching; *A. vidalii* var. *confusum* Miyabe & Kudô; *A. vidalii* var. *yamadae* Miyabe & Tatewaki; *A. wugongshanense* Ching & Y. T. Hsieh; *A. yamadae* Miyabe & Kudô.

Pinnules oblong-lanceolate, 1.2–2 cm × 4–5 mm; costae usually pale red-purple abaxially, glabrate or hairy.  $2n = 160$ .

Valley forests, damp areas at streamsides; 600–2700 m. Anhui, Chongqing, Fujian, Gansu, Guangxi, Guizhou, S Henan, Hubei, Hunan, W Jiangxi, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

**55b. *Athyrium vidalii* var. *amabile*** (Ching) Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 199. 1999.

松谷蹄盖蕨 song gu ti gai jue

*Athyrium amabile* Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 16. 1986.

Pinnules oblong, 2–2.2 × ca. 1 cm; costae brown-stramineous, slightly pale purplish red, with dense brown short glandular hairs abaxially.

mineous, slightly pale purplish red, with dense brown short glandular hairs abaxially.

- Valley forests, wet areas; 500–1500 m. Zhejiang.

*Athyrium vidalii* var. *amabile* is very similar to *A. hirtirachis* but differs by the wing of costae glabrate at margin and lamina broadly ovate.

**56. *Athyrium mackinnonii*** (C. Hope) C. Christensen, Index Filic. 143. 1905.

川滇蹄盖蕨 chuan dian ti gai jue

Rhizomes short, erect, apex densely scaly; scales blackish brown in central part, brown in marginal part, narrowly lanceolate. Fronds caespitose; fertile fronds (25–)50–85(–120) cm; stipe blackish brown at base, upward stramineous, (12–)25–40(–60) cm, (1.5–)2.5–3.5(–7) mm in diam., base similarly densely scaly, upward glabrate; lamina pinnate, narrowly triangular or deltoid-oblong, (13–)35–45(–60) × (15–)24–30(–50) cm, base not narrowed, apex somewhat abruptly narrowed; pinnae pinnatisect to 2-pinnate and pinnules pinnatifid; pinnules (10–)14–20 pairs, alternate, ascending, shortly stalked (stalk 3–5 mm), in small plants basal pinnae shortened, in larger plants basal pinnae nearly as long as second basal pinnae or slightly longer, subopposite, oblong-lanceolate, (3–)22–30 × (1.5–)5–7 cm at middle, shortly acuminate to caudate-acuminate at apex, abruptly narrowed at base, pinnatisect to pinnate-pinnatifid; pinnules up to 20–24 pairs, alternate, ascending, oblong-lanceolate, lanceolate, or ovate-oblong, middle pinnules 2.2–3.5(–4) cm × 5–12 mm, base subequilateral, subtruncate, somewhat auriculate on acroscopic side, rounded-cuneate on basispic side, slightly adnate to costae, pinnatifid to pinnatifid, apex obtuse, acute, or acuminate; pinnule segments up to 8–10 pairs, oblong, 3–6 × ca. 2.5 mm, apex rounded and with few short teeth; upper pinnae similar to basal pinnae and gradually smaller, but slightly narrowed or broadened at base; veins visible on both surfaces, pinnate in segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina papery when dried, pale green, glabrate on both surfaces; rachis and costae stramineous, with sparse pallid short hairs, densely pubescent or glabrate abaxially, with subulate spines on adaxial side at base of costa or costule. Sori shortly linear, J-shaped, sometimes horseshoe-shaped, only 1 per segment, 2–4 on basal acroscopic segments; indusia brown, shortly linear, J-shaped, sometimes horseshoe-shaped, membranous, subentire, persistent. Perispore surface without folds.  $2n = 80, 160, 240$ .

Forests, wet areas, common; 800–3800 m. Chongqing, SE Gansu, Guangxi, Guizhou, NW Hubei, Hunan, Shaanxi, Sichuan, SE Xizang, Yunnan [Afghanistan, N India, Myanmar, Nepal, Pakistan, Thailand, Vietnam].

- 1a. Costae glabrate; pinnules obtuse at apex ..... 56c. var. *glabratum*  
 1b. Costae pubescent abaxially; pinnules acuminate, acute, or obtuse at apex.  
 2a. Costae with sparse pallid short hairs abaxially; pinnules oblong-lanceolate, 2.2–3.5(–4) cm × 9–12 mm, apex obtuse or acute ..... 56a. var. *mackinnonii*

- 2b. Costae densely pubescent  
abaxially; pinnules lanceolate,  
5–7 mm wide, apex  
acuminate ..... 56b. var. *yigongense*

**56a. *Athyrium mackinnonii* var. *mackinnonii***

川滇蹄盖蕨(原变种) *chuan dian ti gai jue* (yuan bian zhong)

*Asplenium mackinnonii* C. Hope, J. Bot. 34: 124. 1896;  
*Athyrium caudipinna* Ching; *A. varians* Ching & Z. Y. Liu.

Costae with sparse pallid short hairs abaxially; pinnules oblong-lanceolate, 2.2–3.5(–4) cm × 9–12 mm, apex obtuse or acute.

Forests, wet areas, common; 800–3800 m. Chongqing, SE Gansu, Guangxi, Guizhou, NW Hubei, Hunan, Shaanxi, Sichuan, SE Xizang, Yunnan [Afghanistan, N India, Myanmar, Nepal, Pakistan, Thailand, Vietnam].

**56b. *Athyrium mackinnonii* var. *yigongense*** Ching & S. K. Wu in C. Y. Wu, Fl. Xizang. 1: 142. 1983.

易贡蹄盖蕨 *yi gong ti gai jue*

Costae densely pubescent abaxially; pinnules lanceolate, 5–7 mm wide, acuminate at apex.

- Forests; 2300–2400 m. SE Xizang.

**56c. *Athyrium mackinnonii* var. *glabratum*** Y. T. Hsieh & Z. R. Wang in C. Y. Wu, Fl. Xizang. 1: 143. 1983.

光轴蹄盖蕨 *guang zhou ti gai jue*

Costae glabrate abaxially; pinnules ovate-oblong, 8–10 mm wide, obtuse at apex.

- Forests; ca. 2400 m. SE Xizang.

**57. *Athyrium ludingense*** Z. R. Wang & Li Bing Zhang, Acta Bot. Yunnan. 17: 303. 1995.

泸定蹄盖蕨 *lu ding ti gai jue*

Rhizomes short, erect, apex densely clothed with dark brown, membranous, linear-lanceolate scales. Fronds caespitose; fertile fronds up to 68 cm; stipe pale stramineous, ca. 25 cm, ca. 4 mm in diam. at base, base similarly densely scaly, upward glabrate; lamina 2-pinnate, deltoid-ovate, ca. 43 × 23 cm at base, base slightly narrowed, apex acuminate; pinnules pinnatifid; pinnae 16 pairs, basal 1 or 2 pairs of pinnae subopposite, upper pinnae alternate, ascending, very shortly stalked (stalk ca. 1 mm), oblong-lanceolate to lanceolate, 3 or 4 pairs of lower pinnae slightly narrowed at base, pinnules anadromous or subopposite; upper pinnae not narrowed or broadened at base, pinnules catadromous; middle pinnae 10–14 × 2–4 cm at middle, base subequilateral, truncate, somewhat auriculate on acroscopic side, cuneate on basiscopic side, pinnate, apex long acuminate to somewhat caudate; pinnules 15–20 pairs, lower pinnules opposite, upper pinnules alternate, oblong to deltoid-ovate; middle pinnules 1.2–1.7 cm × 3–5 mm, sessile, spreading or slightly ascending, base inequilateral, cuneate on basiscopic side, auriculate on acroscopic side, margin dentate or pinnatifid, apex acute; pinnule segments 5 or 6 pairs, oblong, apex dentate; veins visible abaxially, slightly visible

adaxially, pinnate in pinnules, lateral veins 4 or 5 pairs, oblique, 1 or 2 veins forked per segment. Lamina herbaceous when dried, pale green; rachis and costae stramineous, with sparse brownish short hairs abaxially, margin of wing of costae, both surfaces of lamina, and margin of segments similarly shortly hairy, with subulate spines on adaxial side at base of costa or costule. Sori oblong, elliptic, shortly linear, or J-shaped, sometimes horseshoe-shaped, 1–2.5 mm, 4–6 pairs per pinnule, biserial on both sides of costule, 1 per segment, inframedial on basal acroscopic veins, but often 2 or 3 in basal acroscopic pinnule segments; indusia brown, oblong, elliptic, or shortly linear, sometimes horseshoe-shaped, rarely J-shaped, membranous, erose at margin, persistent. Perispore surface without folds.

- Forests; ca. 2700 m. Sichuan (Luding).

*Athyrium ludingense* is very close to *A. hirtirachis* but differs by the adaxial surface of lamina and the margin of segments sparsely shortly hairy, the abaxial surface of costae and the margin of costa wings rather densely shortly hairy, and the pinnules narrowly triangular to deltoid-oblong and acute at apex.

**58. *Athyrium hirtirachis*** Ching & Y. P. Hsu, Fl. Tsinling. 2: 215. 1974.

毛轴蹄盖蕨 *mao zhou ti gai jue*

*Athyrium gonggaense* Z. R. Wang & Li Bing Zhang.

Rhizomes short, erect, apex densely clothed with dark brown, membranous, linear-lanceolate scales. Fronds caespitose; fertile fronds up to 65–106 cm; stipe pale stramineous, 30–40 cm, 3–4 mm in diam. at base, base similarly densely scaly, upward glabrate; lamina 2-pinnate-pinnatifid, oblong or deltoid-oblong, 33–61 × (7–)22–46 cm at base, base slightly narrowed or almost not narrowed, apex acuminate; pinnae (8–)14–18 pairs, basal 1 or 2 pairs subopposite, upper pinnae alternate, ascending, shortly stalked (stalk ca. 3 mm), oblong-lanceolate to lanceolate, basal pinnae slightly narrowed at base, pinnules anadromous; upper pinnae not narrowed or broadened at base, pinnules catadromous; middle pinnae (3.5–)13–22 × (1.5–)4–6 cm at middle, base subequilateral, truncate or somewhat auriculate on acroscopic side, cuneate on basiscopic side, pinnate, apex long acuminate to somewhat caudate; pinnules (5–)14–22 pairs, lower pinnules opposite, upper pinnules alternate, oblong to deltoid-ovate; middle pinnules 1.8–2.2 cm × ca. 7 mm, sessile, spreading or slightly ascending, base inequilateral, auriculate on acroscopic side, cuneate on basiscopic side, dentate or pinnatifid to 1/2 at margin, apex obtuse-rounded to obtuse; pinnule segments 5 or 6 pairs, oblong, dentate at apex; veins visible abaxially, slightly visible adaxially, pinnate in pinnules, lateral veins 3–6 pairs, oblique, 2–4 veins forked per segment. Lamina herbaceous when dried, pale green; rachis and costae stramineous, slightly purplish red, with sparse brownish short hairs abaxially, hairs rather dense on middle and lower parts of costae on abaxial side, short hairs sparse on margin of costa wings, costules, and veins, with subulate spines on adaxial side at base of costa or costule. Sori oblong, elliptic, shortly linear, or J-shaped, sometimes horseshoe-shaped, 1–3 mm, 4–6 pairs per pinnule, biserial on both sides of costule, 1 per segment, inframedial on basal acroscopic veins, often 2–4 on basal acroscopic pinnule segments; indusia brown, oblong,

elliptic, or shortly linear, sometimes horseshoe-shaped, rarely J-shaped, membranous, erose at margin, persistent. Perispore surface without folds.

- Forests; 1800–3200 m. SE Gansu, Sichuan.

*Athyrium hirtirachis* morphologically is intermediate between *A. mackimmonii* and *A. dubium*. It differs from the former in the distal part of costae rather densely shortly hairy abaxially and the margin of wings  $\pm$  hairy. It also differs from the latter in the pinnae shortly stalked, the lowest pinnae broader, the sori longer, and the scales at stipe base linear-lanceolate.

**59. *Athyrium himalaicum*** Ching ex Mehra & Bir, Res. Bull. Panjab Univ. Sci., n.s., 15: 137. 1964.

中锡蹄盖蕨 zhong xi ti gai jue

Rhizomes short, erect, apex densely clothed with dark brown, narrowly lanceolate scales. Fronds caespitose; fertile fronds (12–)75–100 cm; stipe stramineous, 4–32 cm, 1–3.6 mm in diam., base similarly densely scaly, upward sparsely scaly; lamina pinnate-pinnatifid to 2-pinnate, oblong, 12–40 (–60)  $\times$  5–23 (–32) cm at middle, base hardly narrowed, apex acuminate and pinnatifid; pinnae 10–18 pairs, basal 2–4 pairs opposite, separated from each other, upper pinnae alternate, spreading, sessile; basal pinnae slightly shortened, (1.5–)9–10 cm, slightly narrowed at base, reflexed; middle pinnae lanceolate, up to 12–16  $\times$  2–3 cm, base equilateral, truncate, slightly broadened, pinnatifid nearly to costae, apex acuminate and toothed; pinnules (or pinna segments) up to 24 pairs, usually deltoid-oblong, basal pinnules longer, ca. 1 cm  $\times$  3.5 mm, connate with each other by narrow wing of costa, dentate at margin, apex subacute to acuminate; veins somewhat visible, pinnate in pinnules, lateral veins 4–7 pairs, simple (basal acroscopic veins frequently forked). Lamina papery when dried, brown, glabrate on both surfaces; rachis and costae stramineous, with very short spines on adaxial surface in distal part of costa, often with rather dense pallid unicellular hairs abaxially, with hairs also at sinus between segments. Sori large, oblong, 5 or 6 pairs per pinnule, supramedial on veins, reaching pinna margin; indusia brown, oblong, thickly membranous, subentire, persistent, often hidden under sporangia at maturity. Perispore surface without folds.  $2n = 80$ .

Bamboo and coniferous forests on gentle mountain slopes; 2300–3600 m. W Sichuan, Xizang, NW Yunnan [Bhutan, N India, Nepal].

**60. *Athyrium emeicola*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 13. 1986.

石生蹄盖蕨 shi sheng ti gai jue

Rhizomes erect, apex densely clothed with red-brown, lanceolate scales. Fronds caespitose; fertile fronds 20–30 cm; stipe stramineous, 9–15 cm, ca. 1.5 mm in diam., base similarly scaly, upward glabrate; lamina pinnate-pinnatifid, lanceolate, 10–15  $\times$  3.5–5 cm at middle, base slightly narrowed, apex acuminate; pinnae 13–15 pairs, lower pinnae opposite, upper pinnae alternate, spreading, sessile, basal pinnae shortened, 2–3 cm  $\times$  7–9 mm at base, base not narrowed or slightly broadened, pinnatifid, apex shortly acuminate; pinna segments 6–8 pairs, basal segments opposite or subopposite, upper segments

alternate, spreading or slightly ascending, approximate, oblong, middle segments ca. 3  $\times$  1.5 mm, margin dentate, apex truncate or rounded with 3 or 4 teeth; veins inconspicuous on both surfaces, pinnate in segments, lateral veins 3 or 4 pairs, simple, sometimes forked on basal acroscopic segments. Lamina herbaceous when dried, brown-green, glabrate on both surfaces; rachis stramineous, glabrate abaxially, wing of costae with short hairs at margin; rachis and costae with short spines adaxially. Sori orbicular, 1 per segment, sometimes 2 or 3 in lower segments, on basal acroscopic veins; indusia brown, horseshoe-shaped, thickly membranous, entire, persistent. Perispore surface without folds.

- Rock crevices; ca. 3200 m. Sichuan (Emei Shan, Jinding).

**61. *Athyrium bomicola*** Ching in C. Y. Wu, Fl. Xizang. 1: 136. 1983.

波密蹄盖蕨 bo mi ti gai jue

Fertile fronds 36–40 cm; stipe blackish brown at base, upward brown-stramineous, 17–20 cm, 1.5–3.5 mm in diam. at base, upward glabrate; lamina bipinnatifid, oblong-lanceolate, up to 20  $\times$  ca. 10 cm at middle, base not narrowed and subtruncate, apex shortly acuminate; pinnae 16–18 pairs, basal pinnae opposite, upper pinnae alternate, spreading, sessile, basal pinnae slightly shortened, not narrowed, broader, subtruncate at base, subbasal pinnae linear-lanceolate, 4.3–4.8  $\times$  ca. 1.2 cm at middle, base widened, truncate, pinnatifid, apex shortly acuminate; pinna segments ca. 14 pairs, spreading, separate from each other, rhomboid, ca. 4.5  $\times$  2 mm, margin subentire, apex rounded-truncate, with 3–5 teeth; upper pinnae similar to second basal pinnae, gradually shortened. Veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina thickly papery when dried, greenish brown, with sparse pale short hairs on adaxial surface, subglabrate abaxially; rachis brownish stramineous, wing of costae with short hairs at margin, purplish red abaxially, rachis and costa with needlelike thick spines on adaxial side at base of costa or costule. Sori orbicular or elliptic, 1–5 per segment, often up to 6 in basal acroscopic segments; indusia brown, horseshoe-shaped or elliptic, rarely orbicular-reniform, membranous, entire, persistent. Perispore surface without folds.

- Shrub groves; ca. 4100 m. SE Xizang.

**62. *Athyrium flabellulatum*** (C. B. Clarke) Tardieu, Asplén. Tonkin, 85. 1932.

狭叶蹄盖蕨 xia ye ti gai jue

*Asplenium filix-femina* (Linnaeus) Bernhardt var. *flabellulata* C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 493. 1880; *Athyrium filix-femina* (Linnaeus) Roth var. *deltoidea* Christ, p.p.; *A. filix-femina* var. *flabellulata* (C. B. Clarke) Beddome; *A. tenuifolium* Y. T. Hsieh & C. R. Wang (1983), not Copeland (1929).

Rhizomes short, erect, apex densely clothed with brown or chestnut-brown, ovate or ovate-lanceolate scales. Fronds caespitose; fertile fronds 37–40 cm; stipe blackish brown at base, upward stramineous, 10–13 cm, 1.5–2.5 mm in diam. at base, base similarly densely scaly, upward glabrate; lamina 2-pinnate,

lanceolate, 27–32 × 7–9 cm at middle, base gradually narrowed, apex acuminate; pinnae ca. 18 pairs, lower pinnae opposite, upper pinnae alternate, ascending, lowest 4 pairs of pinnae gradually shortened; basal pinnae ovate-oblong, 2–2.5 × 1.4–2 cm; middle pinnae lanceolate, 4.5–6.5 × 1.5–2 cm at middle, base truncate and broadened, basal acroscopic base overlaying rachis, pinnate, apex acuminate; pinnules 8–11 pairs, basal pinnules subopposite, upper pinnules alternate; middle pinnules spreading, sessile, oblong or narrowly ovate, 8–10 × 4–5 mm at middle, base broadly cuneate, slightly inequilateral, somewhat auriculate on acroscopic side, cuneate on basiscopic side, pinnatifid to 1/3–1/2, apex obtuse or acute, toothed; pinnule segments oblong, toothed at margin; veins pinnate in pinnules, 5 pairs, lower veins forked, upper veins simple. Lamina herbaceous when dried, brown-green adaxially, yellow-green abaxially, glabrate on both surfaces; rachis and costae pale purplish red abaxially, with subulate short spines adaxially. Sori oblong, sometimes J-shaped, 1 per segment, uniseriate on each side of midrib, slightly closer to midrib; indusia brown, oblong, sometimes J-shaped, firmly membranous, subentire or ciliate, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80$ .

Coniferous forests; (2800–)3700(–4000) m. SE Xizang [Bhutan, N India, Nepal].

*Athyrium flabellulatum* is morphologically intermediate between *A. mehrae* and *A. davidii* and has erect rhizomes and subulate short spines on the adaxial side of the rachis and costae.

**63. *Athyrium daxianglingense*** Ching & H. S. Kung, Acta Bot. Boreal.-Occid. Sin. 6(1): 16. 1986.

大相岭蹄盖蕨 da xiang ling ti gai jue

Rhizomes short, erect, apex clothed with red-brown, linear scales. Fronds caespitose; fertile fronds 37–50 cm; stipe blackish brown at base, upward stramineous, shiny, 18–28 cm, ca. 2.2 mm in diam. at base, base similarly scaly, upward glabrate; lamina nearly 2-pinnate, narrowly ovate, ca. 25 × 13 cm at middle, base slightly narrowed, apex acuminate; pinnae ca. 16 pairs, basal pinnae opposite, upper pinnae alternate, subspreading, subsessile, base slightly narrowed; middle pinnae lanceolate, up to 7 × ca. 1.5 cm, base equilateral, truncate, slightly broadened, nearly pinnate, apex acuminate; pinnules ca. 15 pairs, basal pinnules opposite, upper pinnules alternate, spreading, approximate, oblong, ca. 7 × 3.5 mm, base decurrent and adnate to costa wing, somewhat crenate at margin, apex rounded and with 3–5 teeth; veins visible abaxially, pinnate in pinnules, lateral veins 5 or 6 pairs, oblique, simple, or forked on basal acroscopic side. Lamina papery when dried, yellow-green, glabrate on both surfaces; rachis stramineous, with short hairs, costae pale red-purple, with sparse short hairs abaxially, with subulate spines on basiscopic margin of adaxial groove at costa or costule bases. Sori elliptic, 3 or 4 pairs per pinnule (or segments), inframedial on costules; indusia brown, similar to sori in shape, occasionally J-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

• Meadows on mountain slopes; 2200–2500 m. W Sichuan, Yunnan.

**64. *Athyrium obtusilimum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 11. 1986.

钝顶蹄盖蕨 dun ding ti gai jue

Rhizomes erect, apex densely clothed with brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 48–100 cm; stipe blackish brown at base, upward stramineous, 22–44 cm, up to 4 mm in diam. at base, base similarly densely scaly, upward with sparse small scales; lamina 2-pinnate, oblong or ovate-oblong, 28–54 × 18–36 cm, base slightly narrowed, apex somewhat abruptly narrowed; pinnae 7–9 pairs below abruptly narrowed tip, basal 1 or 2 pairs of pinnae subopposite, upper pinnae alternate, subspreading or ascending, with short stalk 1–2 mm or sessile, basal pinnae slightly shortened, narrowed to base; middle pinnae narrowly lanceolate or linear-lanceolate, 9–22 × 2.8–4.8 cm, base subequilateral, truncate and parallel to rachis on acroscopic side, broadly cuneate on basiscopic side, pinnate, apex long acuminate or somewhat caudate; pinnules 10–25 pairs, basal pinnules subopposite, upper pinnules alternate, spreading, shortly stalked or sessile, narrowly oblong, 1–2.5 cm × 4–10 mm, base widened, subtruncate, auriculate and parallel to rachis on acroscopic side, broadly cuneate on basiscopic side, decurrent and sometimes adnate to wing of costae, cut to 1/2, apex obtuse-rounded or acute; pinnule segments 4–9 pairs, subsquare, ascending, margin with 2 or 3 small teeth; upper pinnae similar to middle pinnae and gradually smaller, base not narrowed; veins visible on both surfaces, slightly protuberant and pale red-purple abaxially, forked or pinnate in segments. Lamina papery when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous, with sparse small scales and short hairs abaxially, with subulate spines on adaxial side at base of costa or costule. Sori orbicular-reniform, J-shaped, horseshoe-shaped, or oblong, inframedial on basal acroscopic veins, 1 per segment, biseriolate on both sides of costule; indusia brown, orbicular-reniform, J-shaped, horseshoe-shaped, or oblong, membranous, ciliate at margin, persistent. Perispore surface without folds, with reticulate ornamentation, reticulation size unequal.

• Shrub forests; 2500–3400 m. NW Yunnan.

**65. *Athyrium baoxingense*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 14. 1986.

宝兴蹄盖蕨 bao xing ti gai jue

Rhizomes short, erect, apex densely clothed with dark brown, linear-lanceolate, fibriform-tipped scales. Fronds caespitose; fertile fronds 80–100 cm; stipe blackish brown at base, upward stramineous, 35–50 cm, ca. 4 mm in diam. at base, base similarly densely scaly, upward glabrate; lamina 2-pinnate, oblong-lanceolate, 40–50 × 12–15 cm at middle, base slightly narrowed, apex long acuminate; pinnae 12–16 pairs, lower pinnae subopposite, upper pinnae alternate, slightly ascending, subsessile or shortly stalked (stalk ca. 1.5 mm), lower 2 or 3 pairs of pinnae subequal in size, lanceolate, slightly curved upward, 12–15 × 2.5–3 cm, long caudate-acuminate, base subcordate, pinnate; pinnules 15–17 pairs, basal pinnules subopposite, slightly larger, ovate-oblong, alongside rachis, pinnatifid; upper pinnules alternate, subspreading; basal 2 or 3 pairs of pinnules deltoid-oblong, 1–1.3 cm × 5–7 mm, base inequilateral, truncate,

auriculate on acroscopic side, cuneate on basispic side, decurrent and slightly adnate to costae, margin biserrate, apex acute; fourth basal and upper pinnules gradually smaller, decurrent and adnate to wing of costae; veins somewhat visible adaxially, protuberant abaxially, pinnate in pinnules, lateral veins ca. 6 pairs, oblique, forked, but pinnate on basal acroscopic side. Lamina subleathery when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous, with short glandular hairs abaxially, with subulate spines on adaxial side. Sori oblong, sometimes J-shaped, 4 or 5 pairs per pinnule, inframedial; indusia brownish, oblong, sometimes J-shaped, membranous, entire, partly fugacious when mature. Perispore surface without folds, ornate, net ridge disconnected, sometimes granular.

- Forests on mountains; ca. 2500 m. SW Sichuan.

**66. *Athyrium jinshajiangense*** Ching & K. H. Shing, Acta Bot. Boreal.-Occid. Sin. 6(1): 14. 1986.

金沙江蹄盖蕨 jin sha jiang ti gai jue

Rhizomes short, erect, apex clothed with red-brown, lanceolate scales. Fronds caespitose; fertile fronds up to 55 cm; stipe blackish brown, upward stramineous, up to 25 cm, base ca. 1.8 mm in diam., densely clothed with scales, upward glabrate; lamina 2-pinnate, oblong, 25–30 × ca. 16 cm at middle, base slightly narrowed, subrounded, apex acuminate; pinnae ca. 15 pairs, lower pinnae opposite, upper pinnae alternate, subspreading, sessile, basal pinnae slightly shortened, up to 7 cm, base slightly narrowed; third basal pinnae lanceolate, up to 10 cm × 2–2.4 cm, base equilateral, subtruncate, pinnate, apex acuminate; pinnules ca. 14 pairs, basal pinnules opposite, upper pinnules alternate, spreading, approximate, sessile, oblong, 1.2–1.4 cm × ca. 7 mm, base inequilateral, truncate, parallel to costae on acroscopic side, cuneate on basispic side, decurrent and adnate to wing of costae, pinnatifid to 1/2, apex obtuse-rounded and with lacerate long teeth; pinnule segments 3 or 4 pairs, rhomboid, ca. 2.5 × 1.5 mm, apex obtuse, with long teeth; veins visible on both surfaces, pinnate in segments, lateral veins 1 or 2 pairs, oblique, simple. Lamina thinly herbaceous when dried, pale yellow-green, glabrate on both surfaces; rachis stramineous, costae pale red-purple, with sparse short hairs abaxially, with needlelike spines on adaxial side at base of costa, costule, or midrib. Sori oblong, occasionally J-shaped, 1 per segment, 3 or 4 pairs per pinnule, close to costules; indusia brown, oblong, occasionally J-shaped, membranous, entire, persistent. Perispore surface without folds.

- Evergreen forests in valleys; ca. 3000 m. C Yunnan.

**67. *Athyrium interjectum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 15. 1986.

居中蹄盖蕨 ju zhong ti gai jue

*Athyrium acutiserratum* Ching.

Rhizomes short, erect, apex densely clothed with dark brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 35–42 cm; stipe blackish brown, upward stramineous, shiny, 18–22 cm, base ca. 3 mm in diam., similarly densely scaly; lamina nearly 2-pinnate, ovate-oblong, 20–25 × 13–15 cm at

middle, base slightly narrowed, apex acuminate; pinnae ca. 12 pairs, basal 1–3 pairs subopposite, upper pinnae alternate, spreading, sessile; basal pinnae shortened, 5.5–7 cm, base slightly narrowed; middle pinnae lanceolate, 7–8 × ca. 2 cm at middle, base equilateral, truncate alongside rachis, nearly pinnate, apex shortly acuminate; pinnules ca. 15 pairs, adnate to costae, oblong, 8–10 × 4–5 mm at middle, base decurrent and adnate to wing of costae, pinnatifid or biserrate, apex obtuse; veins inconspicuous adaxially, visible on abaxial surface, pinnate in pinnules, lateral veins ca. 5 pairs, oblique, lower veins forked, upper veins simple. Lamina firmly herbaceous when dried, greenish brown, sometimes sparsely shortly hairy adaxially, glabrate abaxially; rachis and costae stramineous abaxially, glabrate or shortly hairy, with subulate spines on adaxial side at base of costa or costule, wing of costae shortly hairy at margin. Sori mostly oblong, slightly curved, sometimes J-shaped, inframedial on basal acroscopic veins, 4 or 5 pairs per pinnule; indusia pale brown, J-shaped, often horseshoe-shaped on basal acroscopic veins, membranous, ciliate at margin, persistent. Perispore surface without folds, with reticulate ornamentation, areoles unequal in size, ridges sometimes disconnected.

- Valley forests; 2700–3500 m. NW Yunnan.

**68. *Athyrium suprapuberulum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 14. 1986.

毛叶蹄盖蕨 mao ye ti gai jue

*Athyrium muliense* Ching.

Rhizomes erect, apex densely scaly; scales brown, linear-lanceolate, fibriform-tipped, but scales above base of stipe often broadly lanceolate, chestnut-colored in central part, brown in marginal part. Fronds caespitose; fertile fronds 60–88 cm; stipe blackish brown, upward brown-stramineous, 20–45 cm, 4–6 mm in diam. at base, base similarly scaly, upward glabrate; lamina 2-pinnate, ovate-oblong, 30–35 × 20–25 cm at base, base ± rounded, apex acuminate; pinnae ca. 16 pairs, lower pinnae opposite, upper pinnae alternate, subspreading or falcate, sessile; basal pinnae almost equal to upper pinnae, lanceolate, 11–13 × 2.5–3.5 cm, base narrowed, equilateral, truncate, pinnate, apex acuminate; pinnules ca. 20 pairs, basal pinnules opposite, upper pinnules alternate, spreading, approximate; lower pinnules oblong, 1.2–1.5 cm × 5–6 mm at base, gradually narrowed to pointed toothed tip, base rounded-truncate, subequilateral, pinnatifid; pinnule segments 7 or 8 pairs, oblong, ca. 3 × 1.5 mm, apex acute and toothed; veins protuberant abaxially, visible adaxially, pinnate in segments, lateral veins 2–4 pairs, oblique, simple. Lamina herbaceous when dried, yellowish brown, with sparse pallid short hairs adaxially, glabrate abaxially; rachis and costae brownish stramineous, with dense short hairs abaxially, with subulate spines on adaxial side at base of costa or costule. Sori mostly oblong, sometimes J-shaped, 5–8 pairs per pinnule, inframedial on basal acroscopic veins, often 3–5 on lower segments; indusia brownish, oblong, sometimes J-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

- Coniferous forests in valleys; 2800–3500 m. Sichuan, NW Yunnan.

**69. *Athyrium zayuense*** Z. R. Wang, Acta Phytotax. Sin. 32: 84. 1994.

察隅蹄盖蕨 cha yu ti gai jue

Rhizomes short, erect, apex densely scaly; scales chestnut-black in central part, dark brown in marginal part, linear-lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds 38–40 cm; stipe stramineous, 12–14 cm, 1–1.5 mm in diam., base densely scaly, upward subglabrate; lamina 2-pinnate, ovate-oblong, ca. 28 × 11–12 cm at middle, base hardly narrowed, apex long acuminate; pinnae ca. 15 pairs, sessile, lower pinnae subopposite, upper pinnae alternate, basal 1–3 pairs of pinnae slightly shortened, reflexed, base slightly narrowed, but slightly prominent, subspreading-ascending, linear-lanceolate, 5–6 cm × 9–10 mm at middle, base truncate, equilateral, pinnate, apex long acuminate; pinnules ca. 15 pairs, lower pinnules opposite, upper pinnules alternate, spreading, oblong, 3–4 × 2–2.5 mm at base, base subequilateral, decurrent and adnate to wing of costa, somewhat auriculate on acroscopic side, margin biserrate, apex rounded-truncate and toothed; veins visible abaxially, pinnate in pinnules, lateral veins ca. 5 pairs, oblique, forked. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous, with brownish short glandular hairs abaxially, margin of wings sparsely hairy, with subulate spines on adaxial side at base of costa or costule. Sori oblong, ca. 3 pairs per pinnule, basal acroscopic sori often J-shaped; indusia pale brown, oblong or J-shaped, membranous, erose, persistent. Spores bilateral, perispore surface without folds.

• Coniferous forests on mountain slopes; 3300–3400 m. SE Xizang (Zayü).

*Athyrium zayuense* is very similar to *A. dubium* in appearance but differs by the pinnae and segments much smaller, pinnae less than 1 cm wide, pinnules oblong, subtruncate, 2–3 mm wide, and scales at stipe base black in central part with prominent brown narrow margin.

The name "*Athyrium chayense*" (Z. R. Wang, Vasc. Pl. Hengduan Mount. 1: 84. 1993) was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**70. *Athyrium lineare*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 11. 1986.

线羽蹄盖蕨 xian yu ti gai jue

Rhizomes short, erect, apex densely clothed with dark red-brown, linear-lanceolate, fibriform-tipped scales. Fronds caespitose; fertile fronds 60–70 cm; stipe stramineous, ca. 30 cm, ca. 3.5 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate-pinnatifid, ovate-oblong, ca. 40 × 20–25 cm at middle, base hardly narrowed, apex long acuminate; pinnae ca. 16 pairs, lower pinnae subopposite, upper pinnae alternate, basal pinnae slightly shortened, reflexed, base narrowed, subspreading-ascending, sessile, linear-lanceolate, 12–14 × 2–2.5 cm at middle, base truncate, equilateral, pinnate-pinnatifid, apex long acuminate; pinnules ca. 20 pairs, lower pinnules opposite, reflexed, upper pinnules alternate, spreading, oblong, 1–1.2 cm × 4–5 mm at base, base subequilateral, somewhat auriculate, decurrent and adnate to wing of costae, pinnatifid to 1/3–1/2, apex

acute and toothed; veins visible abaxially, pinnate in pinnules, lateral veins ca. 8 pairs, oblique, forked, but pinnate in basal segments. Lamina papery when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous, with brownish short glandular hairs abaxially, narrow wings hairy at margin, with subulate spines on adaxial side at base of costa or costule. Sori oblong, ca. 6 pairs per pinnule, inframedial; indusia pale brown, oblong, sometimes lower indusia reniform or hooked, membranous, subentire or somewhat erose, persistent. Spores bilateral, perispore surface without folds.

• Forests; 2800–3700 m. NW Yunnan.

**71. *Athyrium chungtienense*** Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 277. 1949.

中甸蹄盖蕨 zhong dian ti gai jue

*Athyrium habaense* Ching.

Rhizomes short, erect, apex densely clothed with red-brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 55–90 cm; stipe blackish brown, upward pale stramineous, 25–35 cm, 1.5–2.5 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate with pinnules pinnatifid, or nearly 3-pinnate, narrowly deltoid-ovate, 35–60 × 30–45 cm, base broadened, apex acuminate; pinnae 14–16 pairs, alternate, subspreading, sessile (basal pinnae sometimes shortly stalked), basal pinnae largest, oblong-lanceolate, up to 25 × ca. 12 cm at middle, base narrowed, truncate, alongside rachis, bipinnatifid, apex acuminate; pinnules ca. 18 pairs, basal pinnules subopposite, catadromous, upper pinnules alternate, subspreading, broadly lanceolate, basal 2 or 3 pairs of pinnules shortened (basal pinnules 1.5–2.2 cm); middle pinnules largest, 5–6 × 1.9–2.1 cm at base, base equilateral, subtruncate, alongside costae, somewhat adnate to costae, but not decurrent, pinnatifid nearly to costule, apex acuminate; pinnule segments ca. 12 pairs, subspreading, acroscopic and basicopic segments subequal, oblong, basal segments slightly larger, 9–10 × 4–5 mm, pinnatifid, apex rounded-obtuse; ultimate segments with 2 or 3 small teeth or biserrate at margin; second or third basal pinnule segments subequal in size to basal segments, but not narrowed to base; upper pinnule segments gradually smaller, distal part of pinnule pinnatifid; veins visible adaxially, clearly visible abaxially, pinnate in segments, lateral veins 5 or 6 pairs, oblique, lower veins 2- or 3-forked. Lamina herbaceous when dried, green, glabrate; rachis, costae, and costules stramineous abaxially, with subulate spines on adaxial side at base of costa and costule, and sometimes also in distal part of midrib. Sori orbicular-reniform, J-shaped, or horseshoe-shaped, 3–5 pairs per segment, biserrate on both sides of costules; indusia brown, orbicular-reniform, J-shaped, or horseshoe-shaped, membranous, erose at margin, persistent. Perispore surface without folds, reticulate.

• Coniferous forests on mountains; 3000–4000 m. NW Yunnan.

**72. *Athyrium austro-orientale*** Ching in C. Y. Wu, Fl. Xizang. 1: 141. 1983.

藏东南蹄盖蕨 zang dong nan ti gai jue

*Athyrium aculeatum* Ching; *A. dajinense* Ching.

Fertile fronds ca. 66 cm; stipe blackish brown, upward pale red-purple, 24–28 cm, 2.5–3.5 mm in diam. at base, base densely clothed with brownish, narrowly lanceolate scales, upward glabrate; lamina 2-pinnate, ovate-lanceolate, up to 40 × ca. 22 cm above base, base hardly narrowed, apex acuminate; pinnae ca. 15 pairs, basal pinnae opposite, upper pinnae alternate, subspreading or ascending, sessile; basal pinnae slightly shortened, up to 13 cm, base narrowed; middle pinnae narrowly lanceolate, up to 14 × ca. 3 cm at middle, base inequilateral, truncate, parallel to rachis on acroscopic side, broadly cuneate on basicopic side, pinnate, apex acuminate; pinnules 15–17 pairs, basal pinnules subopposite, upper pinnules alternate, spreading, widely separated from each other, ovate-oblong, middle pinnules 1.2–1.5 cm × 6–7 mm at base, base inequilateral, rounded-truncate on acroscopic side, narrowly cuneate on basicopic side, decurrent and adnate to wing of costae, pinnatifid to 1/2, apex obtuse-rounded or acute; pinnule segments 5 or 6 pairs, with 2 or 3 stretched teeth at apex; veins somewhat visible adaxially, visible abaxially, pinnate in pinnules, lateral veins 2- or 3-forked, sometimes pinnate in basal acroscopic segments. Lamina herbaceous when dried, dark green, with sparse short hairs adaxially; rachis and costae pale purplish red, with subulate short spines adaxially, wings of costae with short hairs at margin. Sori mostly elliptic, occasionally curved, 1 per segment, inframedial; indusia brown, elliptic, occasionally J-shaped, membranous, subentire, persistent. Perispore surface without folds.

- Coniferous forests; 2400–3800 m. Sichuan, SE Xizang, Yunnan.

*Athyrium austro-orientale* is very similar to *A. suprapuberulum* but differs by the stipes and rachis pale red-purple abaxially, lower pinnules separated from each other by 3–5 mm, and pinnule segments shortly toothed at apex.

**73. *Athyrium dubium*** Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 281. 1949.

毛翼蹄盖蕨 mao yi ti gai jue

*Asplenium filix-femina* (Linnaeus) Bernhardt subvar. *rubricaula* Edgeworth ex C. B. Clarke; *Athyrium acutum* Ching; *A. aequilaterale* Ching; *A. filix-femina* (Linnaeus) Roth subvar. *rubricaula* (Edgeworth ex C. B. Clarke) Beddome; *A. longipinum* Ching; *A. machangense* Ching; *A. rubricaula* (Edgeworth ex C. B. Clarke) Bir; *A. serratodentatum* Ching; *A. sublineare* Ching; *A. uniseriatum* Ching.

Rhizomes short, erect, apex densely clothed with brown or dark brown, lanceolate scales. Fronds caespitose; fertile fronds 45–70 cm; stipe blackish brown, upward pale stramineous, 20–25 cm, 2–3 mm in diam., base densely clothed with scales, upward glabrate; lamina pinnate, oblong, 30–40 × ca. 16 cm at middle, base hardly narrowed, apex acuminate; pinnae pinnatifid or nearly 2-pinnate, ca. 15 pairs, lower pinnae subopposite, upper pinnae alternate, spreading or slightly ascending, sessile, lanceolate, basal pinnae slightly shortened, middle pinnae 8–12 × 1.8–2.2 cm at base, base truncate, equilateral, pinnate, apex acuminate; pinnules ca. 20 pairs, basal pinnules opposite, upper pinnules alternate, spreading, oblong, ca. 1.3 cm × ca. 6 mm, base inequilateral, subtruncate, slightly auriculate on acroscopic side, cuneate on basicopic side, decurrent and ad-

nate to wing of costules, pinnatifid, apex obtuse; pinnule segments ca. 6 pairs, obtuse-rounded, toothed (occasionally lacinate) at apex; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins pinnate in larger segments, 2- or 3-forked in small segments. Lamina papery when dried, pale green, glabrate on both surfaces; rachis and costae brownish stramineous, sparsely shortly hairy abaxially, with subulate spines on adaxial side at base of costa or costule. Sori elliptic, 4 or 5 pairs per pinnule, inframedial on basal acroscopic veins; indusia brownish, elliptic, membranous, entire, fugacious when mature. Perispore surface without folds, with granular ornamentation.  $2n = 80^*$ .

Coniferous or mixed forests, wet areas; (1000–)2500–3900 m. Guizhou, Sichuan, Xizang, Yunnan [India (Sikkim)].

**74. *Athyrium clivicola*** Tagawa, Acta Phytotax. Geobot. 3: 32. 1934.

坡生蹄盖蕨 po sheng ti gai jue

Rhizomes short, erect, apex densely clothed with dark brown, linear-lanceolate, fibriform-tipped scales. Fronds caespitose; fertile frond 30–40 cm; stipe blackish brown, upward stramineous, 15–25 cm, 2–2.5 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate, deltoid-ovate, 20–25 × 16–20 cm at base, apex abruptly narrowed; pinnae 6 or 7 pairs, alternate, approximate, ascending, with stalk up to 5 mm, basal pinnae not shortened, prominently narrowed toward base, lower pinnae broadly lanceolate, 8–12 × 2.5–3.5 cm at middle, base truncate, equilateral, pinnate, apex long acuminate; pinnules ca. 12 pairs, alternate, subspreading, shortly stalked or sessile, lower pinnules oblong-triangular or ovate, (1–)1.5–2.2 cm × (5–)8–10 mm at middle, apex obtuse-rounded to obtuse, base truncate and auriculate on acroscopic side, auricles overlaying or parallel to costa, rounded at apex, cuneate on basicopic side, apex small-toothed; veins slightly visible adaxially, visible abaxially, lateral veins ca. 7 pairs, oblique, pinnate in segments. Lamina herbaceous when dried, pale green, glabrate; rachis and costae stramineous, sometimes pale purplish red, glabrate abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong or shortly linear, 5 pairs per pinnule, biserrate on both sides of costule, subcostular, occasionally 1 or 2 in auriculate lobes; indusia brownish, oblong or shortly linear, sometimes reniform at base of pinnule, membranous, entire, persistent. Perispore surface without folds.  $2n = 160$ .

Valley forests, partly shaded areas near ridges, wet areas; 500–2500 m. Anhui, Chongqing, Fujian, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, C and S Taiwan, Zhejiang [Japan, Korea].

- 1a. Pinnules oblong-triangular, 1.5–2.2 cm × 8–10 mm, basal acroscopic auricular base of pinnule often overlaying costa ..... 74a. var. *clivicola*
- 1b. Pinnules ovate-oblong, 1–1.8 cm × 5–8 mm, basal acroscopic auricular base of pinnule subparallel to costa, not overlaying costa ..... 74b. var. *rotundum*

**74a. *Athyrium clivicola* var. *clivicola***

坡生蹄盖蕨(原变种) po sheng ti gai jue (yuan bian zhong)

*Athyrium auriculatum* Serizawa; *A. wardii* (Hooker) Makino var. *clivicola* (Tagawa) Kurata; *A. wardii* var. *majus* Ohwi (1957), p.p., not Makino (1899).

Pinnules oblong-triangular, 1.5–2.2 cm × 8–10 mm, basal acroscopic auricular base of pinnule often overlaying costa.  $2n = 160$ .

Valley forests, partly shaded areas near ridges, wet areas; 500–2500 m. Anhui, Chongqing, Fujian, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, C and S Taiwan, Zhejiang [Japan, Korea].

**74b. *Athyrium clivicola* var. *rotundum*** Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 508. 1999.

圆羽蹄盖蕨 *yuan yu ti gai jue*

Pinnules ovate-oblong, 1–1.8 cm × 5–8 mm, basal acroscopic auricular base of pinnule subparallel to costa, not overlaying costa.

• About 2100 m. Chongqing (Jinfo Shan).

*Athyrium clivicola* var. *rotundum* differs from var. *clivicola* in the pinnules short and ovate-oblong, rounded at apex, entire or with small teeth at margin, and the acroscopic basal pinnules subparallel to costae, not overlapping costae at base.

**75. *Athyrium infrapuberulum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(2): 100. 1986.

凌云蹄盖蕨 *ling yun ti gai jue*

Rhizomes erect, apex densely clothed with yellow-brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 40–70 cm; stipe blackish brown, upward brown-stramineous to purplish red, 20–28 cm, 2–4 mm in diam. at base, base similarly densely scaly, upward glabrate; lamina 2-pinnate, broadly ovate, 22–42 × 18–25 cm, base hardly narrowed, apex acuminate, slightly cuspidate; pinnae 12–17 pairs, spreading or slightly ascending, lower pinnae with stalk 1–3 mm, upper pinnae sessile, basal pinnae hardly shortened, broadly lanceolate, base prominently narrowed; middle pinnae oblong-lanceolate or lanceolate, 8–18 × 2–4.5 cm at middle, base slightly narrowed, subtruncate on acroscopic side, broadly cuneate on basicopic side, pinnate, apex acuminate; pinnules 20–22 pairs, basal pinnules subopposite, upper pinnules alternate, ascending, sessile; middle pinnules oblong, somewhat falcate, 1–3 cm × 4–10 mm, base decurrent and adnate to wing of costa, pinnatilobate, apex rounded or obtuse; pinnule segments dentate at margin; lower pinnae similar to middle pinnae but slightly smaller; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 4–10 pairs, middle and lower veins forked or pinnate. Lamina papery when dried, greenish brown, glabrate on both surfaces; rachis and costae pale red-purple, with dense brownish short glandular hairs abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong, frequently J-shaped in distal part of pinna or basal acroscopic part of pinnule, inframedial on basal acroscopic veins, 6–8 pairs per pinnule, biseriolate on both sides of costules, inframedial; indusia brownish, oblong, or J-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

• Mountain slopes, forests, wet areas; 500–600 m. NW Guangxi (Baise, Lingyun).

**76. *Athyrium criticum*** Ching, Fl. Tsinling. 2: 216. 1974.

蒿坪蹄盖蕨 *hao ping ti gai jue*

Rhizomes short, stout, erect, apex densely clothed with dark brown, lanceolate scales. Fronds caespitose; fertile fronds 42–85 cm; stipe pale stramineous, 20–45 cm, ca. 2.5 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate-pinnatifid, broadly ovate, 25–45 × 24–30 cm, base not narrowed, apex abruptly narrowed; pinnae ca. 15 pairs, alternate, approximate, oblique, stalked, basal pinnae larger, 20–24 × ca. 7 cm at middle, broadly lanceolate, base slightly narrowed, pinnate-pinnatifid, apex long acuminate; pinnules ca. 20 pairs, ascending, lower pinnules conspicuously shortened, 1.5–2 cm × 4–6 mm; middle pinnules lanceolate, 2.5–2.8 cm × ca. 6 mm, base narrowly truncate, somewhat auriculate on acroscopic side, margin pinnatifid 1/2–2/3, apex long acuminate; pinnule segments 8–12 pairs, oblong, 2.5–3 × 1.8–2.2 mm, apex acute with long teeth; veins visible on both surfaces, 2- or 3-forked or simple in segments, but pinnate on basal acroscopic segments. Lamina herbaceous when dried, pale green, glabrate; rachis and costae abaxially stramineous, with sparse linear-lanceolate small scales, usually glabrous, sometimes sparsely shortly hairy, with subulate spines on adaxial side at base of costa or costule. Sori elliptic, biseriolate on both sides of costules; indusia brown, elliptic, occasionally J-shaped, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

• Forests; 1100–2300 m. Shaanxi, W Sichuan, NW Yunnan.

**77. *Athyrium brevistipes*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 12. 1986.

短柄蹄盖蕨 *duan bing ti gai jue*

Rhizomes short, erect, apex densely clothed with brownish, linear-lanceolate scales. Fronds caespitose; fertile fronds ca. 50 cm; stipe blackish brown, upward stramineous to slightly purplish red, ca. 20 cm, ca. 3 mm in diam. at base, base similarly densely scaly, upward glabrate; lamina 2-pinnate, ovate-oblong, ca. 35 × 20 cm at middle, base slightly narrowed, apex abruptly narrowed; pinnae under abruptly narrowed tip 8 or 9 pairs, alternate, ascending, with stalk ca. 5 mm, lower pinnae subequal to above, lanceolate, up to 18 × 3–3.5 cm, base equilateral, somewhat auriculate (acroscopic auricles larger, triangular), crenulate at margin, apex caudate-acuminate; upper pinnae sessile, falcate-lanceolate, base inequilateral, truncate, somewhat auriculate on acroscopic side, cuneate and slightly decurrent on basicopic side, apex acute; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 7 or 8 pairs, oblique, forked or simple (pinnate in basal acroscopic segment). Lamina subherbaceous when dried, pale green, glabrate on both surfaces; rachis and costae pale red-purple, with short brownish glandular hairs abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong or shortly linear, 7 pairs per pinnule (2 pairs per basal acroscopic auriculate lobes), inframedial; indusia brownish, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds, with or-

nate ornamentation, reticulations different in size, ridges usually disconnected.

• Valley forests; ca. 1300 m. Chongqing, Guizhou, Hubei, Hunan, S Shaanxi, Sichuan.

**78. *Athyrium kenzo-satakei*** Sa. Kurata, J. Geobot. 7: 75. 1958.

紫柄蹄盖蕨 *zi bing ti gai jue*

Plants evergreen. Rhizomes erect or ascending, apex densely clothed with blackish brown, linear-lanceolate, fibri-form-tipped scales. Fronds caespitose; fertile fronds 42–62 cm; stipe blackish, upward purple, 22–30 cm, 1.5–2 mm in diam., base similarly densely scaly, upward glabrate; lamina 2-pinnate, narrowly triangular, 20–30 × 10–18 cm at base, base hardly narrowed, truncate, apex acuminate; pinnae up to 16 pairs, basal pinnae opposite or subopposite, upper pinnae alternate, lower pinnae spreading, upper pinnae ascending, with stalk (1.5–)2–3 mm, basal pinnae slightly shortened, 4.5–9.5 cm, base narrowed; basal 2–4 pairs of pinnae subequal in size, lanceolate, 4.5–11 × 2–3 cm at middle, base equilateral, subtruncate, broadened, pinnate (or pinnatifid), apex caudate-acuminate; pinnules 8–12 pairs, basal pinnules subopposite, upper pinnules alternate, subspreading, sessile, catadromous, deltoid-lanceolate or oblong, 1–1.6 cm × 5–9 mm at base, base inequilateral, rounded-truncate, auriculate on acroscopic side, auricles oblong, subentire, cuneate on basicopic side, shallowly lobed or repand, apex obtuse-rounded; fifth basal and upper pinnae gradually shortened; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 4–7 pairs, lower veins forked, upper veins simple, but pinnate in basal acroscopic segments. Lamina thickly papery when dried, blackish brown adaxially, brownish green abaxially, both surfaces glabrate; rachis and costae purplish, with short hairs abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong, biseriate on both sides of costules on acroscopic veinlet, subcostular; indusia brown, oblong, rarely J-shaped, membranous, entire, persistent. Perispore surface without folds.  $2n = 160$ .

Forests, wet areas; 800–2100 m. Guangdong, Guangxi, Guizhou, Sichuan [Japan].

*Athyrium kenzo-satakei* differs from related species in the lamina narrowly triangular; pinnae 12–16 pairs or 6 pairs under abruptly narrowed apex, up to 11 cm; pinnules deltoid-lanceolate or oblong except auriculate base, 1–1.5 × 5–9 mm (at base with acroscopic auriculate segments), usually less than 5 mm wide at middle, less than 3 × as long as wide at middle, subentire or minutely toothed; sori oblique to midrib; and indusia entire.

- 1a. Lamina gradually narrowed to apex, pinnae 12–16 pairs, lower pinnae stalked (stalk 2–3 mm), rachis and costae with sparse short hairs ..... 78a. var. *kenzo-satakei*  
 1b. Lamina abruptly narrowed to apex, pinnae up to 6 pairs below narrowed apex, lower pinnae shortly stalked (stalk ca. 1.5 mm), rachis and costae with dense brownish short glandular hairs ..... 78b. var. *jieguishanense*

**78a. *Athyrium kenzo-satakei* var. *kenzo-satakei***

紫柄蹄盖蕨(原变种) *zi bing ti gai jue* (yuan bian zhong)

*Athyrium arisanense* (Hayata) Tagawa var. *kenzo-satakei* (Sa. Kurata) Serizawa.

Lamina gradually narrowed to apex, pinnae 12–16 pairs, lower pinnae stalked (stalk 2–3 mm), rachis and costae with sparse short hairs.  $2n = 160$ .

Forests, wet areas; 800–2100 m. Guangdong, Guangxi, Guizhou, Sichuan [Japan].

**78b. *Athyrium kenzo-satakei* var. *jieguishanense*** (Ching) Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 225. 1999.

介贵山蹄盖蕨 *jie gui shan ti gai jue*

*Athyrium jeguishanense* Ching, Acta Bot. Boreali-Occid. Sin. 6(3): 157. 1986.

Lamina abruptly narrowed to apex, pinnae up to 6 pairs below narrowed apex, lower pinnae shortly stalked (stalk ca. 1.5 mm); rachis and costae with dense brownish short glandular hairs.

• Open forests. Guangxi (Dingpu, Jiegui Shan, Jinxiu).

**79. *Athyrium longius*** Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 178. 1941.

长柄蹄盖蕨 *chang bing ti gai jue*

Rhizomes short, erect, apex densely clothed with blackish brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 50–60 cm; stipe blackish brown, upward stramineous, 25–30 cm, 2.5–3 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate, broadly ovate, ca. 25 × 15 cm, apex acuminate; pinnae ca. 8 pairs, basal pinnae opposite, upper pinnae alternate, stalked (stalk 6–15 mm), broadly lanceolate, 13–15 × 4–4.5 cm at middle, base subcordate, pinnate, apex acuminate; pinnules ca. 12 pairs, alternate, subspreading, lower pinnules shortly stalked (stalk 1–2 mm), oblong-triangular, 2–2.5 × ca. 1 cm at base, base slightly inequilateral, ± auriculate (acroscopic side larger), pinnatifid, apex acute and serrulate; veins visible abaxially, inconspicuous adaxially, pinnate in segments, lateral veins oblique, simple. Lamina papery when dried, dark greenish brown, glabrate; rachis and costae with brownish short glandular hairs abaxially. Sori oblong, ca. 7 pairs per pinnule, inframedial, uniseriate on both sides of midrib, often 1 or 2 pairs in basal auriculate lobe of pinnule; indusia brownish, elongated, sometimes horseshoe-shaped in auriculate lobes, membranous, entire, persistent. Perispore surface without folds.

• Wet areas in forests on mountain slopes; 800–1800 m. Guizhou, Hunan.

**80. *Athyrium wardii*** (Hooker) Makino, Bot. Mag. (Tokyo) 13: 28. 1899.

华中蹄盖蕨 *hua zhong ti gai jue*

Rhizomes short, erect, apex densely clothed with dark brown, linear-lanceolate scales. Fronds caespitose; fertile fronds (30–)45–60 cm; stipe blackish brown, upward pale stramineous, (20–)25–30 cm, (1–)2.5–3 mm in diam., base densely

clothed with scales, upward glabrate; lamina lower part pinnate-pinnatifid to 2-pinnate, apical part pinnatifid, deltoid-ovate or ovate-oblong, sometimes lanceolate in small plants, (22-)25-35 × (8-)20-25 cm at base, apex abruptly narrowed, long acuminate; pinnae 5-8 pairs, alternate, ascending, stalked (stalk 2-6 mm), broadly lanceolate, 3-15 × (1.2-)3-3.5 cm at middle, base truncate, pinnate, apex obtuse to long acuminate; pinnules 10-14 pairs, alternate, ascending, sessile, oblong, ca. 2 cm × 8 mm, slightly narrowed toward apex, base inequilateral, truncate, slightly auriculate on acroscopic side, decurrent on basiscopic side, margin serrulate, apex acute or subobtuse; upper pinnae sessile, oblong, base truncate or rounded-cuneate on acroscopic side, slightly decurrent on basiscopic side, apex acute or obtuse; middle pinnae pinnatifid; veins visible abaxially, somewhat visible adaxially, pinnate in pinnules, lateral veins ca. 8 pairs, oblique, forked, but pinnate in basal acroscopic lobe (second basal veins 3-forked). Lamina papery when dried, pale brown, glabrate; rachis stramineous, sparsely scaly; costae and costules pale purple on abaxial surface, with dense brownish short glandular hairs or glabrate. Sori oblong or shortly linear, ca. 5 pairs per pinnule, inframedial, biserial on both sides of costule; indusia brownish, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds.  $2n = 160$ .

Valley forests, streamsides, damp areas; 500-1900(-3600) m. Anhui, Chongqing, Fujian, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang [Japan, Korea].

*Athyrium wardii* differs from related species in the lamina deltoid or deltoid-ovate with abruptly narrowed apex; the pinnae ca. 5 pairs below cuspidate apex; the lower pinnules of basal pinnae shortened; the pinnules of middle pinnae ascending, oblong, inequilateral, auriculate only at acroscopic base, ca. 8 mm wide, serrate; and the costae densely pubescent on abaxial side.

- 1a. Costae glabrate abaxially ..... 80c. var. *glabratum*  
 1b. Costae glandular hairy abaxially.  
     2a. Pinnae moderately separated from each other; costae with dense brownish short glandular hairs ..... 80a. var. *wardii*  
     2b. Pinnae and pinnules approximate ..... 80b. var. *densipinnum*

### 80a. *Athyrium wardii* var. *wardii*

华中蹄盖蕨(原变种) hua zhong ti gai jue (yuan bian zhong)

*Asplenium wardii* Hooker, Sp. Fil. 3: 189. 1860; *Athyrium tsusimense* Koidzumi.

Pinnae moderately separated from each other; costae with dense brownish short glandular hairs.  $2n = 160$ .

Valley forests, streamsides, damp areas; 500-1900(-3600) m. Anhui, Chongqing, Fujian, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang [Japan, Korea].

**80b. *Athyrium wardii* var. *densipinnum*** Z. R. Wang & Li Bing Zhang, Acta Bot. Yunnan. 17: 303. 1995.

密羽华中蹄盖蕨 mi yu hua zhong ti gai jue

Pinnae and pinnules approximate.

- About 3600 m. Sichuan (Kangding).

**80c. *Athyrium wardii* var. *glabratum*** Y. T. Hsieh & Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 508. 1999.

无毛华中蹄盖蕨 wu mao hua zhong ti gai jue

Costae without glandular hairs abaxially.

- 500-1500 m. Fujian, Hunan, Zhejiang.

**81. *Athyrium venulosum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 13. 1986.

粗脉蹄盖蕨 cu mai ti gai jue

Rhizomes short, erect, apex clothed with brown, subulate lanceolate scales. Fronds caespitose; fertile fronds 42-60 cm; stipe blackish brown, upward stramineous, shiny, 30-36 cm, ca. 3 mm in diam. at base, base similarly scaly, upward glabrate; lamina 2-pinnate, deltoid-ovate, 22-26 × 21-25 cm at base, base rounded-cuneate, apex abruptly narrowed, shortly acuminate; pinnae ca. 15 pairs, subopposite, ascending, with stalk 2-3 mm, pinnae under abruptly narrowed tip 5 pairs, basal pinnae largest, broadly lanceolate, 11-15 × 3.2-4.6 cm at middle, base equilateral, subtruncate, alongside rachis, pinnate, apex long acuminate; pinnules 16-18 pairs, basal pinnules opposite, upper pinnules alternate, ascending, sessile, several lower pinnae slightly shortened, broadly lanceolate, middle pinnules 1.8-3 cm × 8-12 mm at base, base inequilateral, truncate, somewhat auriculate and parallel to costae on acroscopic side, cuneate on basiscopic side, ± adnate to costae or decurrent and adnate to wing of costa, pinnatifid, apex shortly acuminate; pinnule segments 4-6 pairs, basal acroscopic segments larger, oblong, up to 7 × ca. 4 mm, margin with small teeth, apex obtuse-rounded; upper segments gradually smaller; second basal and upper 4 pairs of pinnae similar to basal pinnae, but gradually shallowly pinnatifid; veins visible on both surfaces, protuberant abaxially, pinnate in segments, lateral veins 3-5 pairs, mostly simple, oblique, thick. Lamina thickly papery when dried, yellow-green, glabrate on both surfaces; rachis and costae stramineous, with sparse short hairs abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong, only 1 per segment, 2 or 3 in basal acroscopic segments, lateral on basal acroscopic vein; indusia pale brown, oblong, membranous, arose at margin, persistent. Perispore surface without folds.

- Valleys, damp areas, by rocks; 1600-1700 m. NW Hubei (Xingshan).

**82. *Athyrium christensenii*** Tardieu, Asplén. Tonkin, 80. 1932.

中越蹄盖蕨 zhong yue ti gai jue

*Lunathyrium christensenii* (Tardieu) Ching.

Rhizomes short, erect, apex densely scaly; scales dark brown, linear-lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds 40-75 cm; stipe blackish brown, upward green-stramineous, 18-30 cm, 2-2.5 mm in diam. at base, base similarly densely scaly, upward with sparse small scales; lamina 2-pinnate, ovate-oblong, (28-)35-55 × 12-16 cm, base narrowed, apex acuminate; pinnae 15-20 pairs, basal pinnae subopposite, upper pinnae alternate, spreading or slightly ascending, with short stalk ca. 1.5 mm or subsessile, basal pinnae conspicuously shortened, broadly lanceolate, 10-12 × ca. 2 cm, base inequi-

lateral, narrowly cuneate on basiscopic base, pinnate, apex acuminate; pinnules 8–12 pairs, alternate, slightly ascending, sessile, narrowly elliptic, ca. 1.2 cm × 4 mm, base adnate to costae, decurrent on basiscopic side, margin shallowly repand-lobed or crenate, apex rounded or obtuse-acute; middle pinnae larger, up to 13 × ca. 2.5 cm, base equilateral, subtruncate, pinnate, apex long acuminate, somewhat caudate; pinnules similar to pinnules of basal pinna, slightly larger; veins slightly visible adaxially, visible abaxially, pinnate in pinnules, lateral veins 6–8 pairs, basal veins forked (sometimes pinnate), upper veins simple. Lamina herbaceous when dried, light greenish brown, glabrate on both surfaces; rachis and costae on abaxial surface stramineous, with dense brown short glandular hairs, with subulate spines on adaxial side at base of costa or costule. Sori shortly linear or oblong, ca. 7 pairs per pinnule, biseriate on both sides of costules, medial or supramedial; indusia brown, shortly linear or oblong, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.

Evergreen forests; 1000–2300 m. SW Guangxi, SE Yunnan [Vietnam].

**83. *Athyrium delavayi*** Christ, Bull. Soc. Bot. France 52(Mém. 1): 47. 1905.

翅轴蹄盖蕨 *chi zhou ti gai jue*

*Athyrium latibasis* Ching; *A. mairei* Rosenstock; *A. neo-delavayi* Ching & H. S. Kung.

Rhizomes short, stout, erect, apex densely clothed with brown, linear-lanceolate, fibriform-tipped scales. Fronds caespitose; fertile fronds 35–65 cm; stipe blackish brown, upward stramineous, 15–30 cm, 2–3 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate, ovate-oblong or lanceolate, 25–35 × 14–25 cm at middle, abruptly narrowed to caudate apex; pinnae 16–18 pairs, lower pinnae subopposite, sessile, gradually shortened, reflexed, base slightly narrowed, middle pinnae spreading, upper pinnae ascending; pinnae linear-lanceolate, 8–13 × 1.2–1.5 cm, caudate or long acuminate, toothed at apex, base truncate, not narrowed, pinnate; pinnules 18–20 pairs, alternate, often approximate, spreading, free, basal pinnules slightly larger, usually ± overlaying rachis, subsquare, 5–7 × 4–6 mm, base inequilateral, truncate and slightly auriculate on acroscopic side, cuneate on basiscopic side, dentate at margin, apex obtuse, occasionally acute; veins slightly visible adaxially, visible abaxially, pinnate in pinnules, lateral veins ca. 5 pairs, very oblique, forked or simple (3-forked or pinnate in basal acroscopic veins). Lamina thinly papery when dried, greenish brown, ± with short glandular hairs on abaxial surface; rachis and stipe abaxially with brown lanceolate scales. Sori oblong or shortly linear, ca. 3 pairs per pinnule, inframedial; indusia brownish, oblong or shortly linear, thinly membranous, entire, persistent. Perispore surface without folds.

Wet areas in forests, among shrubs in valleys, forest margins; 600–2500 m. Chongqing, Guangxi, Guizhou, Hubei, Sichuan, Taiwan, Yunnan [India, Myanmar].

“*Athyrium costale* T. Moore var. *polystichoides*” (T. Moore, Index Fil. 180. 1860) belongs here but is a nomen nudum and was not therefore validly published (*Melbourne Code*, Art. 38.1(a)).

**84. *Athyrium caudiforme*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 21. 1986.

长尾蹄盖蕨 *chang wei ti gai jue*

Rhizomes short, erect, apex densely scaly; scales dark brown, linear-lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds 50–60 cm; stipe blackish brown, upward stramineous, 25–30 cm, ca. 3 mm in diam. at base, base similarly densely scaly, stipe and rachis with dense brownish short glandular hairs; lamina 2-pinnate, ovate-oblong, 30–35 × up to 25 cm, base narrowed, apex shortly acuminate; pinnae 18–20 pairs, lower pinnae opposite, reflexed, upper pinnae alternate, spreading, basal 2 pairs of pinnae slightly shortened, slightly narrowed at base; middle pinnae linear-lanceolate, 14–16 × 2–2.5 cm at middle, base subequilateral, truncate, pinnate, apex long acuminate or caudate; pinnules 18–20 pairs, basal pinnules opposite, upper pinnules alternate, spreading, sessile, basal pinnules larger, ± pinnatifid, overlaying rachis; pinnules other than basal pinnules oblong-triangular, up to 1.2 cm × ca. 4 mm at middle, base inequilateral, truncate and auriculate on acroscopic side, auricles long, narrowly cuneate on basiscopic side, with 2 or 3 shallow segments or duplicate teeth, apex shortly acuminate; veins inconspicuous adaxially, visible and protuberant abaxially, pinnate in pinnules, lateral veins 5 or 6 pairs, oblique, lower veins forked, upper veins simple, pinnate in auriculate lobes. Lamina firmly papery, brown-green, glabrate on both surfaces; costae abaxially brown-stramineous, with dense brownish short glandular hairs, with subulate spines on adaxial side at base of costa or costule. Sori oblong, 4 or 5 pairs per pinnule, biseriate on both sides of costule, inframedial; indusia brownish, oblong, membranous, entire, persistent. Perispore surface without folds.

• Forests, among shrubs; 1000–1600 m. Hunan, W Sichuan.

*Athyrium caudiforme* looks very similar to *A. subrigescens* but differs by being larger, and having pinnae longer, long acuminate and caudate at apex, pinnules basal acroscopic side prominently auriculate at base, and midrib on adaxial surface without spines.

**85. *Athyrium subrigescens*** (Hayata) Hayata ex H. Itô, Bot. Mag. (Tokyo) 52: 647. 1938.

姬蹄盖蕨 *ji ti gai jue*

*Diplazium subrigescens* Hayata, Icon. Pl. Formosan. 4: 219. 1914; *Athyrium elegans* Tagawa; *A. subrigescens* var. *puberulum* Sa. Kurata.

Rhizomes short, erect or ascending, apex densely scaly; scales brown, linear-lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds up to 55 cm; stipe blackish brown, upward pale stramineous, 15–26 cm, ca. 2.5 mm in diam. at base, base similarly scaly, upward glabrate; lamina 2-pinnate, ovate-oblong, ca. 25 × 20 cm, base slightly narrowed, apex acuminate; pinnae ca. 15 pairs, alternate, subspreading, sessile, basal 2 or 3 pairs of pinnae slightly shortened, middle pinnae lanceolate, 10–12 × ca. 2 cm, base equilateral, truncate, pinnate, apex shortly caudate; pinnules ca. 18 pairs, alternate, approximate, ascending, sessile, basal pinnules ± overlaying rachis, middle pinnules oblong-triangular, ca. 1 cm × 6 mm at base, base inequilateral, truncate and auriculate on acroscopic side, auri-

cles rounded at apex, narrowly cuneate on basiscopic base, with short teeth at margin, apex acute; veins slightly visible adaxially, visible and protuberant abaxially, pinnate in pinnules, lateral veins 5 or 6 pairs, oblique, lower veins forked, upper veins simple, pinnate in auriculate lobes. Lamina subherbaceous when dried, greenish brown, glabrate on both surfaces; rachis stramineous, glabrate abaxially, with dense brown short glandular hairs adaxially, costae densely hairy abaxially, with subulate spines on adaxial side at base of costa or costule. Sori shortly linear or oblong, 4 or 5 pairs per pinnule, biseriate on both sides of costules, subcostular; indusia brownish, shortly linear or oblong, membranous, entire, persistent. Perispore surface without folds.

Forests; 1900–2400 m. Taiwan [Japan].

*Athyrium subrigescens* is very close to *A. delavayi* and was treated as a synonym of *A. delavayi* by C. M. Kuo (Taiwania 30: 65. 1985). The relationship between these needs further investigation.

**86. *Athyrium decorum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 13. 1986.

林光蹄盖蕨 lin guang ti gai jue

Rhizomes short, erect, apex with dense broadly lanceolate dark brown scales. Fronds caespitose; fertile fronds 25–65 cm; stipe stramineous, 25–30 cm, ca. 2 mm in diam., base densely scaly, upward glabrate; lamina pinnate-pinnatifid to 2-pinnate, oblong, (15–)30–35 × (5–)15–17 cm at middle, base slightly narrowed, apex acuminate; pinnae 8–15 pairs, basal pinnae subopposite, upper pinnae alternate, ascending, shortly stalked (stalk 1–2 mm), lanceolate; lower pinnae 2–8 × 1.2–2 cm at base, base rounded-truncate, subequilateral, sometimes slightly auriculate on acroscopic side, pinnate, apex acuminate; pinnules ca. 12 pairs, basal pinnules subopposite, upper pinnules alternate, ascending, sessile, lower pinnules subrhomboid, 8–10 mm (basal acroscopic one larger, 1.2–1.5 cm, pinnatifid), ca. 4 mm wide at base, base inequilateral, truncate on acroscopic side, narrowly cuneate and decurrent on basiscopic side, margin lobed, dentate, or serrate, apex ca. 2-crenate and obtuse; veins visible abaxially, pinnate in pinnules, lateral veins 7 pairs, oblique, lower veins 2- or 3-forked, upper veins simple. Lamina thinly herbaceous when dried, light greenish brown, glabrate; rachis and costae stramineous, glabrate abaxially, with subulate spines on adaxial side at base of costa or costule. Sori shortly linear or oblong, 3 or 4 pairs per pinnule, costular, biseriate on both sides of costule; indusia brownish, shortly linear or oblong, membranous, entire, persistent. Perispore surface without folds.

• Forests, wet areas; 2700–3300 m. NW Yunnan.

*Athyrium decorum* looks like *A. fangii* in frond appearance but differs by the spines on the adaxial surface of rachis, costae, and midribs thick, shortly subulate, not needlelike.

**87. *Athyrium uniforme*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 11. 1986.

同形蹄盖蕨 tong xing ti gai jue

*Athyrium bijiangense* Y. T. Hsieh & W. M. Chu; *A. gongshanense* Ching.

Fronds caespitose; fertile fronds (40–)65–110 cm; stipe stramineous, (18–)28–50 cm, ca. 2.5 mm in diam., base sparsely scaly; scales dark brown and narrowly lanceolate, upward glabrate; lamina 2-pinnate, deltoid-oblong, (25–)35–60 × (9–)18–30 cm, base broadly cuneate, apex acuminate; pinnae 10–18 pairs, basal pinnae opposite, upper pinnae alternate, obliquely spreading, shortly stalked or sessile, several basal pinnae equal in size, broadly lanceolate, (5–)11–14 × 2–3(–4) cm, base not narrowed, rounded-truncate, equilateral, with very short stalk ca. 1 mm, pinnate, apex long acuminate; pinnules ca. 15 pairs, lower pinnules subopposite, upper pinnules alternate, subspreading, basal pinnules oblong-lanceolate, somewhat falcate, separated from each other, 2–2.2 cm × ca. 5 mm, base subequilateral, slightly auriculate on acroscopic side, adnate to costae on basiscopic side, but not decurrent, pinnatifid to 1/3, apex subobtuse or obtuse-acute and serrate; small pinnule segments rounded and with 1 or 2 teeth at apex; upper pinnae gradually shortened, lanceolate, somewhat falcate, separate from each other; veins visible abaxially, 2- or 3-forked in segments. Lamina papery when dried, pale green, glabrate; rachis and costae stramineous abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong or shortly linear, 7–10 pairs per pinnule, biseriate on both sides of costules; indusia dark brown, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds.

• Evergreen broad-leaved forests, wet areas; 1200–2600 m. NW Yunnan.

*Athyrium uniforme* is very close to *A. mengtzeense* and sympatric with it but differs by the lamina and pinnules usually narrower and longer, the pinnae usually shortly stalked, and the spines on the upper costae and rachis very short.

**88. *Athyrium roseum*** Christ, Bull. Herb. Boissier 6: 961. 1898.

玫瑰蹄盖蕨 mei gui ti gai jue

Rhizomes short, erect, apex densely scaly; scales dark brown, linear-lanceolate. Fronds caespitose; fronds ca. 50 cm; stipe blackish brown, upward light red-purple, ca. 22 cm, ca. 2 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate, ovate-lanceolate, up to 35 × ca. 15 cm, base slightly narrowed, apex acuminate; pinnae ca. 10 pairs, alternate, spreading, sessile, lower pinnae falcate-lanceolate, up to 10 × ca. 1.7 cm, base truncate, alongside rachis, pinnate, apex caudate-acuminate; pinnules 16–20 pairs, alternate, approximate, ascending, sessile; lower pinnules suboblong, 8–9 × 3–4 mm at middle, base inequilateral, truncate, somewhat auriculate on acroscopic side, cuneate on basiscopic side, margin prominently or finely toothed or shallowly lobed, apex obtuse, obtuse-rounded, or acute; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins ca. 7 pairs, lower veins forked, upper veins simple, but pinnate in auriculate lobes. Lamina papery when dried, pale greenish brown, glabrate on both surfaces; rachis and costae pale red-purple, glabrate abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong, 3 or 4 pairs per pinnule, subcostular; indusia brownish, oblong, membranous, entire, persistent. Perispore surface without folds.

- Mountain forests; 1600–2400 m. Yunnan.

*Athyrium roseum* differs from related species in the lamina narrowly ovate or lanceolate, acuminate; the pinnae sessile or very shortly stalked; the pinnules suboblong, obtuse or acute at apex, unlobed or shallowly lobed, toothed at margin, inequilateral at base, cuneate on the basisopic side, subauriculate, truncate and parallel to costa on the acroscopic side; spines prominent on the adaxial side of costae and the distal part of rachis; and the rachis and costae shiny, glabrate abaxially. *Athyrium roseum* is most similar to *A. mengtzeense* but differs by the lamina and costae glabrate on the abaxial surface.

- 1a. Pinnules obtuse or obtuse-rounded at apex, prominently toothed or shallowly lobed at margin ..... 88a. var. *roseum*  
 1b. Pinnules acute or obtuse at apex, finely toothed at margin ..... 88b. var. *fugongense*

### 88a. *Athyrium roseum* var. *roseum*

玫瑰蹄盖蕨(原变种) *mei gui ti gai jue* (yuan bian zhong)

Pinnules obtuse or obtuse-rounded at apex, prominently toothed or shallowly lobed at margin.

- Mountain forests; ca. 1600 m. Yunnan (Mengzi).

### 88b. *Athyrium roseum* var. *fugongense* Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 508–509. 1999.

福贡蹄盖蕨 *fu gong ti gai jue*

Pinnules acute or obtuse at apex, finely toothed at margin.

- Evergreen broad-leaved forests on mountain slopes; ca. 2400 m. Yunnan (Fugong).

### 89. *Athyrium mengtzeense* Hieronymus, Hedwigia 59: 319. 1918.

蒙自蹄盖蕨 *meng zi ti gai jue*

*Asplenium sinense* Baker; *Athyrium confertipinnum* Ching; *A. liangwangshanicum* Ching; *A. sinense* (Baker) C. Christensen (1913), not Ruprecht (1845); *A. thelypteroides* (Michaux) Desvaux var. *henryi* Christ.

Rhizomes short, erect, apex densely scaly; scales dark brown, linear-lanceolate, fibriform-tipped, wavy. Fronds caespitose; fertile fronds (30–)50–84 cm; stipe blackish brown, upward light red-purple, (8–)22–28 cm, base 2–3.5 mm in diam., similarly scaly, upward glabrate; lamina 2-pinnate-pinnatilobate, ovate or oblong-ovate, (25–)35–50 × 15–24 cm at middle, base not narrowed or slightly narrowed, apex acuminate or slightly abruptly narrowed; pinnae 10–20 pairs, alternate, spreading or slightly ascending, subsessile, falcate-lanceolate, lower pinnae opposite, basal 2 or 3(or 4) pairs of pinnae slightly shortened, 7–15 × 1.7–4 cm, base slightly narrowed, truncate, alongside rachis, apex caudate-acuminate, descending or spreading; middle pinnae linear-lanceolate, 12–13 × 2.2–3 cm, base equilateral, truncate, broader, pinnate, apex long acuminate; pinnules 16–20 pairs, alternate, basal pinnules subopposite, approximate, ascending or subspreading, subsessile; basal pinnules oblong-lanceolate or deltoid-oblong, 8–16 × 3–7 mm at middle, base inequilateral, truncate, somewhat auriculate on acroscopic side, cuneate on basisopic side, with small teeth or

pinnatilobate to 1/2, apex obtuse to acute; pinnule segments with small teeth at apex; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 7 or 8 pairs, lower veins forked, upper veins simple, pinnate in auriculate lobes. Lamina thinly papery when dried, pale greenish brown, glabrate on both surfaces; rachis and costae pale red-purple abaxially, with dense brownish short glandular hairs, with thick spines on adaxial side at base of costa or costule. Sori oblong or shortly linear, 3–7 pairs per pinnule (sometimes with 1 or 2 pairs in auriculate lobes), biseriate on both sides of costules, inframedial; indusia brownish, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.

- Mountain forests, forest margins, shrub groves at streamsides; 1500–3000 m. W Guizhou, SW Sichuan, ?Taiwan, Yunnan.

### 90. *Athyrium epirachis* (Christ) Ching in C. Christensen, Index Filic., Suppl. 3: 41. 1934.

轴果蹄盖蕨 *zhou guo ti gai jue*

*Diplazium epirachis* Christ, Bull. Soc. Bot. France 52(Mém. 1): 51. 1905; *Athyrium eremicola* Oka & Kurata; *A. lilacinum* Ching; *A. muticum* Christ; *A. subcoriaceum* Ching; *A. wardii* (Hooker) Makino var. *elongatum* Christ.

Rhizomes short, erect, apex densely scaly; scales dark brown in central part, brownish in marginal part, linear-lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds 30–80 cm; stipe blackish brown, upward brown-stramineous to pale purplish red, 18–25 cm, 2–3 mm in diam. at base, base similarly scaly, upward glabrate; lamina pinnate or 2-pinnate, oblong-lanceolate, 20–50 × 7–27 cm, apex acuminate; pinnae 20–22 pairs, alternate, subspreading, stalked (stalk ca. 1.5 mm), lanceolate, 4–14 × 1–3.5 cm, with acute long teeth at apex, base subequilateral, rounded-truncate, auriculate on acroscopic side, variably pinnatifid (up to 1/2–2/3 to costa) or pinnate; in 2-pinnate lamina, pinnules ca. 20 pairs, basal pinnules opposite, upper pinnules alternate, spreading, subsessile, suboblong, 1.2–1.8 cm × 5–7 mm, base inequilateral, rounded-cuneate and somewhat auriculate or not on acroscopic side, narrowly cuneate and decurrent on basisopic side, margin crenate, apex obtuse or obtuse-rounded and toothed; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules or segments, lateral veins 3–5 pairs, forked or simple, considerably oblique. Lamina thickly papery when dried, yellowish brown or greenish brown, glabrate on both surfaces; rachis and costae abaxially brown- or red-stramineous, purplish, with dense brown short glandular hairs, with subulate spines on adaxial side at base of costa or costule. Sori shortly linear or oblong, 1 per segment or 3–5 pairs per pinnule, costular or costal; indusia shortly linear or oblong, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80$ .

- Evergreen broad-leaved forests, bamboo forests; 800–2000 m. Chongqing, Fujian, S Guangdong, Guangxi, Guizhou, SW Hubei, Hunan, Sichuan, Taiwan (Taidong, Yilan), Yunnan [Japan].

### 91. *Athyrium pubicostatum* Ching & Z. Y. Liu, Bull. Bot. Res., Harbin 4(3): 7. 1984.

贵州蹄盖蕨 *gui zhou ti gai jue*

*Athyrium guizhouense* Ching; *A. hirtirachis* Ching & Z. Y. Liu (1984), not Ching & Y. P. Hsu (1974); *A. pseudo-epirachis* Ching; *A. sessile* Ching; *A. subpubicostatum* Ching & Z. Y. Liu.

Rhizomes short, erect, apex densely scaly; scales dark brown, linear-lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds 35–45 cm; stipe blackish brown, upward stramineous, 15–18 cm, 2.5–3 mm in diam. at base, base similarly densely scaly, clothed with brownish short glandular hairs in distal part; lamina 2-pinnate, narrowly subtriangular, 25–30 × 15–20 cm, base not narrowed, apex acuminate; pinnae 13–16 pairs, lower pinnae subopposite, upper pinnae alternate, subspreading, sessile, basal pinnae slightly shortened, frequently reflexed, narrowed at base; lower pinnae lanceolate, ca. 10 × 2.5–3 cm, base equilateral, truncate, apex long acuminate; upper pinnae falcate-lanceolate, gradually shortened upward, base slightly unequally sided, auriculate, cuneate and slightly decurrent on basiscopic side, pinnate, apex acuminate; pinnules 12–16 pairs, basal pinnules opposite, larger and alongside rachis; upper pinnules alternate, approximate, subspreading; basal 2 or 3 pairs of pinnules deltoid-oblong, 1–1.3 cm × 5–7 mm, base unequally sided, subtruncate, prominently auriculate on acroscopic side, cuneate and slightly decurrent on basiscopic side, margin crenate, apex acute; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins ca. 7 pairs, lower veins forked, upper veins simple, basal acroscopic veins often pinnate. Lamina papery when dried, pale greenish brown, glabrate; rachis and costae stramineous, with dense brownish short glandular hairs on adaxial surface, with subulate spines on adaxial side at base of costa or costule. Sori oblong or shortly linear, 3–6 pairs per pinnule, biseriate on both sides of costules, inframedial; indusia brown, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds, reticulate.  $2n = 80^*$ .

• Evergreen broad-leaved forests, bamboo forest margins; 200–2600 m. Chongqing, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Taiwan, Yunnan.

“*Athyrium kweichowense*” (Ching in Y. L. Zhang et al., Sporae Pterid. Sin. 206. 1976) belongs here but was not validly published because no Latin description or diagnosis, or reference to such, was provided (*Melbourne Code*, Art. 39.1).

**92. *Athyrium otophorum*** (Miquel) Koidzumi, Fl. Symb. Orient.-Asiat. 40. 1930.

光蹄盖蕨 *guang ti gai jue*

*Asplenium otophorum* Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 175. 1867; *Athyrium erythrocaulon* Ching; *A. rigescens* Makino; *A. sinovidalii* Ching & Z. Y. Liu; *A. vidalii* Nakai var. *chinense* Koidzumi; *A. violascens* Diels; *Diplazium otophorum* (Miquel) C. Christensen.

Rhizomes short, ascending, apex densely clothed with brown or blackish brown, linear-lanceolate, fibriform-tipped scales. Fronds caespitose; fertile fronds 45–70(–85) cm; stipe blackish brown, upward slightly purplish red, (15–)25–35 cm, 2.5–3 mm in diam., base densely clothed with scales, upward

glabrate; lamina 2-pinnate, narrowly ovate or deltoid-ovate, 25–35(–50) × 20–25 cm at middle, base not narrowed, apex abruptly narrowed; pinnae ca. 15 pairs, under abruptly narrowed tip ca. 7 pairs, basal pinnae opposite, upper pinnae alternate, subspreading, sessile or very shortly stalked, lanceolate; middle pinnae 10–12(–25) × 2.5–3.5 cm, base truncate, pinnate, apex long acuminate; pinnules 14–17 pairs, alternate, subspreading, sessile, lower pinnules subtriangular to oblong-lanceolate, 1–1.7 cm × 4–6 mm at middle, base inequilateral, truncate, parallel to costae, auriculate on acroscopic side, auricles triangular, cuneate on basiscopic side, subentire or with small tooth at acroscopic margin, apex acute; veins visible abaxially, inconspicuous adaxially, pinnate in pinnules, lateral veins 7 or 8 pairs, oblique, lower veins forked, basal acroscopic veins 2-pinnate or 3-forked. Lamina papery when dried, pale brown, glabrate on both surfaces; rachis and costae pale red-purple, glabrate abaxially, with subulate spines on adaxial side at base of costa or costule. Sori oblong or shortly linear, 3–5 pairs per pinnule, inframedial; indusia brownish, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 160$ .

Evergreen broad-leaved forests, bamboo forests, wet areas; 400–1400(–3000) m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

Knapp (Ferns Fern Allies Taiwan, 439. 2011) noted that *Athyrium otophorum* is closely allied with *A. delavayi*, *A. epirachis*, and *A. pubicostatum*; and, although it is often distinguished by the glabrous abaxial surface of the rachis and costae, sessile pinnae, and auriculate pinnule bases, its diagnostic characters are not always definite.

**93. *Athyrium kuratae*** Serizawa, J. Jap. Bot. 45: 117. 1970.

仓田蹄盖蕨 *cang tian ti gai jue*

Rhizomes erect, moderately stout, scaly at apex; scales dark brown, narrowly lanceolate, fibriform-tipped. Fronds caespitose; fertile fronds ca. 60 cm; stipe purplish red, slightly shiny, 15–50 cm; lamina 2-pinnate, ovate, 20–40 × 15–25 cm, base rounded-truncate, apex slightly abruptly narrowed; pinnae 8–10 pairs, basal 1 or 2 pairs of pinnae subopposite, spreading; upper pinnae alternate, oblique, lanceolate, acuminate; basal pinnae ovate-lanceolate, nearly as long as second basal pinna, shortly stalked, base narrowed; pinnules anadromous or subopposite, pinnules on basiscopic side of pinna longer than those on acroscopic side; pinnae above basal and subbasal pinnae sessile, base not narrowed, pinnules catadromous; middle pinnae ca. 15 × 4 cm, pinnate; pinnules 10–12 pairs, oblong, 15–30 × 5–8 mm, sessile, base inequilateral, auriculate, parallel to costa on acroscopic side, cuneate on basiscopic side, crenate at margin, basiscopic pinnules of basal pinnae sometimes pinnatilobate, apex obtuse. Lamina papery when dried, rachis and costae hairy in adaxial groove, costae with spines adaxially, but costules without spines adaxially. Sori shortly linear or oblong, occasionally J-shaped, biseriate on both sides of costules; indusia shortly linear, oblong, or J-shaped, persistent.  $2n = 160$ .

Mountain forests; 2400–2500 m. ?Taiwan, Yunnan [S Japan].

C. M. Kuo (Taiwania 30: 65. 1985) thought *Athyrium kuratae* to be conspecific with *A. otophorum*. Their relationship requires further investigation.

**94. *Athyrium arisanense*** (Hayata) Tagawa, Acta Phytotax. Geobot. 2: 195. 1933.

阿里山蹄盖蕨 a li shan ti gai jue

*Diplazium arisanense* Hayata, Icon. Pl. Formosan. 4: 212. 1914.

Rhizomes short, erect, apex densely clothed with pale brown, linear-lanceolate scales. Fronds caespitose; fertile fronds 45–60 cm; stipe blackish brown, upward light purplish red, 25–30 cm, ca. 2.5 mm in diam., base densely scaly, upward glabrate; lamina 2-pinnate, deltoid-ovate, 30–35 × ca. 18 cm at base, base broader, apex slightly abruptly narrowed, long acuminate; pinnae ca. 10 pairs, alternate, ascending, shortly stalked (stalk ca. 2 mm), basal pinnae not shortened, slightly narrowed toward base, lower pinnae subfalcate-lanceolate, ca. 13 × 3–3.5 cm at middle, base rounded-truncate, slightly unequally sided, pinnate, apex long acuminate; pinnules ca. 14 pairs, basal pinnules opposite, upper pinnules alternate, ascending, sessile; lower pinnules oblong, 1.3–1.5 × 5–6 mm at base, base inequilateral, truncate, somewhat auriculate on acroscopic side, cuneate, almost not decurrent on basiscopical side, margin entire or somewhat repand, with small teeth toward apex, apex obtuse and mucronate; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins ca. 7 pairs, oblique, mostly forked, but pinnate in auriculate lobes. Lamina papery when dried, pale green, glabrate on both surfaces; rachis and costae abaxially slightly purplish, sparsely shortly hairy, with subulate spines on adaxial side at base of costa or costule. Sori elliptic, 3 or 4 pairs per pinnule, biseriate on both sides of costules, subcostular; indusia brownish, oblong, sometimes reniform at base of pinnules, membranous, entire, often fugacious at maturity. Perispore surface without folds.  $2n = 160$ .

Broad-leaved forests; 600–2500 m. Taiwan [Japan].

**95. *Athyrium caudatum*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(1): 21. 1986.

尾羽蹄盖蕨 wei yu ti gai jue

Fertile fronds up to 68 cm; stipe brown, upward pale red-purple, shiny, ca. 30 cm, ca. 3 mm in diam., base densely clothed with dark brown, linear-lanceolate scales, upward glabrate; lamina 2-pinnate, ovate-triangular, up to 35 × ca. 25 cm, base hardly narrowed, apex abruptly narrowed; pinnae under abruptly narrowed tip 8 or 9 pairs, basal pinnae subopposite, basal and subbasal pinnae slightly shortened, base not narrowed; middle pinnae broadly lanceolate, 13–15 × 2.5–3 cm, base equilateral, rounded-truncate, pinnate, apex caudate-acuminate; pinnules 16–18 pairs, alternate, approximate, subspreading, basal pinnules slightly larger, acroscopic pinnules close to rachis, basal 2 or 3 pairs of pinnules adnate to costae, separate from each other, suboblong, 10–16 × 5–7 mm, base unequally sided, auriculate on acroscopic side, slightly decurrent on basiscopical side, margin toothed, apex acute; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 5–8 pairs, lower veins forked, upper veins simple, but pinnate in auriculate lobes. Lamina firmly herbaceous when dried, pale greenish brown adaxially, grass-green abaxially, glabrate on both surfaces; rachis and costae abaxially

brown-stramineous, slightly purplish red, with dense brownish short glandular hairs, with subulate spines on adaxial side of costa or costule. Sori oblong or shortly linear, 2–4 pairs per pinnule, biseriate on both sides of costules, subcostular; indusia brownish, oblong or shortly linear, thinly membranous, entire, often fugacious at maturity. Perispore surface without folds.

• Forests, streamsides; 1900–2600 m. NW Yunnan.

*Athyrium caudatum* is very similar to *A. epirachis* but differs by the lamina deltoid-ovate, abruptly narrowed at apex, pinnae long acuminate-caudate at apex, and basal pinnules prominently auriculate on the acroscopic side.

**96. *Athyrium adpressum*** Ching & W. M. Chu, Acta Bot. Boreal.-Occid. Sin. 6(1): 13. 1986.

金平蹄盖蕨 jin ping ti gai jue

Rhizomes short, stout, erect, apex densely clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds 30–75 cm; stipe blackish brown, upward brown-stramineous, ca. 38 cm, ca. 3 mm in diam. at base, base similarly scaly, upward glabrate; lamina 3-pinnate, deltoid-ovate, ca. 38 × 34 cm, base subtruncate, apex acuminate; pinnae ca. 12 pairs, alternate, ascending, with stalk ca. 1 cm, basal pinnae larger, oblong-ovate, ca. 19 × 8 cm at middle, base rounded-cuneate, 2-pinnate, apex long acuminate; pinnules ca. 12 pairs, alternate, ascending, basiscopical pinnules usually slightly longer than acroscopic pinnules, basal pinnules slightly shortened, middle pinnules ovate-oblong, up to 4.6 × ca. 2 cm at base, base inequilateral, truncate, parallel to costae on acroscopic side, narrowly cuneate on basiscopical side, with stalk 2–3 mm, pinnate, apex obtuse or obtuse-acute; secondary pinnules 7 or 8 pairs, alternate, subspreading, very shortly stalked or sessile, acroscopic secondary pinnules usually larger than basiscopical pinnules, basal acroscopic secondary pinnules largest, oblong-ovate, ca. 1.4 cm × 5–7 mm at base, base broadly cuneate, inequilateral, pinnatipartite, apex obtuse-rounded; tertiary segments ca. 3 pairs, oblong, up to 4 × ca. 3 mm, apex rounded with teeth; veins visible on both surfaces, pinnate in segments, lateral veins 2 or 3 pairs, simple. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae stramineous on abaxial surface, sometimes pale purplish red, glabrate, with needlelike spines on costa, costule, and midrib adaxially. Sori elliptic, 1 per segment, but 2 or 3 pairs in basal acroscopic segments, subcostular; indusia yellow-brown, elliptic, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.

• Mossy forests; 1700–2600 m. S Yunnan.

**97. *Athyrium rhachidosorum*** (Handel-Mazzetti) Ching in C. Christensen, Index Filic., Suppl. 3: 43. 1934.

轴生蹄盖蕨 zhou sheng ti gai jue

*Asplenium rhachidosorum* Handel-Mazzetti, Symb. Sin. 6: 33. 1929; *Athyrium amoenum* C. Christensen; *A. densisorum* X. C. Zhang; *A. wuliangshanense* Ching.

Rhizomes short, erect, apex densely clothed with dark brown, lanceolate scales. Fronds caespitose; fertile fronds (25–) 40–80 cm; stipe blackish brown, upward stramineous, (10–)15–

30 cm, 1.5–2.5 mm in diam., base sparsely scaly, upward glabrate; lamina 2-pinnate to 3-pinnate-pinnatifid, oblong-lanceolate or oblong, (12–)20–45 × (6–)9–18 cm at middle, base almost not narrowed, apex acuminate; pinnae (8–)15–24 pairs, basal pinnae subopposite, upper pinnae alternate, oblique, with stalk (2–)4–7 mm, basal pinnae slightly shortened, second basal pinnae lanceolate or somewhat falcate, (3–)7–14 × 1.5–3.8 cm, base rounded-cuneate, 2-pinnate-pinnatifid, apex acuminate; pinnules (6–)10–20 pairs, alternate, anadromous, oblique, separate from each other, stalked, lanceolate, 1.2–2.5 cm × 5–9 mm, base inequilateral, rounded-cuneate, pinnate, apex acuminate; secondary pinnules 3–8 pairs, alternate, oblique, broadly linear or oblong, 3–6 × 1–2 mm, ± connate to each other by narrow wing of costule, pinnatifid, apex obtuse, cuneate; ultimate segments 2–4 pairs, oblique, linear; veins visible on both surfaces, pinnate in ultimate pinnules, lateral veins 1–4 pairs, oblique, simple or forked in basal acroscopic veins. Lamina thinly herbaceous when dried, greenish brown, glabrate; rachis and costae stramineous abaxially, with needlelike spines on adaxial side at base of costa and costule. Sori small, elliptic, orbicular-reniform, or horseshoe-shaped, 1 per segment or ultimate pinnules, costular; indusia brownish, elliptic, orbicular-reniform, or horseshoe-shaped, membranous, subentire or erose, partly fugacious at maturity. Perispore surface without folds.

Mixed alpine forests; 1900–3700 m. SW Sichuan, Xizang, Yunnan [N Myanmar].

**98. *Athyrium araiostegioides*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(2): 103. 1986.

鹿角蹄盖蕨 *lu jiao ti gai jue*

Rhizomes short, erect, apex with sparse brown or blackish brown, lanceolate small scales. Fronds caespitose; fertile fronds 30–45 cm; stipe stramineous, 14–22 cm, 1–2 mm in diam., base similarly scaly, upward glabrate; lamina 3-pinnate-pinnatifid, oblong-lanceolate, 20–28 × ca. 9 cm at middle, base hardly narrowed, apex acuminate; pinnae ca. 15 pairs, alternate, ascending, with stalk ca. 2 mm, basal pinnae slightly shortened, second basal pinnae lanceolate, up to 6.5 × ca. 2.2 cm at base, base rounded-cuneate, 2-pinnate-pinnatifid, apex acuminate; pinnules 10–12 pairs, alternate, ascending, lower pinnules stalked (stalk ca. 1 mm), oblong, up to 1.2 cm × 5–6 mm, base inequilateral, rounded-cuneate, pinnate, apex obtuse; secondary pinnules 3–5 pairs, alternate, ascending, acroscopic pinnules usually slightly larger than basiscopic pinnules; basal acroscopic secondary pinnules largest, oblong, ca. 3 × 1.5–2 mm, base cuneate, decurrent and adnate to wing of costule on basiscopic side, pinnatifid, apex acute; ultimate segments up to 5, ascending, subulate or linear, apex acute or acuminate, sometimes deeply 2-parted; veins inconspicuous adaxially, visible abaxially, pinnate in secondary pinnules, lateral veins 1–3 pairs, oblique, simple or forked. Lamina thinly herbaceous when dried, greenish brown, glabrate on both surfaces; rachis, costae, and costules stramineous, glabrate abaxially, with needlelike spines on adaxial side at base of costae, costules, or midribs. Sori elliptic, reniform, or ± horseshoe-shaped, inframedial, close to midrib, 1 per segment or ultimate pinnules; indusia yellow-brown, elliptic, reniform, or ± horseshoe-shaped, membranous,

erose at margin or subentire, persistent. Perispore surface without folds.

• Broad-leaved and mixed forests; 1700–2600 m. SW Sichuan, Yunnan.

**99. *Athyrium chingianum*** Z. R. Wang & X. C. Zhang, Bull. Bot. Res., Harbin 11(3): 12. 1991.

秦氏蹄盖蕨 *qin shi ti gai jue*

Rhizomes slender, creeping, 1–2 mm in diam., with sparse dark brown ovate-lanceolate scales. Fronds distant; fertile fronds 10–25 cm; stipe stramineous, 5–15 cm, ca. 1 mm in diam., base with sparse dark brown lanceolate scales, upward glabrate; lamina pinnate, ovate-oblong, 6–13 × 4–6 cm, apex acuminate; lower pinnae narrowly lanceolate, ascending, sessile, pinnatifid, basal acroscopic pinna segments slightly larger; pinna segments 5–10 pairs, subopposite, slightly ascending, oblong, toothed at margin; veins pinnate in segments. Lamina herbaceous when dried, green, glabrate, with needlelike spines on adaxial side at base of costule, midrib, and lateral veins. Sori lateral on base of midribs; indusia erose at margin. Perispore surface without folds.

• Shrub groves, evergreen broad-leaved forest margins; 3000–3700 m. Yunnan.

*Athyrium chingianum* is somewhat similar to *A. nigripes* in the shape of lamina. It is frequently sympatric with *A. yui*, which is also morphologically similar to it, but is different in the rhizomes long creeping, pinnae longer, fewer (6–10 pairs), and sori not close to costae at pinnae, but often leaning on midribs of segments.

**100. *Athyrium supraspinescens*** C. Christensen, Contr. U.S. Natl. Herb. 26: 297. 1931.

腺叶蹄盖蕨 *xian ye ti gai jue*

Rhizomes short, erect, apex densely clothed with brown, subulate or lanceolate scales. Fronds caespitose; fertile fronds up to (20–)30(–40) cm; stipe blackish brown, upward stramineous, 10–20 cm, 1.5–2 mm in diam., base with sparse scales, upward glabrate; lamina 2-pinnate (or pinnate, pinnae pinnatifid), subdeltoid-lanceolate, 8–12 × 4–6 cm, base not narrowed, apex acuminate; pinnae 12–15 pairs, lower pinnae opposite, upper pinnae alternate, spreading or slightly ascending, sessile (or lower pinnae shortly stalked), basal pinnae lanceolate, somewhat falcate, 3–4 cm × 9–13 mm, base rounded-truncate, parallel alongside rachis on acroscopic side, pinnate, apex acuminate; pinnules 8–10 pairs, basal pinnules subopposite, upper pinnules alternate, ascending; basal pinnules larger, oblong, 5–6 × ca. 3 mm, base cuneate and adnate to costa, long toothed, apex rounded-truncate and toothed; suprabasal pinnules similar to basal pinnules but gradually smaller, decurrent and adnate to narrow wing of costule on basiscopic side; upper pinnae similar to basal pinnae but gradually smaller, inequilateral, auriculate on acroscopic side, cuneate on basiscopic side; veins visible on both surfaces, pinnate in pinnules, lateral veins ca. 4 pairs, oblique, simple. Fronds papery when dried, greenish brown, with shiny glandular hairs on both surfaces (particularly on adaxial surfaces); rachis and costae stramineous, glabrate abaxially, with needlelike spines on adaxial side at base of costa and costule. Sori large, ovate or orbicular, 1–3 pairs per pinnule,

subcostular on basal acroscopic veins; indusia brown, small, oblong, membranous. Perispore surface without folds.

• Evergreen broad-leaved forests, wet areas; 2400–2800 m. SW Yunnan.

**101. *Athyrium medogense*** X. C. Zhang, Bull. Bot. Res., Harbin 11(3): 11. 1991.

墨脱蹄盖蕨 mo tuo ti gai jue

Rhizomes erect, apex densely clothed with subulate-lanceolate scales. Fronds caespitose; fertile fronds 30–45 cm; stipe blackish brown, 10–20 cm, 1.5–2 mm in diam., base with sparse lanceolate scales, upward glabrate; lamina 2-pinnate, subovate-deltoid, 20–25 × 6–10 cm, base slightly narrowed or broadened, apex caudate-acuminate; pinnae ca. 15 pairs, lanceolate, lower pinnae opposite, upper pinnae alternate, spreading or slightly ascending, lower pinnae shortly stalked (stalk 1–2 mm), base rounded-truncate, parallel alongside rachis on acroscopic side, pinnate, apex acuminate or obtuse; pinnules 10–13 pairs, base auriculate on acroscopic side, cuneate on basicopic side, ascending; basal pinnules larger, oblong, margin crenate or shallowly lobed, apex rounded-obtuse; upper pinnules similar to basal pinnules but gradually smaller, decurrent and adnate to narrow wing of costule on basicopic side; veins visible on both surfaces, pinnate in pinnules, lateral veins ca. 4 pairs, oblique, simple; rachis and costae stramineous, with needlelike spines on adaxial side at base of costa and costule, with glandular hairs or subglabrate abaxially. Sori oblong, 1–3 pairs per pinnule, on basal acroscopic veins, close to midrib; indusia pale brown, small, oblong, membranous, shallowly lobed at margin. Perispore surface without folds.

• Wet areas in forests; 1700–2200 m. Xizang.

**102. *Athyrium yui*** Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 6. 1940.

俞氏蹄盖蕨 yu shi ti gai jue

Rhizomes short, erect, apex clothed with dark brown, lanceolate scales. Fronds caespitose; fertile fronds (20–)40–55 cm, stipe dark brown, upward stramineous, shiny, (8–)20–30 cm, (0.5–)1.5 mm in diam., base similarly scaly, with sparse lanceolate scales, upward glabrate; lamina pinnate-pinnatifid to pinnate-pinnatifid, lanceolate, (12–)20–35 × (3–)5–7 cm at middle, base slightly narrowed, apex acuminate; pinnae (10–)16–20 pairs, alternate, spreading, with short stalk ca. 1 mm or subsessile; middle pinnae subfalcate-lanceolate, ca. 3.5 × (0.7–)1–1.3 cm at base, base rounded-truncate or subtruncate, slightly unequally sided, pinnatifid, apex acuminate; pinnules ca. 10 pairs, alternate, approximate, oblique; lower pinnules oblong-ovate, ca. 4 × 2.5 mm (basal acroscopic pinnules larger), base decurrent on basicopic side, margin subentire, apex obtuse and with small teeth; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins oblique, simple, basal acroscopic veins forked. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis and costae pale stramineous, glabrate abaxially, with needlelike spines on adaxial side at base of costa and costule. Sori oblong, 2 or 3 pairs in lower pinnules, close and subparallel to costules, 1 pair

in upper pinnules; indusia brownish, oblong, membranous, entire, persistent. Perispore surface without folds.

• Margins of mixed forests, bamboo forests, shrub meadows, rare; 2600–3700 m. NW Yunnan.

**103. *Athyrium fangii*** Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 282. 1949.

方氏蹄盖蕨 fang shi ti gai jue

Rhizomes short, erect, apex densely clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds 60–80 cm; stipe dark brown, upward pale green-stramineous, 25–40 cm, 2.5–3 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate or 2-pinnate-pinnatifid, narrowly oblong, 30–40 × 14–20 cm at middle, base slightly narrowed, apex acuminate; pinnae ca. 15 pairs, alternate, ascending, with short stalk 2–4 mm; middle pinnae lanceolate, 8–10 × 2–2.5 cm at base, base subequilateral, subtruncate, pinnate, apex caudate-acuminate; pinnules 12–16 pairs, basal pinnules opposite, upper pinnules alternate, ascending, separate from each other, subsessile; basal pinnules larger, deltoid-oblong, 1–1.2 cm × 3–4 mm, base inequilateral, truncate, auriculate, parallel to rachis on acroscopic side, cuneate on basicopic side, cut to 1/2, apex obtuse; pinnule segments 5 or 6 pairs, acroscopic segments longer, basal acroscopic segment largest, entire or with few teeth at apex; upper pinnules similar to basal pinnules but gradually smaller, lower pinnules subsessile, upper pinnules decurrent and adnate to wing of costa; veins inconspicuous adaxially, visible abaxially, pinnate in pinnules, lateral veins 2 or 3 pairs, oblique, simple. Lamina herbaceous when dried, pale yellow-green, glabrate on both surfaces; rachis and costae stramineous abaxially, with sparse short hairs at base, with needlelike spines on adaxial side at base of costa, costule, and midrib. Sori oblong or elliptic, on acroscopic veins, usually 1 per segment, biserial on both sides of costules, costular; indusia brown, oblong or elliptic, membranous, entire, persistent, often partly overlapping costules. Perispore surface without folds.

Mixed forests; 2200–3100 m. W Sichuan, Yunnan [Bhutan, N India, Nepal].

**104. *Athyrium nyalamense*** Y. T. Hsieh & Z. R. Wang in C. Y. Wu, Fl. Xizang. 1: 138. 1983.

聂拉木蹄盖蕨 nie la mu ti gai jue

Rhizomes erect, apex densely clothed with brown, subulate-lanceolate scales. Fronds caespitose; fertile fronds 34–60 cm; stipe blackish brown, upward stramineous, 17–26 cm, 1.5–2 mm in diam. at base, base similarly scaly, upward glabrate; lamina 2- or 3-pinnate, or 3-pinnate-pinnatifid, ovate, 21–34 × 17–24 cm, base rounded-cuneate, apex acuminate, slightly abruptly narrowed; pinnae 13–16 pairs, basal pinnae subopposite, upper pinnae alternate, slightly ascending, with stalk 1–3 mm; basal pinnae slightly shortened, broadly lanceolate, 7–10 × ca. 2.5 cm, base inequilateral, truncate, auriculate and parallel to rachis on acroscopic side, narrowly truncate on basicopic side, pinnate, apex long caudate-acuminate, slightly narrowed; pinnules 10–14 pairs, alternate, subspreading, basal pinnules with short stalk ca. 1 mm, upper pinnules sessile, subrhomboid, 1–2 cm × ca. 8 mm (acroscopic pinnules larger than

basiscopical pinnules), base inequilateral, subtruncate, somewhat auriculate on acroscopic side, narrowly cuneate on basiscopical side, pinnatifid to pinnatifid or biserrate at margin, apex obtuse-rounded or obtuse, toothed; middle pinnae similar to basal pinnae but slightly larger, up to  $15 \times 2.5$  cm, base hardly narrowed; pinnules pinnatifid, pinnule segments long toothed; sixth to seventh and upper pinnae abruptly narrowed at apex, pinnatifid, pinna segments subrhomboid, biserrate at margin and apex; veins visible on both surfaces, pinnate in pinnules, lateral veins 5 or 6 pairs, lower veins pinnate, upper veins forked. Lamina thinly herbaceous when dried, green, glabrate on both surfaces; rachis and costae stramineous, glabrate or with short hairs abaxially, with needlelike or subulate spines on adaxial side at base of costa, costule, and midrib. Sori oblong, on basal acroscopic veins, close to costules, 2–4 (or 5) pairs per pinnule; indusia brownish, oblong, membranous, erose at margin, persistent, often partly overlapping costules. Perispore surface without folds, with granular ornamentation.

Broad-leaved forests; 1400–2400 m. SE Xizang, Yunnan [Bhutan, India, Myanmar, Nepal].

*Athyrium nyalamense* differs from related species in the lamina ovate, 2-pinnate or 3-pinnate; pinnae 13–16 pairs, lanceolate or linear-lanceolate, 5–15 cm or more; pinnules oblong, separate from each other; pinnule lobes with prominently long or short teeth at margin; and rachis and costae glabrate or shortly hairy abaxially.

- 1a. Lamina 2-pinnate; spines on adaxial side at base of costa, costule, and midrib needlelike; rachis and costae glabrate abaxially ..... 104a. var. *nyalamense*  
 1b. Lamina to 3-pinnate or 3-pinnate-pinnatifid; spines on adaxial side at base of costae and costules subulate; rachis, costae, and costules with short hairs abaxially ... 104b. var. *puberulum*

**104a. *Athyrium nyalamense* var. *nyalamense***

聂拉木蹄盖蕨(原变种) nie la mu ti gai jue (yuan bian zhong)

Lamina 2-pinnate; spines on adaxial side at base of costa, costule, and midrib needlelike; rachis and costae glabrate abaxially.

Broad-leaved forests; 1400–2400 m. SE Xizang, Yunnan [Bhutan, India, Myanmar, Nepal].

**104b. *Athyrium nyalamense* var. *puberulum* Z. R. Wang, Acta Phytotax. Sin. 32: 84. 1994.**

毛聂拉木蹄盖蕨 mao nie la mu ti gai jue

Lamina to 3-pinnate or 3-pinnate-pinnatifid; spines on adaxial side at base of costae and costules subulate; rachis, costae, and costules with short hairs abaxially.

• Evergreen broad-leaved forests; ca. 2000 m. Yunnan (Gongshan).

**105. *Athyrium yuanyangense* Y. T. Hsieh & W. M. Chu, Acta Bot. Boreal.-Occid. Sin. 7(1): 54. 1987.**

元阳蹄盖蕨 yuan yang ti gai jue

Rhizomes somewhat ascending, apex densely clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds up to 65 cm; stipe brown, upward pale green-stramineous, up to 28 cm, ca. 3 mm in diam. at base, base similarly densely scaly, upward with sparse small scales; lamina 2-pinnate, ovate, up to  $38 \times$  ca. 28 cm, base rounded, apex abruptly narrowed; pinnae under abruptly narrowed tip 6 (or 7) pairs, alternate, stalked (stalk 2–3 mm), ascending, basal pinnae hardly shortened, base not narrowed, second basal pinnae lanceolate, up to  $18 \times$  ca. 5 cm at base, base subequilateral, truncate, pinnate, apex caudate-long-acuminate; pinnules ca. 15 pairs, alternate, spreading, with short stalk 1–1.5 mm, basal acroscopic pinnules nearly pinnate, others pinnatifid; basal acroscopic pinnule segments larger, obovate, with short teeth at margin; veins visible abaxially, somewhat visible adaxially, pinnate in segments, lateral veins 2–4 pairs, oblique, forked or simple. Lamina herbaceous when dried, green, glabrate on both surfaces; rachis and costae pale stramineous, densely shortly hairy abaxially, with needlelike spines on adaxial side at base of costa, costule, and midrib. Sori elliptic or oblong, on basal acroscopic veins, 1 per segment (but 1 or 2 pairs in basal acroscopic 1 (or 2) segment), biserrate on both sides of costules (or midribs), subcostular; indusia brown, elliptic or oblong, membranous, subentire, persistent. Perispore surface without folds.

• Mossy forests; ca. 2600 m. S Yunnan (Yuanyang).

*Athyrium yuanyangense* is similar to *A. clivicola* in frond appearance but differs by the fronds larger (to 65 cm); pinnules more (ca. 15 pairs), more dissected (pinnatifid); basal acroscopic pinnules much larger, obovate, almost free; costae more shortly pubescent abaxially; and needlelike spines on the adaxial side at the base of costa, costule, and midrib.

**106. *Athyrium clarkei* Beddome, Suppl. Ferns S. Ind. 11. 1876.**

芽胞蹄盖蕨 ya bao ti gai jue

*Asplenium clarkei* (Beddome) Atkinson ex C. B. Clarke; *Athyrium nigripes* (Blume) T. Moore var. *clarkei* (Beddome) Beddome.

Rhizomes short, stout, erect, densely clothed with brown lanceolate or ovate-lanceolate scales at apices and stipe bases. Fronds caespitose; fertile fronds 20–80 cm; stipe blackish brown, upward stramineous, 2–20 cm, 1.5–2 mm in diam., upward glabrate; lamina 2-pinnate, narrowly lanceolate or linear-lanceolate,  $25\text{--}60 \times 7\text{--}12$  (–18) cm at middle, base slightly narrowed, apex acuminate; pinnae 20–24 pairs, opposite or subopposite, subspreading, subsessile; basal pinnae 1.8–3 cm, narrowly triangular, apex obtuse; middle pinnae broadly lanceolate,  $3.5\text{--}4.2 \times 1.6\text{--}2$  cm at base, base equilateral, truncate, parallel to rachis, pinnate, apex acuminate; pinnules 8 or 9 pairs, subopposite, slightly ascending, approximate; basal pinnules largest, oblong-ovate, up to 1 cm  $\times$  5–6 mm, base cuneate, adnate to costa, margin serrulate; upper pinnules gradually smaller, decurrent and connate with each other by wing of costule, apex rounded; veins visible on both surfaces, pinnate in pinnules, lateral veins 3–5 pairs, oblique, 2- or 3-forked, but pinnate in basal acroscopic lobes. Lamina herbaceous when dried, greenish brown, glabrate on both surfaces; rachis stramineous, upward gradually becoming brownish stramineous,

costae brownish stramineous, sparsely shortly hairy abaxially, with needlelike spines on adaxial side at base of costa and costule; distal part of rachis with scaly bulbils usually 1 per frond. Sori shortly linear or lunate, 1–3 pairs per pinnule, on acroscopic veins (rarely also on basiscopic veins), biseriate on both sides of costule; indusia brown, shortly linear or lunate, membranous, erose at margin, persistent. Perispore surface without folds.  $2n = 80$ .

Evergreen broad-leaved forests in valleys, wet areas, watersides; 1500–2700 m. Guizhou, S Yunnan [India, Myanmar, Nepal].

**107. *Athyrium viviparum*** Christ, Bull. Acad. Int. Géogr. Bot. 20: 13. 1910.

胎生蹄盖蕨 tai sheng ti gai jue

*Athyrium spinosissimum* Ching; *A. tianzishanense* S. F. Wu & L. F. Zhang; *A. yindeense* Ching.

Rhizomes short, erect, apex densely clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds (23–)50–80 cm; stipe blackish brown, upward green-stramineous, 15–25(–32) cm, 2–3 mm in diam. at base, base similarly scaly, upward glabrate; lamina 2-pinnate-pinnatifid, oblong-lanceolate, 30–45 × 12–22 cm at middle, base slightly narrowed, rounded, apex acuminate; pinnae 15–18 pairs, several pairs of lower pinnae subopposite; upper pinnae alternate, ascending, with stalk 1–3 mm, basal 1 or 2 pairs of pinnae slightly shortened, base hardly narrowed; middle pinnae lanceolate, 8–11 × ca. 3 cm at base, base equilateral, rounded-truncate, pinnate, apex long acuminate; pinnules 15(–20) pairs, basal pinnules opposite, upper pinnules alternate, ascending; basal pinnules larger, oblong-lanceolate, 1.6–2 × ca. 1 cm at base, base inequilateral, truncate, parallel to costa, somewhat auriculate on acroscopic side, cuneate on basiscopic side, pinnatifid 1/3–1/2 to costa, apex obtuse-acute; acroscopic pinnule segments larger, oblique, with few short dentate teeth at apex; upper pinnules similar to basal pinnules but gradually smaller, base decurrent and connate to each other by wing of costa; veins somewhat visible adaxially, visible abaxially, pinnate in pinnules, lateral veins 5–7 pairs, oblique, lower veins forked, upper veins simple. Lamina thinly herbaceous when dried, grass-green, glabrate on both surfaces; rachis and costae stramineous, sparsely glandular hairy abaxially, with needlelike spines on adaxial side of rachis, costae, and costules; scaly bulbils usually 1 per frond, borne in upper portion of rachis. Sori oblong or shortly linear, lateral on acroscopic veins, costular, 1 per segment, 1 or 2 pairs in basal acroscopic segments; indusia brownish, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds.

• Damp areas in forests, streamsides; 200–1700 m. Chongqing, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Yunnan.

**108. *Athyrium strigillosum*** (E. J. Lowe) T. Moore ex Salmon, Nomencl. Gefässkrypt. 112. 1883.

软刺蹄盖蕨 ruan ci ti gai jue

*Asplenium strigillosum* E. J. Lowe, Ferns 5: 107. 1858; *A. tenellum* C. Hope, p.p. (1899), not Roxburgh (1816), nor Fée (1850); *Athyrium clarkei* Beddome var. *membranaceum* Rosenstock; *A. nigripes* (Blume) T. Moore var. *tenuifrons* (Wallich ex

Sim) Beddome; *A. petiolosum* Christ (1907), not Milde (1870); *A. setiferum* C. Christensen; *A. tenuifrons* Wallich ex Sim.

Rhizomes short, stout, erect, apex with sparse blackish brown or brown, lanceolate scales. Fronds caespitose; fertile fronds 55–90 cm; stipe blackish brown, upward stramineous, 25–35 cm, 2–3 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate, oblong-lanceolate, 25–45 × 10–15 cm at middle, base hardly narrowed, apex acuminate; pinnae ca. 18 pairs, lower pinnae opposite or subopposite, upper pinnae alternate, ascending, with short stalk 2–4 mm, basal 1–3 pairs of pinnae slightly shortened, base not narrowed; middle pinnae lanceolate, somewhat falcate, 6.5–10 × 2.5–3.5 cm, base broadly rounded, pinnate, apex acuminate; pinnules 12–16 pairs, alternate, ascending, approximate, basal pinnules larger, oblong-ovate, 1–1.5 cm × 6–8 mm, base inequilateral, ± adnate to costae, truncate, parallel to costae on acroscopic side, cuneate and decurrent on basiscopic side, cut to 1/2, apex acute, with long teeth; upper pinnules similar to basal pinnules, but gradually smaller, widened, decurrent and adnate to wing of costule; veins visible on both surfaces, pinnate in small segments, lateral veins 4–6 pairs, oblique. Lamina herbaceous when dried, greenish brown or green, glabrate; rachis and costae stramineous, with needlelike spines on adaxial side at base of costa and costule, scaly bulbils usually 1 per lamina, borne at upper portion of rachis. Sori oblong, 1 per segment (sometimes 2 or 3 in basal segments), 4 or 5 per pinnule, lateral on acroscopic veins; indusia brown, oblong, membranous, entire, fugacious at maturity. Perispore surface without folds.  $2n = 80, 160$ .

Wet areas in forests, streamsides in valleys; (600–)1700–2600 m. Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan [Bhutan, N India, Japan, Kashmir, Myanmar, Nepal].

**109. *Athyrium nigripes*** (Blume) T. Moore, Index Fil. 49. 1857.

黑足蹄盖蕨 hei zu ti gai jue

*Aspidium nigripes* Blume, Enum. Pl. Javae 2: 162. 1828; *Asplenium nigripes* (Blume) Hooker; *A. tozanense* Hayata; *Athyrium aristulatum* Copeland; *A. tozanense* (Hayata) Hayata.

Rhizomes shortly erect, apex clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds up to (15–)35(–50) cm; stipe stramineous, (8–)10(–18) cm, 1–3 mm in diam., base similarly scaly; lamina 2-pinnate with pinnatifid pinnules, narrowly ovate to oblong-lanceolate, (8–)15–25(–35) × (3.5–)6(–14) cm at middle, base hardly narrowed, apex acuminate; pinnae 10–15 pairs, alternate, spreading or ascending, shortly stalked, deltoid-lanceolate, up to (2–)3(–7) × 1–1.2(–3) cm at base, apex obtuse to acuminate; pinnules 5–8 pairs, spreading or oblique, lower 2 or 3 pairs of pinnules separate from each other, upper pinnules decurrent and adnate to wing of costa, ovate, base subcuneate, somewhat inequilateral, apex obtuse-rounded; basal acroscopic pinnules larger, 6(–26) × 4.5–8 mm, biserrate to shallowly lobed at margin; other pinnae smaller, with triangular teeth at margin; veins pinnate in pinnules, lateral veins 3 or 4 pairs, simple (often forked in basal acroscopic pinnules). Lamina thinly herbaceous when dried, greenish brown, glabrate; rachis and costae stramineous, sometimes slightly purplish, with dense brownish short hairs abaxially, with needle-

like spines on adaxial side at base of costa and costule. Sori orbicular-reniform, horseshoe-shaped, J-shaped, or elliptic, 2 or 3 pairs per pinnule, medial; indusia brown, orbicular-reniform, horseshoe-shaped, J-shaped, or elliptic, membranous, ciliate at margin, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80, 160$  ( $4\times$  apomictic).

Wet areas of valleys in evergreen broad-leaved forests, coniferous and mixed forests; 1200–2800 m. Taiwan, Xizang, Yunnan [N India, Indonesia, Japan, Sri Lanka, N Vietnam].

**110. *Athyrium guanganense*** Ching, Acta Bot. Boreal.-Occid. Sin. 6: 103. 1986.

广南蹄盖蕨 *guang nan ti gai jue*

*Athyrium acrocarpum* W. M. Chu (1992), not (Rosenstock) Copeland (1951); *A. guanganense* var. *acrocarpum* W. M. Chu; *A. yunnanicum* Ching.

Rhizomes short, erect, apex with sparse blackish brown, lanceolate scales. Fronds caespitose; fertile fronds 35–55 cm; stipe blackish brown, upward stramineous, ca. 22 cm, ca. 1.5 mm in diam. at base, base similarly scaly, with sparse scales, upward glabrate; lamina 2-pinnate, narrowly oblong, up to 30 × ca. 16 cm at middle, base slightly narrowed, apex acuminate; pinnae 15–17 pairs, opposite, subspreading, with short stalk 1–2 mm; basal pinnae slightly shortened, ca. 7 cm; middle pinnae lanceolate, 8.5–9 × 2.2–2.5 cm at base, base subequilateral, rounded-truncate, pinnate, apex caudate-acuminate; pinnules 16–18 pairs, lower pinnules opposite; upper pinnules alternate, ascending, approximate; basal pinnules slightly larger, oblong, 1.1–1.3 cm × ca. 5 mm at base, base subequilateral, truncate, parallel to costae on acroscopic side, cuneate on basicopic side, subsessile, pinnatifid, apex obtuse-rounded, with 2 or 3 triangular teeth; veins visible on both surfaces, pinnate in pinnules, lateral veins ca. 5 pairs, oblique, forked, often pinnate in basal acroscopic segments. Lamina papery when dried, yellow-green, glabrate on both surfaces; rachis stramineous, costae pale purplish red, with sparse short hairs abaxially, with pale brown needlelike spines on adaxial side at base of costa, costule, or midrib. Sori oblong, lateral on basal acroscopic veins, 1 per segment, close to costule; indusia brown, oblong, membranous, entire, persistent. Perispore surface without folds.

- Forests; (600–)1100–1800(–2300) m. Guizhou, SE Yunnan.

*Athyrium guanganense* is very close to *A. viviparum* but differs by the absence of bulbils on the rachis. The relationship between them requires further investigation.

**111. *Athyrium silvicola*** Tagawa, Acta Phytotax. Geobot. 2: 17. 1933.

高山蹄盖蕨 *gao shan ti gai jue*

Rhizomes short, erect, densely clothed with brown, linear-lanceolate scales at apices and stipe bases. Fronds caespitose; fertile fronds (25–)50–60(–90) cm; stipe pale stramineous, (15–)35–40(–45) cm, 2.5(–5) mm in diam., upward glabrate; lamina 2-pinnate-pinnatifid, deltoid-ovate, (15–)25–30(–45) × (12–)15–20(–40) cm, base broadest, apex acuminate; pinnae (8–)13 pairs; lower pinnae opposite, upper pinnae alternate, ascending, with stalk (2–)5(–10) mm; basal pinnae larger,

ovate-lanceolate, up to (5–)12(–20) × (2–)4(–5) cm, base subequilateral, slightly narrowed (upper pinnae not narrowed at base), pinnate-pinnatifid, apex acuminate; pinnules (8–)15 pairs, alternate, ascending, lower pinnules with short stalk ca. 2 mm, ovate-oblong, 1.5–2.5(–3) × ca. 1 cm at base, base inequilateral, truncate and somewhat auriculate on acroscopic side, cuneate on basicopic side, pinnatifid to 1/2 or more, apex obtuse-rounded; pinnule segments 5–9 pairs, oblique, oblong or ovate-oblong, basal acroscopic segments larger, ca. 7 × 3–4 mm, with few shallow teeth at apex; veins inconspicuous adaxially, visible abaxially, pinnate in lower segments, forked in upper segments. Lamina thinly papery when dried, pale greenish brown, glabrate on both surfaces; rachis and costae stramineous, with sparse brownish short glandular hairs abaxially, with needlelike spines on adaxial side at base of costa, costule, and midrib. Sori oblong or shortly linear, 3 or 4 pairs per pinnule, close to midrib; indusia brownish, oblong or shortly linear, membranous, entire, persistent. Perispore surface without folds.  $2n = 160$ .

Evergreen broad-leaved forests in valleys, rain forests, shaded shrub groves; 500–2600 m. Guangxi, Sichuan, Taiwan, Yunnan [N India, Japan, Nepal].

**112. *Athyrium cryptogrammoides*** Hayata, Icon. Pl. Formosan. 6: 156. 1916.

合欢山蹄盖蕨 *he huan shan ti gai jue*

*Athyrium dissectifolium* Ching; *A. iseanum* Rosenstock f. *angustisectum* (Tagawa) Sa. Kurata; *A. iseanum* var. *angustisectum* Tagawa.

Rhizomes short, erect, apex densely clothed with brown, ovate-lanceolate scales. Fronds caespitose, up to 35–55 cm; stipe blackish brown, upward stramineous, 10–25 cm, ca. 2 mm in diam. at base, base similarly scaly, upward glabrate; lamina 2-pinnate, with finely pinnate pinnules, ovate-lanceolate, 25–35 × 12–18 cm, base ± rounded, apex long acuminate; pinnae 10–12 pairs, alternate, slightly ascending, stalked (stalk 2–4 mm), lanceolate, middle pinnae up to 10 × ca. 3 cm at base, base subrounded-cuneate, pinnate-pinnatifid, apex acuminate; pinnules 10–12 pairs; basal pinnules of middle pinnae anadromous, alternate, subspreading, subsessile, broadly lanceolate; middle pinnules ca. 2 cm × 7 mm at base, base inequilateral, narrowly cuneate on basicopic side, pinnatifid nearly to costule, apex obtuse; pinnule segments ca. 4 pairs, ovate-lanceolate, ca. 5 × 2 mm, margin biserrate, apex obtuse. Veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 3–5 pairs, oblique, forked or simple. Lamina thinly herbaceous when dried, brownish green, glabrate on both surfaces; rachis and costae abaxially stramineous, subbasal part of costae with dense short glandular hairs, with needlelike spines on adaxial side at base of costa, costule, or midrib. Sori oblong or orbicular-reniform, lateral on acroscopic veins, 1–4 sori per segment; indusia brown, oblong or orbicular-reniform, membranous, erose at margin, persistent. Perispore surface without folds.  $2n = 80, 160$ .

Valley forests, wet areas, *Tsuga* forests or high-elevation bamboo grasslands; (600–)1500–3000 m. Guangxi, Guizhou, Hubei, Hunan, Taiwan, Zhejiang [Japan].

**113. *Athyrium iseanum*** Rosenstock, Repert. Spec. Nov. Regni Veg. 13: 124. 1913.

长江蹄盖蕨 *chang jiang ti gai jue*

Rhizomes short, erect, apex densely clothed with brown, lanceolate scales. Fronds caespitose; fertile fronds 25–70 cm; stipe blackish brown, upward pale green-stramineous, 10–25 cm, 1–2.5 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate-pinnatifid, oblong or oblong-ovate, (10–) 18–45 × (6–) 11–14 cm at middle, base rounded, hardly narrowed, apex acuminate; pinnae 10–20 pairs, alternate, ascending, with stalk 3–4 mm; basal pinnae slightly shortened, 2–5 cm; second basal pinnae lanceolate, 6–10 × 2–2.5 cm at base, base equilateral, subtruncate, pinnate-pinnatifid to 2-pinnate, apex long acuminate; pinnules 10–14 pairs, basal pinnules opposite; upper pinnules alternate, ascending, narrowly separate from each other, basal pinnules slightly larger, ovate-oblong, 1–1.3 cm × 4–5 mm at base, base inequilateral, truncate, parallel to costae on acroscopic side, cuneate on basicopic side, pinnatifid nearly to costule, apex acute; pinnule segments 4–6 pairs, oblong, acroscopic segments larger than basicopic segments; basal acroscopic segments largest, with few short teeth; veins visible abaxially, pinnate in lower segments, lateral veins 2 or 3(–5) pairs, upper veins forked. Lamina herbaceous when dried, pale greenish brown, glabrate on both surfaces; rachis and costae stramineous abaxially, with dense short glandular hairs at base of costa, with needlelike spines on adaxial side at base of costa, costule, or midrib. Sori usually oblong, sometimes J-shaped, horseshoe-shaped, or orbicular-reniform, 1 per segment, but 2 or 3 sori in basal acroscopic segments; indusia yellow-brown, polymorphic, membranous, entire, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80, 160$ .

Valley forests, wet areas; near sea level to 2800 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Japan, S Korea].

*Athyrium iseanum* differs from related species in the lamina oblong or oblong-ovate; pinnules oblong-ovate, pinnatifid into 4–6 pairs of segments with few short sharp teeth; prominent needlelike spines present on rachis, costae, costules, and midribs; sori oblong, J-shaped, horseshoe-shaped, or orbicular-reniform, indusia entire; and bulbils absent or present in distal part of rachis and also costa.

- 1a. Lamina oblong, bulbil usually absent, indusia usually oblong, sometimes J-shaped, horseshoe-shaped, or orbicular-reniform ..... 113a. var. *iseanum*
- 1b. Lamina usually oblong-ovate, bulbils usually 1 or 2 per lamina, in upper portion of rachis, frequently present also in costae, indusia polymorphic, i.e., hooked, reniform, or oblong ..... 113b. var. *chuanqianense*

**113a. *Athyrium iseanum* var. *iseanum***

长江蹄盖蕨(原变种) *chang jiang ti gai jue* (*yuan bian zhong*)

?*Athyrium filix-femina* (Linnaeus) Roth var. *filipes* Christ; *A. wuyishanense* Ching.

Lamina oblong, bulbil usually absent, indusia usually oblong, sometimes J-shaped, horseshoe-shaped, or orbicular-reniform.  $2n = 80, 160$ .

Valley forests, wet areas; near sea level to 2800 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Japan, S Korea].

**113b. *Athyrium iseanum* var. *chuanqianense*** Z. R. Wang, Fl. Reipubl. Popularis Sin. 3(2): 509. 1999.

西南蹄盖蕨 *xi nan ti gai jue*

Lamina usually oblong-ovate; indusia polymorphic, i.e., hooked, reniform, or oblong; bulbils usually 1 or 2 per lamina, large, in upper portion of rachis, frequently present in upper portion of costae also.

• Damp areas in mixed forests; 800–1900 m. Guangxi, Guizhou, Sichuan, Xizang, Yunnan.

**114. *Athyrium imbricatum*** Christ, Bull. Acad. Int. Géogr. Bot. 16: 123. 1906.

密羽蹄盖蕨 *mi yu ti gai jue*

*Athyrium frangulum* Tagawa; *A. iseanum* Rosenstock var. *fragile* Tagawa.

Rhizomes short, erect, apex densely clothed with blackish brown, narrowly lanceolate scales. Fronds caespitose; fertile fronds 60–90 cm; stipe greenish stramineous, 28–36 cm, 2–3 mm in diam., base sparsely scaly, upward glabrescent; lamina 2-pinnate-pinnatifid, broadly ovate or oblong, 35–50 × 15–35 cm, base cuneate, not narrowed, apex acuminate; pinnae ca. 12 pairs, alternate, markedly oblique, approximate, stalked (stalk 5–6 mm), lanceolate; basal 1 or 2 pairs of pinnae larger, 14–22 × 4–5 cm, base broadly cuneate, parallel to rachis on acroscopic side, pinnate, apex acuminate; pinnules ca. 20 pairs, alternate, oblique, approximate, narrowly deltoid-lanceolate, 2–2.8 cm × 8–12 mm, base inequilateral (but basal pinnule sub-equilateral), truncate, parallel to costae on acroscopic side, cuneate on basicopic side, pinnatifid nearly to costule, apex acute; pinnule segments 8–10 pairs, oblique, approximate, oblong, with long teeth at margin; third and upper pinnae gradually smaller, pinnatifid; veins visible abaxially, pinnate in segments, lateral veins 2–4 pairs, oblique, simple (occasionally forked). Lamina papery when dried, grass-green, glabrate; rachis and costae pale red-purple, with pale or pale brown needlelike spines on adaxial side at base of costa, costule, or midrib bases. Sori narrowly elliptic, biserial on both sides of costules or midribs, usually inframedial; indusia yellow-brown, narrowly elliptic, membranous, erose at margin, persistent. Perispore surface without folds, with granular ornamentation.  $2n = 80^*$ .

Evergreen broad-leaved forests in valleys; 800–1800 m. Chongqing, Guizhou, Sichuan [Japan].

**115. *Athyrium xichouense*** Y. T. Hsieh & Z. R. Wang, Acta Phytotax. Sin. 27: 155. 1989.

西畴蹄盖蕨 *xi chou ti gai jue*

Rhizomes short, erect, densely clothed with brown, lanceolate scales at apices and stipe bases. Fronds caespitose, up to 75 cm; stipe blackish brown, upward stramineous, shiny, 40–48 cm, ca. 3 mm in diam. at base, upward glabrate; lamina 2-pinnate, ovate, 27–30 × 18–20 cm, base rounded, apex slightly abruptly narrowed; pinnae 5 or 6 pairs, alternate or basal pinnae subopposite, stalked (stalk 3–10 mm) ascending; basal pinnae not shortened, broadly lanceolate, up to 12 × ca. 4 cm; middle pinnae lanceolate, up to 10 × 2.5–3 cm, base subequilateral, rounded-cuneate, parallel to rachis on acroscopic side, narrowly cuneate on basisopic side, pinnate, apex long acuminate and somewhat caudate; pinnules 14–17 pairs, alternate, basal pinnules with stalk ca. 1 mm, upper pinnules sessile, ascending; basal pinnules slightly larger, oblong-lanceolate, somewhat falcate, 1.4–1.6 cm × 6–7 mm, base inequilateral, subtruncate, auriculate, somewhat parallel to rachis on acroscopic side, narrowly cuneate on basisopic side, pinnatifid, apex obtuse-acute, with 3–5 small teeth; pinnule segments ca. 6 pairs, suboblong, with 2 or 3 short teeth at apex; upper pinnules equal to basal pinnules but gradually smaller, decurrent at base; veins visible abaxially, somewhat visible adaxially, pinnate in segments, lateral veins 2 or 3 pairs, oblique, simple. Lamina herbaceous when dried, pale green, glabrate on both surfaces; rachis and costae stramineous, occasionally with few brownish, linear small scales abaxially, with pale needlelike spines on upper part of rachis and midrib adaxially. Sori oblong, lateral on basal acroscopic veins, 1 per segment (2–4 in basal acroscopic segments), biseriate on both sides of costules, inframedial; indusia brown, oblong, membranous, entire, persistent or partly fugacious. Perispore surface without folds.

• Damp areas in evergreen broad-leaved forests; 1400–2600 m. NW and SE Yunnan.

**116. *Athyrium nanyueense*** Ching, Acta Bot. Boreal.-Occid. Sin. 6(3): 152. 1986.

南岳蹄盖蕨 *nan yue ti gai jue*

Rhizomes short, erect, apex with sparse dark brown, lanceolate scales. Fronds caespitose; fertile fronds up to 50 cm; stipe dark brown, upward brownish stramineous, 17–20 cm, ca. 2.4 mm in diam., base similarly scaly, upward glabrate; lamina 2-pinnate-pinnatifid, with pinnatifid pinnules, oblong, 25–30 × ca. 15 cm, base ± rounded, apex acuminate; pinnae ca. 13 pairs, alternate, ascending, with stalk 4–5 mm, basal pinnae not shortened, broadly lanceolate, up to 10 × ca. 3.5 cm, shortly acuminate at apex, equilateral and rounded at base, pinnate; pinnules ca. 12 pairs, alternate, ascending; basal pinnules shortly stalked (stalk ca. 1 mm), oblong-lanceolate, up to 2 cm × 7–8 mm, base subequilateral, truncate, not auriculate on acroscopic side, cuneate on basisopic side, pinnatifid nearly to costule, apex obtuse; pinnule segments 5 or 6 pairs, approximate, oblong; basal acroscopic segments larger, ca. 1 cm × 5 mm, with 3–5 long teeth, obtuse at apex; veins inconspicuous adaxially, visible abaxially, pinnate in segments, lateral veins 3 or 4 pairs, oblique, lower veins forked, upper veins simple. Lamina thinly herbaceous when dried, dark green, glabrate on both surfaces; rachis and costae dark brown, glabrate abaxially, with needlelike spines on adaxial side at base of costa, costule, or

midrib. Sori oblong or orbicular, 1 per segment (2–4 in basal acroscopic one), 5 or 6 pairs per pinnule, close to costule; indusia brown, oblong or orbicular, membranous, entire, persistent. Perispore surface without folds.

• Shrub groves; ca. 800 m. Hunan (Heng Shan).

*Athyrium nanyueense* is very similar to *A. imbricatum* in appearance but differs by the rachis and costae glabrate abaxially and the pinnules subequilateral at base, not auriculate on acroscopic side, obtuse-acute at apex.

**117. *Athyrium atkinsonii*** Beddome, Suppl. Ferns S. Ind. 11. 1876 [*“Atkinsonii”*].

大叶假冷蕨 *da ye jia leng jue*

*Araiostegia yaklaensis* (Beddome) B. K. Nayar & S. Kaur; *Aspidium senanense* Franchet & Savatier; *Asplenium andersonii* C. B. Clarke; *A. atkinsonii* (Beddome) C. B. Clarke; *A. atkinsonii* var. *andersonii* (C. B. Clarke) C. B. Clarke; *A. fimbriatum* Kunze var. *sphaeropteroides* C. B. Clarke; *A. lastreoides* Baker; *Athyrium andersonii* (C. B. Clarke) Panigrahi & Basu; *A. filix-femina* (Linnaeus) Roth var. *deltoidea* Christ; *A. fimbriatum* Hooker ex T. Moore var. *sphaeropteroides* (C. B. Clarke) Beddome; *A. lastreoides* (Baker) Diels; *A. microsorum* Makino; *A. monticola* Rosenstock; *A. senanense* (Franchet & Savatier) Koidzumi & Tagawa; *Cystopteris grandis* C. Christensen; *Davallia athyriifolia* Baker; *D. yaklaensis* (Beddome) C. Christensen; *Dryopteris gracilifrons* C. Christensen; *D. senanensis* (Franchet & Savatier) C. Christensen; *Leucostegia yaklaensis* Beddome; *Polypodium leptophyllum* Baker (1891), not Linnaeus (1753); *Pseudocystopteris andersonii* (C. B. Clarke) Ching; *P. atkinsonii* (Beddome) Ching.

Rhizomes shortly creeping, 0.5–1 cm in diam., bearing remaining stipe bases, apex together with stipe bases, clothed with brownish or brown ovate scales. Fronds approximate or distant; fertile fronds (15–)60–100(–200) cm; stipe blackish brown at base, upper part stramineous or pale purplish red, 20–50(–100) cm, 3–10 mm in diam., occasionally with thin scales; lamina (24–)35–50(–100) cm, nearly as broad as long or slightly narrower, broadly ovate or ovate-triangular, in small plants lamina often ovate, in large plants lamina often subtriangular, 2–4-pinnate, acuminate; rachis and costae slightly tortuous; pinnae 10–12(–20) pairs, alternate, ascending, stalk 0.5–1(–3) cm, separate from each other, sometimes imbricate; basal pinnae as large as second basal pinnae, 5–15 cm apart, 15–20(–50) × up to 6–8(–28) cm at middle, slightly narrowed toward base, narrowly ovate to narrowly ovate-lanceolate, acuminate, subtruncate at base, 2-pinnate-pinnatifid to 3-pinnate; pinnules 10 pairs or more, anadromous, alternate, with stalk ca. 2 mm, 1.4–2 cm apart, subspreading, basal pair of pinnules slightly shortened, middle pinnules oblong-lanceolate, 3.5–5 × 1.2–2 cm, acuminate, truncate at base; secondary pinnules 6–8 pairs, oblong or subovate, 5–8 × 2–3 mm, obtuse-rounded, crenate at apex, base broadly cuneate, basisopic base slightly decurrent; ultimate segments ovate-oblong, rounded-obtuse, or subsquare, with 2 or 3 unequal short teeth at apex, broadly cuneate and slightly inequilateral at base. Veins visible on surfaces, more prominent abaxially, pinnate with 4 or 5 pairs of lateral veins, simple, rarely forked. Lamina herbaceous when

dried, blackish brown or greenish brown, glabrate; adaxial groove of costule open to groove of midribs, rachis and costae occasionally with membranous, small-lanceolate scales abaxially, without spines at base of pinnules and segments. Sori orbicular or elliptic, abaxial or semilateral on basal acroscopic veins; indusia pale brown, small, orbicular-reniform, occasionally oblong, or J-shaped, membranous, slightly erose at margin, fugacious, apparently exindusiate when mature. Perispore folded.  $2n = 80$ .

Damp areas in coniferous forests and shrubs; 1200–4000 m. Chongqing, Fujian, Gansu, Guizhou, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Shanxi, Sichuan, Taiwan, SE Xizang, Yunnan [Bhutan, Himalaya, N India, Japan, Kashmir, S Korea, N Myanmar, Nepal, N Pakistan].

"*Polypodium foliolosum*" (Wallich, Numer. List, no. 318. 1829) belongs here but is a nomen nudum and was not therefore validly published (*Melbourne Code*, Art. 38.1(a)).

**118. *Athyrium spinulosum*** (Maximowicz) Milde, Bot. Zeitung (Berlin) 24: 376. 1866.

假冷蕨 *jia leng jue*

*Cystopteris spinulosa* Maximowicz, Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 9: 340. 1859; *Asplenium spinulosum* (Maximowicz) Miquel (1867), not (Blume) Mettenius (1859); *Pseudocystopteris spinulosa* (Maximowicz) Ching.

Rhizomes long creeping, ca. 2.5 mm in diam., blackish brown, with sparse broadly ovate membranous scales. Fronds distant; fertile fronds 45–50 cm; stipe blackish brown at base, upward stramineous, shiny, 22–26 cm, 2–3 mm in diam. at base, base clothed with broadly ovate to lanceolate scales, often densely yellow long pubescent, upper part glabrate, occasionally scaly; lamina triangular to ovate-triangular, 20–28 cm, nearly as broad as long or slightly broader, shortly acuminate or almost acute, 2- or 3-pinnate, with ca. 12 pairs of pinnae; basal pinnae longest, 17–20 × 6–8 cm at middle, elliptic to elliptic-oblancheolate, gradually narrowed toward base, subequilateral at base, with stalk 5–8 mm, acuminate, subopposite, 2–3.5 cm apart from upper pinnae, ascending; basal pinnae with pinnules 12–14-paired, anadromous, ascending or spreading, oblong-lanceolate to ovate-triangular; lower pinnules gradually shorter, obtuse or acuminate, equilateral, rounded or rounded-cuneate at base, sessile or slightly adnate to costae, rarely very shortly stalked, with long pointed teeth at margin; middle pinnules longest, 4–5 cm × 8–15 mm; secondary pinnules 10 pairs or fewer, ascending, oblong or narrowly ovate, 5–8 × 2.5–3.5 mm, usually decurrent to costular wings, sharply lobed or with thin, long, sharp teeth; segments sharply toothed; second basal and upper pinnae lanceolate, narrower, subopposite or alternate, not narrowed toward base, shortly stalked or sessile; basal pair of pinnules catadromous or subopposite; pinnule segments with pointed, long, sharp teeth. Veins visible on surfaces, pinnate, simple, terminating in tooth tip. Lamina herbaceous when dried, green or greenish brown, costule and midrib bases with some short spinulose processes on adaxial surface, rachis, and costae with sparse short hairs adaxially, glabrate abaxially. Sori orbicular, abaxial on veins, 1 to several pairs per every ultimate seg-

ment; indusia brownish, almost orbicular-reniform, membranous. Perispore thin, hyaline, folded.  $2n = 80$ .

Damp areas in coniferous and mixed forests, in shrubs, bamboo groves; 800–3000 m. Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shaanxi, Sichuan [Japan, Korea, E Russia].

**119. *Athyrium subtriangulare*** (Hooker) Beddome, Ferns Brit. India, t. 242. 1867.

三角叶假冷蕨 *san jiao ye jia leng jue*

*Asplenium subtriangulare* Hooker in Hooker & Baker, Syn. Fil. 225. 1867; *A. spinulosum* (Blume) Mettenius var. *subtriangulare* (Hooker) C. B. Clarke; *Athyrium hookerianum* T. Moore; *A. longipes* Christ; *A. sikkimense* (Bir) Á. Löve & D. Löve; *A. spinulosum* (Maximowicz) Milde var. *subtriangulare* (Hooker) C. Christensen; *A. subtriangulare* var. *sikkimense* Bir; *Pseudocystopteris decipiens* Ching & S. K. Wu; *P. longipes* (Christ) Ching; *P. purpurascens* Ching & S. K. Wu; *P. reflexipinnula* Ching & S. K. Wu; *P. remota* Ching; *P. sikkimensis* (Bir) Ching; *P. sparsa* Ching & S. K. Wu; *P. spinulosa* (Maximowicz) Ching var. *taipaishanensis* Ching; *P. subtriangularis* (Hooker) Ching; *P. tibetica* Ching.

Rhizomes long creeping, 3–4 mm in diam., blackish brown, sparsely scaly; scales brownish, ovate-lanceolate. Fronds distant; fertile fronds (13–)60–70(–90) cm; stipe brownish at base, upward stramineous, (5–)30–40(–55) cm, (1–)3–4(–5) mm in diam. at base, base densely scaly, often densely long yellow pubescent, upper part occasionally with brownish lanceolate membranous scales; lamina 2- or 3-pinnate, broadly ovate-triangular to ovate-triangular, (8–)25–35(–40) × (10–)20–30(–45) cm, acuminate; pinnae (10–)15–20 pairs, subalternate, ascending, approximate; basal pinnae largest, 14–20(–28) × 5–9(–12) cm at middle, elliptic to elliptic-oblancheolate, acuminate, gradually narrowed and subequilateral at base, with stalks 5–8 mm, subopposite, (1–)4–5 cm apart from upper pinnae; pinnules of basal pinnae anadromous, (10–)14–20 pairs, spreading or slightly ascending, upper pinnules gradually shortened to base, oblong-lanceolate or ovate-triangular, obtuse, usually with patulous teeth; pinnules of middle pinnae oblong-lanceolate, 2.5–4.5(–7) × 1–1.5 cm at base, shortly acuminate or acute, sessile, subtruncate, separate or partly adnate to costae, approximate; secondary pinnules 10–12 pairs, spreading or slightly ascending, oblong, 5–8 × 2.5–4 mm, obtuse, decurrent to costular wings, dissected or with patulous teeth; second basal pinnae similar to but slightly smaller than basal pinnae, oblong; upward pinnae lanceolate, acuminate, not narrowed toward base; ultimate segments serrate. Veins visible on surfaces, pinnate in ultimate pinnule, simple, terminating into teeth. Lamina herbaceous when dried, green or brown-green, costules and midribs with very short spines on adaxial surface, rachis, costae, and costules ± shortly hairy, veins with sparse glandular short hairs or multicellular hairs abaxially, costa base occasionally with few small scales. Sori orbicular, abaxial on veins, 1 to several pairs per ultimate segment; indusia brownish, membranous, orbicular-reniform. Perispore thin, hyaline, folded.  $2n = 80^*$ , 160.

Damp areas in forests; (500–)2000–4100 m. Chongqing, Gansu,

Hubei, Qinghai, Shaanxi, Sichuan, SE Xizang, Yunnan [Bhutan, N India, Nepal].

**120. *Athyrium schizochlamys*** (Ching) K. Iwatsuki, Bull. Univ. Mus. Univ. Tokyo 31: 313. 1988.

睫毛盖假冷蕨 *jie mao gai jia leng jue*

*Pseudocystopteris schizochlamys* Ching, Acta Phytotax. Sin. 9: 79. 1964; *P. lanpingensis* Ching; *P. laterepens* Ching; *P. sinica* Ching.

Rhizomes long creeping, 2–3 mm in diam., densely clothed with brown ovate-lanceolate membranous scales at apex. Fronds distant; fertile fronds (9–)20–25(–40) cm; stipe upward stramineous, shiny, often pale purplish red, (4–)6–10(–23) cm, 1–3 mm in diam., with sparse scales at base; lamina 1–3-pinnate, ovate to ovate-oblong, (5–)11–17(–25) × (3–)5–9(–20) cm, acuminate; pinnae 10–13(–16) pairs, alternate, lower pinnae sometimes subopposite, basal 1 or 2 pairs slightly shorter, with stalk (stalk 1–2(–4) mm), ascending, curved upward, (1–)1.5–2(–4) cm apart; middle pinnae (1.5–)3–6(–11) × (0.8–)1.5–2.4(–4) cm, oblong-lanceolate, subequilateral at base; pinnules less than 6–10 pairs, broadly ovate to ovate-lanceolate, approximate; basal pinnules 8–10 × 5–8 mm, sharply toothed, inequilateral at base, acroscopic side parallel to costae, basicopic side narrowly cuneate, slightly decurrent to costa wings, all anadromous, basal 1 or 2 pairs of pinnules of lowest pinnae sometimes slightly shorter; secondary pinnules or segments 3 or 4(–8) pairs, elliptic to oblong, 3–4(–7) × ca. 2 mm, oblong, toothed, dissected at margin; ultimate segments with 2 or 3 teeth. Veins visible abaxially, pinnate per pinnule or segment, terminating in teeth. Lamina herbaceous or near papery when dried, dark green, rachis and costae usually pale purplish red, glabrate or shortly glandular hairy. Sori small, orbicular or orbicular-reniform, 1–3 sori per ultimate pinnule, abaxial on or semilateral to basal acroscopic veins; indusia brownish, orbicular-reniform, lacerate with ciliate margin. Perispore thin and hyaline, slightly folded.  $2n = ca. 80$ .

Damp areas in forests; 3000–4500 m. Sichuan, SE Xizang, Yunnan [Nepal].

**121. *Athyrium atuntzeense*** (Ching) Z. R. Wang & Z. R. He, **comb. nov.**

阿墩子假冷蕨 *a dun zi jia leng jue*

Basionym: *Pseudocystopteris atuntzeensis* Ching, Acta Phytotax. Sin. 9: 83. 1964.

Rhizomes long creeping, ca. 2 mm in diam., blackish brown, sparsely scaly, but densely scaly at apex and stipe bases; scales brown, broadly lanceolate. Fronds distant; fertile fronds 30–55 cm; stipe stramineous, 12–23 cm, 1–2 mm in diam., upper part with very sparse small lanceolate scales; lamina 3-pinnate-pinnatifid, 15–32 cm, nearly as broad as long or slightly narrower, ovate-oblong or broadly ovate-triangular, acuminate with shortly caudate apex; pinnae 8–10 pairs, ascending, lowest pinnae 10–16 × 3–5 cm at middle, oblong-lanceolate, acuminate, base rounded-cuneate, anadromous, acroscopic base often imbricate with rachis, basicopic base oblique, with stalks 1.5–3

mm, pinnae subopposite or alternate, 2.5–5 cm apart; pinnules ca. 9 pairs, shortly stalked, alternate, subspreading, separate from each other, basal 1 or 2 pairs often slightly shortened, ovate-triangular; middle pinnules oblong, 1.5–3 cm × 7–12 mm, with 2 or 3 thin long teeth, base broadly cuneate, subequilateral or inequilateral, acroscopic base parallel to costae; secondary pinnules ca. 5 pairs, oblique, distant, oblong or rhomboid, 4–7 × 2–3 mm, with 2 or 3 long, acuminate teeth at apex, base broadly cuneate, decurrent and adnate to costular wings, dissected into segments with 2 or 3 acuminate teeth. Veins visible on surfaces, pinnate in ultimate pinnule, terminating into teeth. Lamina herbaceous when dried, pale green and glabrate; rachis and costae pale purplish red adaxially. Sori small, orbicular, suprabasally abaxial on veins near sinuses between segments; indusia pale green, suborbicular-reniform, lacerate with ciliate margin.

• Grassy slopes; 3600–3700 m. NW Yunnan (Dêqên).

**122. *Athyrium davidii*** (Franchet) Christ, Bull. Soc. Bot. France 52(Mém. 1): 50. 1905 [*“davidii”*].

大卫假冷蕨 *da wei jia leng jue*

*Polypodium davidii* Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 10: 119. 1887; *Asplenium duthiei* Beddome; *Athyrium duthiei* (Beddome) Beddome; *Phegopteris davidii* (Franchet) Beddome; *Pseudocystopteris davidii* (Franchet) Z. R. Wang.

Rhizomes long creeping, with remaining stipe bases, chestnut-black, glabrate, slightly shiny, 1–2 mm in diam., with sparse red-brown, ovate-lanceolate scales at apices and stipe bases. Fronds approximate or distant; fertile fronds 20–35 cm; stipe dark brown at base, upward stramineous, slightly pale purplish red, 2.5–12 cm, 1–2 mm in diam., upper part with few scales; lamina 2-pinnatifid, oblanceolate or narrowly oblanceolate, broadest 1/3 from apex, 14–25 × 3.5–8 cm, gradually narrowed toward base usually 1–2(–3) cm wide, acuminate; pinnae 13–24 pairs, sessile or subsessile, spreading or slightly ascending, subopposite; basal pinnae acroscopically subauriculate, usually 0.3–1.3 cm; longest pinnae slightly ascending, alternate, costae 0.5–3 cm from neighboring pinnae, lanceolate or broadly lanceolate, 1.5–4 cm × 5–14 mm, base subtruncate, subequilateral, or acroscopic segments slightly large, deeply pinnatifid to narrow wings, apex shortly acuminate; pinna segments or pinnules 10 pairs or fewer, ovate to ovate-triangular, 2–8 × 2–5 mm, slightly inequilateral at base, margin with sharp teeth or shallowly lobed, apex obtuse; ultimate segments with 2 or 3 short teeth. Veins visible abaxially, purplish red, lateral veins simple or 2- or 3-forked, ending into tooth tips. Lamina herbaceous or near papery when dried, dark greenish brown adaxially, pale green abaxially. Rachis and costae with few long scalelike hairs abaxially, costae and veins with sparse long multicellular hairs, costae also with short glandular hairs abaxially. Sori elliptic or reniform, 1–7 sori per segment, medial or supramedial; indusia small, thinly membranous, orbicular-reniform or narrowly ovate, lacerate at margin, hidden by sporangia at maturity. Spores bilateral, perispore folded.  $2n = 80$ .

Cool alpine areas on mountains, grassy slopes, under shrub groves, in rock crevices; 3000–4300 m. W Sichuan, SE Xizang, NW Yunnan [N India, N Myanmar, Nepal].

**123. *Athyrium repens*** (Ching) Fraser-Jenkins, *Taxon*. Revis. Indian Subcontinental Pteridophytes, 238. 2008.

长根假冷蕨 *chang gen jia leng jue*

*Pseudocystopteris repens* Ching, *Acta Phytotax. Sin.* 9: 80. 1964.

Rhizomes long creeping, 2.5–3 mm in diam., blackish brown, almost without scales, apex clothed with brownish, membranous, broadly ovate-lanceolate scales. Fronds distant; fertile fronds 20–30 cm; stipe blackish brown at base, upward gradually becoming purplish red, 7–10 cm, 1.5–2 mm in diam. at base, base with similar scales, upper part with sparse broadly lanceolate scales; lamina 2-pinnate, ovate-oblong, 14–17 × 7–10 cm at middle, base subtruncate, slightly narrowed, apex acu-

minate; pinnae 13–15 pairs, lowest two pairs of pinnae slightly shortened, slightly pendulous, 1.5–2.3 cm apart; middle pinnae 4–5 × ca. 1.5 cm at base, broadly lanceolate, shortly acuminate, base truncate, sessile; pinnules 10–12 pairs, spreading, approximate, ca. 7 × 4 mm, oblong-ovate, base subequilateral and broadly cuneate, basiscopic base decurrent to narrow costal wing, margin biserrate, lobed, apex obtuse with triangular short teeth; segments with 2 or 3 short teeth; veins visible abaxially, pinnate in pinnules, 1 veinlet per tooth. Lamina herbaceous when dried, green, rachis and costae with sparse long multicellular hairs and short glandular hairs on surfaces. Sori small, elliptic or orbicular-reniform, abaxial on veins, 1–6 per ultimate pinnule or segment, medial; indusia brownish, orbicular-reniform or narrowly ovate, lacerate at margin.

● *Rhododendron* forests; 3200–3700 m. Sichuan.

#### Uncertain taxa

*Athyrium dulongicola* W. M. Chu (*Acta Bot. Yunnan.*, Suppl. 5: 41. 1992 [*"dulongicolum"*]), described from Yunnan.

*Athyrium excelsium* Ching (*Acta Bot. Boreal.-Occid. Sin.* 6(1): 20. 1986), described from Yunnan.

*Athyrium fargesii* Christ (*Bull. Soc. Bot. France* 52(Mém. 1): 49. 1905), described from Yunnan.

*Athyrium filix-femina* (Linnaeus) Roth subvar. *brevidens* Christ (*Bull. Soc. Bot. France* 52(Mém. 1): 46. 1905), described from Yunnan.

*Athyrium filix-femina* (Linnaeus) Roth var. *duclouxii* Christ (*Bull. Soc. Bot. France* 52(Mém. 1): 46. 1905), described from Yunnan.

*Athyrium filix-femina* (Linnaeus) Roth var. *paleosum* Christ (*Notul. Syst. (Paris)* 1: 48. 1909), described from Yunnan.

*Athyrium ×heterosporum* Y. T. Hsieh & Z. R. Wang (*Acta Phytotax. Sin.* 27: 156. 1989), described from Yunnan and treated in FRPS 3(2): 266. 1999).

*Athyrium nemotum* Ching (*Acta Bot. Boreal.-Occid. Sin.* 6(3): 149–150. 1986), described from Guangxi.

*Athyrium nigripes* (Blume) T. Moore var. *elongatum* Christ (*Bull. Herb. Boissier* 7(1): 13. 1899), described from Yunnan.

*Athyrium rotundifolium* Ching (*Fl. Fujian.* 1: 597. Apr 1982), described from Fujian.

*Athyrium silvestrii* Christ (*Nuovo Giorn. Bot. Ital. n.s.*, 17. 226. 1910), described from Hubei.

## 5. DIPLAZIUM Swartz, *J. Bot. (Schrader)* 1800(2): 61. 1801.

双盖蕨属 *shuang gai jue shu*

He Zhaorong (和兆荣); Masahiro Kato

*Allantodia* R. Brown; *Anisogonium* C. Presl; *Callipteris* Bory; *Monomelangium* Hayata.

Plants terrestrial, evergreen, medium-sized to large. Rhizome creeping to ascending or erect, sometimes subarborescent, brown or nearly black, dictyostelic, ± scaly; scales subulate, lanceolate, or broadly lanceolate, sometimes ovate and adpressed or peltate, margin entire, sometimes sparsely toothed and often narrow, black, brown, yellow-brown, or dark brown to black; fronds caespitose, distant or approximate. Stipe brown or black and scaly at base, scales similar to those on rhizome, and upward gradually glabrescent or with sparse scales, sometimes base and upward prickly, grooved adaxially, not hairy. Lamina mostly broadly ovate, oblong, or deltoid, sometimes broadly lanceolate, usually pinnate to tripinnate-pinnatifid under acuminate and pinnatifid apex, mostly bipinnate or bipinnate-pinnatilobate to bipinnate-pinnatipartite. Pinnae lanceolate, broadly lanceolate, or oblong-lanceolate, base mostly or nearly symmetrical, lower pinnae not reduced or slightly reduced; ultimate pinnules mostly lanceolate or broadly lanceolate, sometimes ovate or oblong, base stalked or sessile, truncate, rounded, or subcordate, margin entire or serrate, apex acute or acuminate to long acuminate, sometimes rounded or truncate; veins free, rarely anastomosing with a row of areoles along costa and costule; veinlets simple or forked, ascending, lower veinlets often curved. Lamina herbaceous or papery, rarely leathery, usually glabrous, rachis, costae, and costules abaxially sometimes with sparse subulate or lanceolate scales, rarely prickly; rachis, costae, and costules adaxially grooved between knife-edgelike ridges, ridges interrupted at insertion of higher-order frond axes, so grooves continuous, both surfaces of costa often with minute glandular hairs. Sori linear, oblong, or ovate, mostly single or less often double on basal acroscopic veinlets, costular, medial, suprasedial, or from base to end of veinlets; indusia membranous or thickly membranous, grayish white or brown, vaulted or ovoid when mature, and irregularly rupturing on back, or compressed, linear, opening acroscopically, persistent or caducous. Spores bilateral, monolete, mostly reniform or bean-shaped, sometimes hemispherical, rarely spherical; perispore generally prominent, ornamentation mostly rugate, glabrous or aculeate, granular, clathrate, reticulate, rarely ridged. *n* = 41.

About 300–400 species: mainly distributed in the tropics and subtropics worldwide; a few species distributed in warm temperate and temperate zones or subalpine belts; 86 species (29 endemic) in China.

Most of the species in China are distributed south of the Chang Jiang and in SW regions on mountains; they occur in evergreen broad-leaved forests or beside shaded streamlets, and a few extend to 3000 m.

The following species, accepted in Knapp (Ferns Fern Allies Taiwan, 152, 451, 487. 2011), has been excluded from the present treatment: *Diplazium proliferum* (Lamarck) Thouars (Esquisse Fl. Tristan d'Acugna, 35. 1808; *Asplenium proliferum* Lamarck, Encycl. 2: 307. 1786; *Callipteris proliferata* (Lamarck) Bory). Further study is needed to establish its presence in Taiwan.

The following taxon, described from Guizhou, is excluded from the present treatment, pending further research: *Diplazium platyphyllum* Christ (Bull. Acad. Int. Géogr. Bot. 17: 148–149. 1907).

- 1a. Veins anastomosing.
- 2a. Rachis glabrous, not spiny ..... 1. *D. esculentum*
- 2b. Rachis spiny ..... 2. *D. paradoxum*
- 1b. Veins free.
- 3a. Stipe, rachis, and costae densely pilose.
- 4a. Fronds up to 65 cm, basal pinnae not strongly reduced; veins hairy ..... 3. *D. pullingeri*
- 4b. Fronds up to 25 cm, basal pinnae reduced; veins subglabrous ..... 4. *D. dinghushanicum*
- 3b. Stipe, rachis, and costae not densely pilose.
- 5a. Lamina imparipinnate with terminal pinna similar to lateral pinnae.
- 6a. Sori usually single, occasionally double, distant.
- 7a. Lamina subleathery; margin of pinna usually serrate only above middle, subentire or shallowly repand near base ..... 5. *D. crassiusculum*
- 7b. Lamina herbaceous; pinna margin serrate from base to apex, sometimes shallowly pinnatifid ..... 6. *D. pinfaense*
- 6b. Sori mostly double, attached back to back, approximate.
- 8a. Pinnae up to 7 cm wide; veinlets 3(or 4) per veinlet group; scales ovate-lanceolate, 2–3 mm wide ..... 7. *D. hainanense*
- 8b. Pinnae 2–5.5 cm wide; veinlets (3 or)4 per veinlet group or more; scales linear-lanceolate or lanceolate, up to 1 mm wide.
- 9a. Pinnae serrate, crenate, or repand from base to apex.
- 10a. Pinnae subleathery, base rounded, margin repand or crenate (crenations ca. 1.5 mm) ..... 8. *D. maonense*
- 10b. Pinnae papery, base cuneate or rounded-cuneate, margin minutely serrate or repand ..... 9. *D. serratifolium*
- 9b. Pinnae entire except slightly serrate in apical part.
- 11a. Pinnae ovate-lanceolate, ca. 2 cm wide ..... 10. *D. basahense*
- 11b. Pinnae ovate-lanceolate or elliptic-lanceolate, 3–5.5 cm wide.
- 12a. Scales membranous, bicolored (middle brown, margin black); lateral pinnae up to 12 pairs ..... 11. *D. splendens*
- 12b. Scales thickly membranous, unicolored; lateral pinnae up to 6 pairs.
- 13a. Rhizome erect; scales linear, black ..... 12. *D. stenolepis*
- 13b. Rhizome slender, creeping to oblique; scales lanceolate, brown or black-brown ..... 13. *D. donianum*
- 5b. Lamina gradually shallowly pinnatifid to apex.
- 14a. Sori ovate-orbicular or cylindrical-oblong, costular; indusia vaulted, ovate-orbicular or shortly sausage-shaped, irregularly ruptured on back.
- 15a. Scales on rhizome apex and stipe base loose, lanceolate or linear-lanceolate.
- 16a. Plants tall; rhizome ascending to erect, robust, more than 5 cm in diam.; stipe above 6 mm in diam.; pinnules usually with broad base, deltoid-lanceolate; veinlets on lobes mostly forked; perispore with prominent spores, with dense granular ornamentation ..... 14. *D. bellum*
- 16b. Plants medium-sized; rhizome creeping, stipe less than 3 mm in diam.; pinnules linear-lanceolate, base same width as middle; veinlets on lobes mostly simple; spores without prominent perispore with dense granular ornamentation ..... 15. *D. ovatum*
- 15b. Scales on stipe ovate or ovate-lanceolate, sometimes lanceolate, peltate or subpeltate (with cordate base).
- 17a. Stipe and base of rachis densely scaly when young, scales at apex of variously long stalks, long stalks adpressed (stipe rough).
- 18a. Rhizome erect, fronds caespitose; stipe with estipitate scales, also with adpressed uniseriate-celled, small, nodose hairs ..... 16. *D. dulongjiangense*
- 18b. Rhizome creeping, fronds distant; stipe lacking uniseriate-celled nodose hairs ..... 17. *D. kawakamii*
- 17b. Scales on stipe sparse, often adpressed, rarely at apices of stiff conical shortly acute protuberances, stipe smooth or prickly after scales fallen.
- 19a. Rhizome thick, ascending to erect; fronds caespitose.
- 20a. Plants medium-sized; lamina less than 1.5 m; costae glabrous ..... 18. *D. medogense*
- 20b. Plants large; lamina more than 3 m; costae often prickly and rough ..... 19. *D. sikkimense*
- 19b. Rhizome creeping; fronds sparse.
- 21a. Lamina 3-pinnate, ultimate pinnules pinnatifid ..... 20. *D. muricatum*
- 21b. Lamina 2-pinnate, pinnules pinnatifid.

- 22a. Pinnule lobe entire or subentire ..... 21. *D. doederleinii*
- 22b. Pinnule lobe prominently serrate or shallowly pinnatilobate.
- 23a. Pinnule oblong-lanceolate, middle wider, or lanceolate, base nearly symmetrical; middle and lower pinnule lobes usually shallowly lobed, apex shallowly crenate ..... 22. *D. spectabile*
- 23b. Pinnule usually deltoid-lanceolate, base wider; pinnule lobes slightly subfalcate, oblique, apex subtruncate, margin serrate, not lobed ..... 23. *D. subspectabile*
- 14b. Sori shortly oblong, narrowly elliptic, shortly or long linear; indusia mostly not vaulted, opening acroscopically.
- 24a. Sori usually broadly oblong, occasionally elliptic or shortly cylindrical; indusia prominently vaulted, easily ruptured.
- 25a. Lamina papery, 2-pinnate; pinnules usually shallowly pinnatilobate to pinnatifid, or only serrate; scales always toothed at margin.
- 26a. Sori supramedial or submarginal, indusia markedly swollen, elliptic or shortly cylindrical ..... 24. *D. conterminum*
- 26b. Sori medial or inframedial, indusia slightly swollen, oblong when mature ..... 25. *D. virescens*
- 25b. Lamina herbaceous, 3-pinnate or 2-pinnate with pinnules pinnatipartite to pinnatisect; lobes of secondary pinnule prominently serrate or pinnate; scales entire.
- 27a. Lamina 2-pinnate; pinnules pinnatipartite; pinnule lobes regularly dentate at margin; sori 2–3 × ca. 1 mm, densely contiguous when mature; perispore with slightly rugate, granular ornamentation ..... 26. *D. multicaudatum*
- 27b. Lamina 3-pinnate or nearly 3-pinnate (pinnules pinnatipartite to pinnatisect, lobes connected with narrow wings); sori mostly ca. 1(–1.5) mm; perispore with aculeate ornamentation.
- 28a. Rhizome creeping; lamina herbaceous or thickly herbaceous, often tall, ca. 2 m, base 3-pinnate; pinnule lobe or secondary pinnule oblong or linear-lanceolate, apex mostly acute to shortly acute, less often rounded ..... 27. *D. prolixum*
- 28b. Rhizome creeping or ascending to erect; lamina herbaceous or thinly herbaceous, usually less than 1 m, sometimes up to 1.5 m, base 3-pinnate, sometimes 2-pinnate; secondary pinnule ovate or oblong, apex rounded or acute.
- 29a. Rhizome ascending to erect; lamina herbaceous, secondary pinnule of lower pinna mostly acuminate at apex, serrate at margin ..... 28. *D. pseudosetigerum*
- 29b. Rhizome creeping to ascending; lamina thinly herbaceous, secondary pinnule rounded at apex, often pinnatifid to pinnatipartite ..... 29. *D. alatum*
- 24b. Sori and indusia shortly or long linear; indusia not vaulted, opening acroscopically, often reflexed under sporangia at maturity.
- 30a. Lamina 1-pinnate, usually lanceolate, broadly lanceolate, or ovate-lanceolate; pinnae entire or pinnatilobate to pinnatipartite.
- 31a. Plants small or medium-sized; lamina oblong, broadly lanceolate, or broadly deltoid-lanceolate, rarely ovate-deltoid or subdeltoid; pinna mostly sickle-shaped, lanceolate at base, asymmetrical, acroscopic base prominently auriculate, margin usually serrate or shallowly lobed.
- 32a. Rhizome slender, creeping; fronds distant.
- 33a. Stipe base with dense, brown, translucent membranous, entire lanceolate scales; upper part to middle of rachis with many black, lanceolate or narrowly lanceolate, entire thick scales; pinnae shallowly lobed (lobes shallowly serrate at margin), rarely slightly deltoid processes; stalks of pinnae except basal pinnae narrowly winged ..... 30. *D. nigrosquamosum*
- 33b. Stipe base with sparse brown, lanceolate, entire, thickly membranous scales.
- 34a. Lamina herbaceous or thinly herbaceous; stipe sparsely scaly; rachis occasionally with black-brown, lanceolate scales; pinnae with shallow deltoid lobes on both sides, lobes shallowly serrate; pinna stalk narrowly winged ..... 31. *D. okudairai*
- 34b. Lamina thickly papery or subleathery; upper part of stipe subglabrous; pinnae double- or single-toothed; pinna stalk wingless ..... 32. *D. wichuriae*
- 32b. Rhizome short, ascending to erect; fronds caespitose.
- 35a. Stipe not more than 1 mm in diam.; middle pinnae less than 3 cm, base (including basal auricle) less than 1 cm wide; pinnae mostly contiguous or imbricate, auricle usually overlapping rachis ..... 33. *D. heterocarpum*
- 35b. Stipe ca. 2 mm in diam.; middle pinnae (3–)5–8(–11) cm, base (1–)1.5–2(–4) cm; pinnae usually approximate but imbricate, auricle not overlapping rachis.
- 36a. Lamina ovate-deltoid or subdeltoid; pinnae pinnatifid to pinnatisect or base nearly pinnate (pinnatisect with 1–3 pairs of ovate lobes, pinna stalk short, narrowly winged) .... 34. *D. dushanense*

- 36b. Lamina broadly oblong-lanceolate; pinnae pinnatilobate or obtusely toothed at margin ..... 35. *D. lobulosum*
- 31b. Plants medium-sized; lamina oblong; pinnae oblong-lanceolate, base symmetrical or nearly symmetrical, exauriculate protuberances acroscopic, mostly pinnatilobate to pinnatisect at margin.
- 37a. Rhizome long creeping; fronds distant.
- 38a. Lamina acuminate at apex; pinnae usually pinnatilobate to pinnatipartite, sometimes repand or serrate, scales glabrous on surface ..... 36. *D. mettenianum*
- 38b. Lamina abruptly narrowed, then acuminate to apex; pinnae dentate at margin, at most shallowly pinnatilobate.
- 39a. Pinnae 10–13 pairs, base rounded; scales linear-lanceolate, superficially shortly hairy ..... 37. *D. hirtisquama*
- 39b. Pinnae 6–8 pairs, base mostly shallowly cordate; scales lanceolate, not hairy ..... 38. *D. yaoshanense*
- 37b. Rhizome ascending to erect, occasionally creeping; fronds caespitose, rarely approximate and sparse.
- 40a. Lamina herbaceous; stipe and rachis densely scaly or persistently scaly; pinnae sessile.
- 41a. Pinnae deeply pinnatilobate or pectinate; pinna lobes regularly crenate at margin ..... 39. *D. hirsutipes*
- 41b. Pinnae shallowly pinnatilobate or incised or broadly toothed; lobes entire or subentire ..... 40. *D. hirtipes*
- 40b. Lamina papery or thickly papery; stipe except base and rachis nearly lacking persistent scales; pinnae stalked.
- 42a. Lamina nearly 1-imparipinnate, terminal pinna subsimilar to and larger than lateral pinnae, base broadened, pinnatipartite with 1 or many ligulate oblong lobes.
- 43a. Base of pinna rounded or cuneate, regularly shallowly crenate at margin ..... 41. *D. changjiangense*
- 43b. Base of pinna cuneate, bidentate at margin ..... 42. *D. wangii*
- 42b. Lamina abruptly or gradually narrowed, acuminate at apex.
- 44a. Lamina acuminate at apex; pinnae pinnatipartite to pinnatisect, lobes densely crenate at margin ..... 43. *D. incomptum*
- 44b. Lamina abruptly narrowed to acuminate apex; pinnae pinnatilobate to pinnatifid or only serrate; pinna lobes entire or slightly shallowly serrate.
- 45a. Pinnae shallowly pinnatilobate or only incised with broadly serrate margin; pinna stalk short, up to 5 mm in basal pinnae.
- 46a. Pinnae broadly oblong-lanceolate, more than 25 × 5 cm, base mostly shallowly cordate; perispore few rugate ..... 44. *D. megaphyllum*
- 46b. Pinnae sickle-shaped, lanceolate, less than 15 × 3 cm, base crenate or nearly so; perispore prominent and with uniform reticulate ornamentation ..... 45. *D. pinnatifidopinnatum*
- 45b. Lower pinnae pinnatifid to pinnatipartite; stalk of basal pinna more than 1 cm.
- 47a. Base of pinna often broad, asymmetrical, broadly crenate, acroscopic and basispic lobes prominently alternate; perispore with thick anastomosing ornamentation ..... 46. *D. jinpingense*
- 47b. Base of pinna slightly narrowed or as wide as middle, symmetrical or nearly symmetrical, cuneate or broadly cuneate, lobes opposite or subopposite; perispore broadly hyaline, few rugate ..... 47. *D. siamense*
- 30b. Lamina of well-grown plants 2-pinnate or base nearly 3-pinnate.
- 48a. Sori and indusia thin, long linear; pinnae, pinnules, and pinnule lobes mostly short and broad, apical pinnae near lamina apex often not pinnatilobate; pinnules and pinnule lobes entire or shallowly crenate; fertile frond 1- or 2-pinnate at base.
- 49a. Veins of pinna and pinnule anastomosing with costal deltoid and subcostal rectangular areoles ..... 48. *D. stenochlamys*
- 49b. Veins not anastomosing, rarely anastomosing with 1 row of costal areoles.
- 50a. Rhizome creeping or ascending; lower pinnae broadly lanceolate; pinnules and pinnule lobes incised or crenate; veinlets usually simple, occasionally basal veinlets united to form areoles ..... 49. *D. matthewii*
- 50b. Rhizome short, erect; lower pinnae oblong or narrowly lanceolate; pinnules and pinnule lobes entire; veinlets mostly forked ..... 50. *D. metcalfei*
- 48b. Sori and indusia shortly linear or linear-oblong; pinnules and pinnae near lamina apex pinnatipartite or pinnatilobate, at least dentate on all margins.
- 51a. Lamina ovate, usually 2-pinnate; pinnules and pinnule lobes mostly rounded or acute-ovate or narrowly ovate at apex, sometimes pinnules of lower pinnae ovate or broadly deltoid-lanceolate, rarely linear-lanceolate; if lamina 1-pinnate then lobes oblong or ovate-oblong.

- 52a. Fertile fronds 1- or 2-pinnate at base; scales entire ..... 51. *D. baishanzuense*
- 52b. Lamina 2-pinnate.
- 53a. Rhizome usually ascending to erect, rarely also creeping; pinnules pinnatipartite to pinnatifid; scales toothed at margin.
- 54a. Base of pinnule prominently asymmetrical, auriculate on acroscopic side, cuneate and slightly decurrent to rachis on basispic side; stipe base with sparse broadly lanceolate scales, upper part of stipe and rachis without persistent scales ..... 52. *D. kansuense*
- 54b. Base of pinnule symmetrical or nearly symmetrical, not auriculate, not decurrent to rachis; stipe and rachis usually with many persistent lanceolate or broadly lanceolate, black-brown scales ..... 53. *D. squamigerum*
- 53b. Rhizome creeping; pinnule pinnatipartite to pinnatisect.
- 55a. Pinnules of lower pinnae linear-lanceolate, less than 1.5 cm wide, sessile or subsessile; scales broadly lanceolate, sparsely thinly toothed at margin ..... 54. *D. sibiricum*
- 55b. Pinnules of lower pinnae ovate or deltoid-lanceolate, 2.5–3.5 cm wide, prominently stalked, up to ca. 5 mm; scales linear-lanceolate, entire ..... 55. *D. leptophyllum*
- 51b. Pinnules often lanceolate, acuminate or long acuminate at apex; plants robust and tall.
- 56a. Lamina papery, thickly papery, or subleathery, shiny; pinnules usually pinnatilobate to pinnatifid, or margin shallowly serrate or entire, rarely pinnatifid.
- 57a. Pinnules and subapical pinnae entire ..... 56. *D. glingense*
- 57b. Pinnules pinnatilobate, at least shallowly incised or serrate at margin.
- 58a. Scales entire; plants medium-sized.
- 59a. Lamina 1-pinnate with pinnae pinnatifid to pinnatipartite, or nearly 2-pinnate, or in lower half 2-pinnate with basal 1 or 2 pairs of pinnules in basal pinnae pinnatipartite to pinnatisect, 1 pinnule or 1 pair in middle pinnae adnate or sessile; stipe brown or brown-green ..... 57. *D. petelotii*
- 59b. Lower half of lamina 2-pinnate; pinnules adnate to cuneate base; stipe gray-stramineous ..... 58. *D. subdilatatum*
- 58b. Scales toothed at margin; plants large or medium-sized.
- 60a. Scales prominently bicolored with black margin.
- 61a. Stipe and rachis quadrangular-cylindrical, square in cross section; perispore with thick anastomosing ornamentation ..... 59. *D. quadrangulatum*
- 61b. Stipe and rachis terete; perispore with non-anastomosing ornamentation.
- 62a. Pinnules lanceolate or ovate-lanceolate, base often asymmetrical, shallowly cordate or broadly cuneate, basispic base broader, sometimes subtruncate ..... 60. *D. dilatatum*
- 62b. Pinnules linear-lanceolate or narrowly elliptic-lanceolate, base rounded or rounded-cuneate, symmetrical or nearly symmetrical ..... 61. *D. uraiense*
- 60b. Scales concolored, margin not black.
- 63a. Plants large; rhizome ascending, up to 5 mm in diam.; stipe and lower half of rachis densely scaly; scales yellow-brown, linear-lanceolate or lanceolate; lamina 2-pinnate, pinnules shortly stalked; sori shortly linear, costular, 1/3–1/2 as long as veinlets ..... 62. *D. forrestii*
- 63b. Plants medium-sized; rhizome creeping, occasionally ascending; scales brown or black-brown; middle and upper parts of stipe glabrous; lamina at most 2-pinnate, pinnules sessile or subsessile; sori linear, not costular, more than 3/4 length of veinlets.
- 64a. Pinnae falcate, lanceolate, asymmetrical with basispic pinnules longer, free pinnules 1 or 2(or 3) pairs, ligulate-oblong or falcately lanceolate, apex obtuse or acute, base truncate or adnate; veinlets usually 2-forked; sori sparse, ca. 3/4 as long as veinlets ..... 63. *D. griffithii*
- 64b. Pinnae broadly lanceolate or lanceolate, mostly not falcate, symmetrical or nearly so; free pinnules 3–5(–8) pairs.
- 65a. Pinnules sickle-shaped lanceolate, pinnatilobate or prominently dentate at margin, veinlets mostly bifurcate; sori broad, shortly linear, dense on pinnular lamina; lamina stiffly papery when dry ..... 64. *D. petrii*
- 65b. Pinnules lanceolate, margin shallowly incised or repand, or entire; veinlets mostly simple; sori sparse, thin; lamina thinly papery when dry ..... 65. *D. tibeticum*
- 56b. Lamina mostly herbaceous, not shiny; pinnules mostly pinnatifid to pinnatipartite, pinnule lobes mostly contiguous or pectinate.
- 66a. Scales on rhizome apex and stipe base adpressed, or stipe not scaly.

- 67a. Pinnules pinnatilobate to pinnatifid, symmetrical or nearly symmetrical; sori as long as veinlets; stipe and lower part of rachis often with fleshy green aculeate or verrucose processes ..... 66. *D. simile*
- 67b. Pinnules pinnatipartite to costa, asymmetrical, basal basiscopic lobes often large and pinnate; sori reaching to 2/3 of veinlet length; stipe and rachis glabrous.
- 68a. Evergreen; rhizome often ascending to erect, up to 40 cm tall, ca. 10 cm in diam., also creeping; lamina thickly herbaceous; pinnules sessile or slightly shortly stalked; perispore prominent, hyaline, with granular ornamentation ..... 67. *D. laxifrons*
- 68b. Summer green; rhizome creeping; lamina thinly herbaceous; pinnules mostly long stalked, up to ca. 4 mm; perispore surface with dense aculeate ornamentation ..... 68. *D. taquetii*
- 66b. Scales on rhizome apex and stipe base loose.
- 69a. Stipe and rachis or at least rachis with prominent prickly protuberances.
- 70a. Stipe glabrous, rachis with thin prickly processes; base of stipe ca. 7 mm in diam., sparsely scaly; scales ovate-lanceolate, rusty membranous; pinnule lobes separate, connected to narrow wings, margin shallowly pinnatilobate or prominently dentate ... 69. *D. amamianum*
- 70b. Stipe and rachis prickly; base of stipe 1.5–2 cm in diam., densely scaly; scales linear or linear-lanceolate, light brown, bicolored, with narrow black margin, up to 2 cm, membranous ..... 70. *D. asperum*
- 69b. Stipe and rachis not spiny, often smooth, sometimes with sparsely verrucose protuberances or green fleshy aculeate protuberances.
- 71a. Scales entire.
- 72a. Rhizome erect, with stiff, black-brown roots; stipe brown; pinnule lobes broadly oblong or rectangular ..... 71. *D. viridescens*
- 72b. Rhizome creeping, roots not stiff.
- 73a. Scales broadly lanceolate, cells of central part of scale wider than those of marginal part; spores globose ..... 72. *D. jinfoshanicola*
- 73b. Scales lanceolate or linear-lanceolate, cells of central part of scale as narrow as those of marginal part; spores reniform or elliptic.
- 74a. Basal part of lamina nearly 3-pinnate with pinnules pinnatisect to costules; scales lanceolate, membranous; sori slender, shortly linear; perispore with aculeate processes ..... 73. *D. chinense*
- 74b. Lamina 2-pinnate with pinnules pinnatilobate or pinnatipartite; scales thickly membranous; sori thick, shortly linear; perispore without aculeate processes.
- 75a. Lamina thickly herbaceous; scales lanceolate; pinnules shallowly pinnatilobate or pinnatipartite 1/2 to base; apex of pinnule lobe falcate, truncate or rounded-truncate; perispore with many verrucose projections ..... 74. *D. hachijoense*
- 75b. Lamina herbaceous; scales linear-lanceolate; pinnules pinnatipartite 1/2 or more to base; apex of pinnule lobe not falcate, rounded or rounded-truncate; perispore with few verrucose projections ..... 75. *D. wheeleri*
- 71b. Scales toothed at margin.
- 76a. Scales concolored, margin not black ..... 76. *D. nipponicum*
- 76b. Scales ± bicolored, with black narrow margin conspicuous or inconspicuous.
- 77a. Stipe, rachis, and costa dark brown, with dingy glandular hairs; sori shortly linear, inframedial from base upward to half of veinlets; huge plants with erect rhizomes ca. 70 cm tall, ca. 20 cm in diam. .... 77. *D. axillare*
- 77b. Stipe (except base), rachis, and costa stramineous or green-stramineous, without dingy glandular hairs; sori mostly medial or inframedial from base to more than 2/3 of veinlet margin, or nearly as long as veinlet.
- 78a. Rhizome usually ascending or erect, rarely creeping.
- 79a. Sori oblong, medial ..... 78. *D. kappanense*
- 79b. Sori linear, mostly from base or near base to more than 2/3 of veinlet length, few sori short, brown, medial.
- 80a. Stipe and rachis with sparse, fleshy, green, aculeate, verrucose processes; rhizome variable, erect, creeping; lamina thinly papery ..... 79. *D. nanchuanicum*
- 80b. Stipe and rachis glabrous; lamina herbaceous.
- 81a. Rhizome creeping to ascending; scales brown, lanceolate; pinnules broadly lanceolate or lanceolate, base asymmetrical, basal acrosopic pinnule lobes usually small; lamina abaxially with sparse light brown scales, without glands ..... 80. *D. calogrammoides*

- 81b. Rhizome ascending to erect; scales mostly dark brown, linear-lanceolate, apex filiform or caudate; pinnules mostly deltoid-lanceolate, few lanceolate, symmetrical; costule and midrib with light brown or gray-white thin glands, rachis and costae abaxially with sparse linear, small scales ..... 81. *D. viridissimum*
- 78b. Rhizome creeping.
- 82a. Costa and costule abaxially with prominent green fleshy aculeate processes; sori mostly as long as veinlets; black margin of scales incomplete ..... 82. *D. calogrammum*
- 82b. Costa and costule without green fleshy aculeate processes.
- 83a. Lamina thickly papery; pinnules broadly lanceolate or oblong-lanceolate; pinnule lobes of lower pinnae (at least those of lower pinnules) acute at apex, only pinnule lobes of upper pinnae or lobes of upper pinnules of middle or lower pinnae rounded at apex ..... 83. *D. succulentum*
- 83b. Lamina herbaceous or thinly herbaceous; pinnule lobes rounded or truncate at apex.
- 84a. Evergreen; pinnules mostly broadly deltoid-lanceolate, upper pinnules rarely lanceolate; sori thin, long, mostly as long as veinlets; stipe usually with sparse verrucose processes and slightly rough ..... 84. *D. maximum*
- 84b. Summer-green; pinnules broadly lanceolate or oblong-lanceolate; sori mostly shortly linear, from base upward to 2/3 of veinlet length, distal part of lobes not soriferous; stipe without verrucose processes, smooth.
- 85a. Pinnules lanceolate or oblong-lanceolate, glandular; sori elongate, from base to more than 2/3 of veinlet length ..... 85. *D. giganteum*
- 85b. Pinnules oblong-lanceolate, glabrous; sori shortly linear, medial-inframedial ..... 86. *D. latipinnulum*

**1. *Diplazium esculentum*** (Retzius) Swartz, J. Bot. (Schrader) 1801(2): 312. 1803.

食用双盖蕨 shi yong shuang gai jue

Rhizome erect, up to 15 cm tall, densely scaly; scales brown, narrowly lanceolate, ca. 10 × 1 mm, thin, toothed at margin; fronds caespitose. Fertile fronds 60–120 cm; stipe brown-stramineous, 50–60 cm, 3–5 mm in diam. at base, sparsely scaly, upward glabrous or hairy; lamina 1-pinnate or 2-pinnate, deltoid or broadly lanceolate, 60–80 cm or longer, 30–60 cm wide, apex acuminate; pinnae 12–16 pairs, alternate, ascending, lower pinnae stipitate, broadly lanceolate, 16–20 × 6–9 cm, pinnatifidate or 1-pinnate; upper pinnae sessile, linear-lanceolate, 6–10 × 1–2 cm, base truncate, margin serrate or pinnatifidate (lobes minutely serrate), apex acuminate; veins per lobes pinnate, veinlets 8–10 pairs, ascending, lower 2 or 3 pairs usually conjoined. Lamina stiffly herbaceous, glabrous or hairy, rachis glabrous or hairy; costae shallowly grooved, glabrous or occasionally with light brown short hairs. Sori mostly linear, slightly curved, from near midribs to laminar margin; indusia yellow-brown, linear, membranous, entire. Spore surface with large granular or tuberculate projections.  $2n = 82$ .

Valley forests, beside brooks or streamlets; 100–1200 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [tropical Asia, subtropical and tropical Polynesia].

- 1a. Rachis and costae not hairy ..... 1a. var. *esculentum*  
 1b. Rachis and costae with dense rust-yellow soft hairs on adaxial side ..... 1b. var. *pubescens*

**1a. *Diplazium esculentum* var. *esculentum***

食用双盖蕨(原变种) shi yong shuang gai jue (yuan bian zhong)

*Hemionitis esculenta* Retzius, Observ. Bot. 6: 38. 1791; *Anisogonium esculentum* (Retzius) C. Presl; *Asplenium ambiguum* Swartz; *Athyrium ambiguum* (Swartz) Milde; *A. esculentum* (Retzius) Copeland; *Callipteris ambigua* (Swartz) T. Moore; *C. esculenta* (Retzius) J. Smith ex T. Moore & Houlston; *Digrammaria ambigua* (Swartz) C. Presl; *Diplazium ambiguum* (Swartz) Hooker (1857), not Raddi (1819); *Microstegia ambigua* (Swartz) C. Presl; *M. esculenta* (Retzius) C. Presl.

Rachis and costae not hairy.

Valley forests, beside brooks; 100–1200 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [tropical Asia, subtropical and tropical Polynesia].

The young frond is edible.

**1b. *Diplazium esculentum* var. *pubescens*** (Link) Tardieu & C. Christensen, Fl. Gén. Indo-Chine 7(2): 270. 1940.

毛轴食用双盖蕨 mao zhou shi yong shuang gai jue

*Diplazium pubescens* Link, Hort. Berol. 2: 72. 1833; *Callipteris esculenta* var. *pubescens* (Link) Ching.

Rachis and pinnae with dense rust-yellow soft short hairs on adaxial side.

Forests beside streamlets; 200–900 m. Guizhou, Hainan, Jiangxi, Sichuan, Xizang, Yunnan, Zhejiang [India, Myanmar, Vietnam].

The young frond is edible.

**2. Diplazium paradoxum** Fée, Mém. Foug. 5: 214. 1852.

刺轴双盖蕨 ci zhou shuang gai jue

*Anisogonium smithianum* (Baker) Beddome; *Asplenium smithianum* Baker; *Callipteris paradoxa* (Fée) T. Moore; *C. smithiana* (Baker) Beddome.

Rhizome ascending. Fertile fronds over 1 m; stipe dark stramineous, 30–40 cm, ca. 6 mm in diam., with slightly aculeate protuberances, slightly scaly to base, all with sparse soft hairs when young, then glabrous; scales brown, narrowly lanceolate, up to 1 cm, margin serrate; lamina lower part 2-pinnate, upper part 1-pinnate, deltoid-ovate, 50–70 × ca. 40 cm at base; pinnae ca. 10 pairs, alternate, ascending, lower pinnae with stalk ca. 1.2 cm; basal pinnae sessile, large, oblong-lanceolate or lanceolate, expanded, 4–6 × 1–1.5 cm, base symmetrical, broadly cuneate or subtruncate, margin subentire or repand, crenate, serrate to apex, apex shortly acuminate; veins abaxially prominent, 4 or 5 pairs per lobe, ascending, basal 1 or 2 pairs anastomosing with tip-deltoid aperture. Lamina herbaceous, both surfaces without hairs; rachis and costa adaxially with dense aculeate protuberances. Sori linear, 3 or 4 pairs per lobe, basal line abaxial, often paired on 1 vein; indusia brown, linear, membranous, persistent.

Dense on wet sandy riverbanks. Guangdong, Hainan [Sri Lanka].

**3. Diplazium pullingeri** (Baker) J. Smith, Ferns Brit. For., ed. 2, 315. 1877.

毛轴双盖蕨 mao zhou shuang gai jue

Rhizome shortly erect or decumbent, glabrous, or apex with sparse, dark brown scales; fronds caespitose; stipe brown at base, upper part and rachis light brown, densely hairy, hairs shiny, curly long nodose, shallowly grooved on adaxial side, rounded abaxially; lamina elliptic or narrowly elliptic, base slightly narrowed; pinnae approximate, alternate or opposite, sickle-shaped, lanceolate, base sessile, asymmetrical, acroscopic base deltoid-auriculate, or rounded-obtuse, basiscopic base rounded, margin entire or repand, sometimes serrate, apex acuminate, acute, rounded, or obtuse; suprasedial pinnae spreading, lower pinnae reflexed, shortened, basal pinnae sometimes ca. 1/2 of middle pinnae, occasionally not reduced; veins prominent on both surfaces of lamina, midrib densely hairy on abaxial surface of lamina, hairs nodose, sparsely hairy or glabrous on abaxial surface. Sori and indusia mostly long linear, up to more than 2/3 or on entire length of veinlet, or shorter; indusial surface ± with long nodose hairs.

At foot of cliffs, on wet rocks, evergreen broad-leaved forests, mountain ridges; 400–1600 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, Vietnam].

- 1a. Pinna apex acuminate, acroscopic basal auricles of pinnae deltoid ..... 3a. var. *pullingeri*  
 1b. Pinna apex acute or rounded, acroscopic basal auricles of pinnae rounded-obtuse ..... 3b. var. *daweishanicola*

**3a. Diplazium pullingeri** var. *pullingeri*

毛轴双盖蕨(原变种) mao zhou shuang gai jue (yuan bian zhong)

*Asplenium pullingeri* Baker, Gard. Chron., n.s., 4: 484. 1875; *A. bireme* C. H. Wright; *A. chlorophyllum* Baker; *A. hancockii* Maximowicz; *A. lepidorachis* C. Christensen; *Athyrium pullingeri* (Baker) Copeland; *Diplazium chlorophyllum* (Baker) Beddome; *D. crenatoserratum* T. Moore var. *hirta* Rosenstock; *D. hancockii* (Maximowicz) Hayata; *D. pullingeri* f. *intermedia* Wu; *Monomelangium hancockii* (Maximowicz) Hayata; *M. pullingeri* (Baker) Tagawa.

Stipe 10–20 cm; lamina elliptic or narrowly elliptic, up to 45 × 20 cm, base slightly reduced; free pinnae up to 15 pairs, up to 12 × 1.7 cm, base sessile, asymmetrical, acroscopic auricles deltoid, basiscopic base rounded, both sides entire or repand, sometimes crenate, apex acuminate. Spores orbicular in equatorial view, in SEM image perispore with dense, filiform, multi-tiered, anastomosing villous projections.

At foot of cliffs, on wet rocks in evergreen broad-leaved forests; 400–1600 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, Vietnam].

**3b. Diplazium pullingeri** var. *daweishanicola* (W. M. Chu & Z. R. He) Z. R. He, **comb. nov.**

大围山毛轴双盖蕨 da wei shan mao zhou shuang gai jue

Basionym: *Monomelangium pullingeri* var. *daweishanicola* W. M. Chu & Z. R. He, Acta Phytotax. Sin. 36: 375. 1998 [“*daweishanicolum*”].

Lamina narrowly elliptic; pinnae short, falcate, lanceolate or obliquely ovate, apex acute or rounded; acroscopic auricles obtuse. Perispore with multitiered anastomosing filiform ornamentation and irregular shallow rugae and thin apertures.

• Mountain ridges, at foot of cliffs, evergreen broad-leaved forests; ca. 1600 m. Yunnan.

**4. Diplazium dinghushanicum** (Ching & S. H. Wu) Z. R. He, **comb. nov.**

鼎湖山毛轴双盖蕨 ding hu shan mao zhou shuang gai jue

Basionym: *Monomelangium dinghushanicum* Ching & S. H. Wu, Acta Bot. Austro Sin. 2: 5. 1986.

Rhizome short, erect; fronds caespitose. Fertile frond 15–25 cm; stipe 4–5 cm, ca. 1 mm in diam.; rachis with dense long nodose soft hairs, pinnae subglabrous on both surfaces; lamina pinnatilobate, lanceolate, 14–16 × 3–5 cm, apex acute; pinnae 16–18 pairs, basal pinnae opposite, upper pinnae alternate, basal 2 pairs reduced, 5–10 mm; middle pinnae falcate, lanceolate or elliptic, 1.5–2.5 cm × 7–10 mm, acroscopic base auriculate, crenate at margin or pinnatilobate to serrate, apex acute; veins prominent, veinlets bifurcate (or trifurcate), pinnate in auricles. Lamina thinly membranous when dry, light brown; rachis densely hairy, hairs nodose, long, soft; pinnae glabrous on both surfaces. Sori shortly linear, indusia glabrous. Spores semi-circular in equatorial view, perispore surface rugate or sparsely reticulate with granules in areoles.

• Valley forests; 700–900 m. Guangdong.

**5. Diplazium crassiusculum** Ching, Lingnan Sci. J. 15: 279. 1936.

厚叶双盖蕨 hou ye shuang gai jue

*Athyrium crassiusculum* (Ching) T. J. Liu; *Diplazium crassiusculum* f. *simplex* Ching; *D. donianum* (Mettenius) Tardieu var. *biserrulatum* Tardieu.

Rhizome erect or oblique, black-brown, woody, stiff, apex with dense scales; scales dark black, glossy, lanceolate, thick, small serrate at margin; fronds caespitose, 1-pinnate fertile frond more than 1 m; stipe black at base, upward gray-stramineous, 40–60 cm, 3–5 mm in diam., base like rhizome, densely scaly, upward glabrous, grooved on abaxial side; lamina 1-imparipinnate, elliptic, 30–50 × 16–24 cm; lateral pinnae often 2–4 pairs, all subequal in size, alternate or basal pinnae subopposite, oblique, shortly stalked (stalk of basal pinnae 6–8 mm), narrowly elliptic, narrowly ovate-lanceolate, or broadly linear-lanceolate, 16–23 cm, middle 3.5–4.4 cm wide, base rounded-cuneate, margin in lower part of pinna often subentire or slightly repand, from middle to apex thin, serrate, apex long acuminate; apical pinna similar to lateral pinnae or nearly so, base often asymmetrical; costae prominent, rounded, occasionally with brown linear small scales on abaxial side, shallowly grooved on adaxial side; veinlets all prominent, slightly oblique, 3 or 4 per veinlet group, thin, reaching laminar margin. Lamina firmly herbaceous, brown-green when dry. Sori and indusia long linear, often single on acroscopic veinlets of each veinlet group, oblique, from costa to ca. 5 mm inside margin.

Evergreen broad-leaved forests and shrubs; 200–1700 m. Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, N Taiwan, Zhejiang (Taishun) [Japan].

Fertile fronds of young plants of *Diplazium crassiusculum* are sometimes simple, elliptic-lanceolate with cordiform, slightly asymmetrical bases, or 1-pinnate with only 2 or 3 pinnae.

**6. *Diplazium pinfaense*** Ching, *Lingnan Sci. J.* 15: 279. 1936 [*“pin-faense”*].

薄叶双盖蕨 bao ye shuang gai jue

*Athyrium pinfaense* (Ching) Ohwi.

Rhizome oblique or erect, dark brown, with dense fleshy thick roots, apex with brown, lanceolate, entire scales; fronds caespitose. Fertile frond ca. 65 cm, stipe brown at base, upward green-stramineous, ca. 30 cm, ca. 2 mm in diam., base with dense scales similar to scales on rhizome, upward glabrous, grooved on adaxial side; rachis stramineous or green-stramineous, slightly glossy, shallowly grooved on adaxial side; lamina 1-imparipinnate, ovate, ca. 34 × 22 cm, base rounded-cuneate; lateral pinnae 2 or 3 pairs, oblique, subfalcate, lanceolate, base mostly nearly symmetrical, rounded-cuneate, whole margin serrate or biserrate, sometimes slightly pinnatilobate, apex long acuminate; basal pinnae asymmetrical, acroscopic base rounded, basicopic base cuneate, shortly stalked, upper pinnae sessile or slightly adnate; apical pinna lanceolate, similar to lateral pinnae, base often asymmetrical, broadly cuneate; costae rounded and swollen on abaxial side, shallowly grooved on adaxial side; veinlets prominent on both surfaces, oblique, 2–4 times forked, 6 per vein group, thin, reaching teeth of lamina margin. Lamina herbaceous, grass-green when dry, glabrous. Sori and indusia long linear, slightly curved, not on all veinlets, often borne on acroscopic veinlets, mostly single, sometimes double, catadromous veinlets sometimes fertile with sori short.

Spores semicircular in equatorial view, perispore hyaline, with sometimes aculeate projections.

Chongqing, Fujian, Guangxi, Guizhou, Hunan (Jishou), Jiangxi (Anyuan), Sichuan (Emei Shan), Yunnan (Maguan), Zhejiang (Longquan) [Japan].

**7. *Diplazium hainanense*** Ching, *Bull. Fan Mem. Inst. Biol.* 2: 206. 1931.

海南双盖蕨 hai nan shuang gai jue

*Diplazium platylepis* Ching.

Rhizome creeping or oblique, apex densely scaly; scales black, glossy, ovate-lanceolate, thickly membranous, subserrate at margin; fronds caespitose. Fertile frond ca. 1.6 m; stipe black at base, upward dark stramineous, ca. 90 cm, ca. 7 mm in diam., base sparsely scaly, upward glabrous; rachis brown-stramineous, glabrous; lamina ovate or elliptic, ca. 70 × 30 cm; lateral pinnae 2–8 pairs, oblique, shortly stalked or upper pinnae sessile, elliptic-lanceolate or ovate-lanceolate, ca. 32 × 7 cm, gradually narrowed at apex, base rounded-cuneate, slightly asymmetrical, entire at margin, slightly incurved; apical pinna similar to lateral pinnae; costae raised, rounded on abaxial side, shallowly grooved on adaxial side; veinlets slightly visible, oblique or slightly so, 3(or 4) per veinlet group, thin, subspreading, reaching margin. Lamina subleathery, green when dry. Sori and indusia long linear, mostly double, occasionally double on catadromous veinlets, but short.

Evergreen broad-leaved forests, beside streamlets; ca. 1200 m. Hainan [Vietnam].

**8. *Diplazium maonense*** Ching, *Hong Kong Naturalist* 7: 88. 1936.

马鞍山双盖蕨 ma an shan shuang gai jue

*Asplenium bantamense* Baker.

Rhizome creeping, black-brown, with black-brown, thin, marginally thick, dentate scales; fronds approximate. Fertile frond more than 1 m; stipe stramineous, 15–40 cm, stiff, grooved adaxially, base like rhizome, scaly, glabrous; lamina 1-imparipinnate, ovate or ovate-elliptic, 10–50 × 8–15 cm; lateral pinnae 3–6 pairs, all equal in size, alternate or subopposite, oblique, shortly stalked, narrowly elliptic or ovate-lanceolate, ca. 18 × 4 cm, base rounded or rounded-cuneate, margin regularly thickly crenate (crenations ca. 1.5 mm tall) or repand throughout, apex acuminate; apical pinna similar to lateral pinnae, but often with 1 or 2 auricles at base, upper pinnae nearly pinnatifid; costae raised, rounded abaxially, shallowly grooved adaxially; veinlets prominent on both sides of pinnae, subspreading; veins nearly pinnate into 6 thin veinlets, reaching laminar margin. Lamina subleathery, brown-green when dry, glabrous on both surfaces. Sori and indusia linear, mostly double, occasionally single, subspreading, on 3 or 4 veinlets per group, usually on 2 basal veinlets.

• Broad-leaved forests; below 100–300 m. Fujian (Changle), Guangdong (Fanyu, Hong Kong), N Taiwan (Jilong, Taibei).

**9. *Diplazium serratifolium*** Ching, *Acta Phytotax. Sin.* 8: 166. 1959.

锯齿双盖蕨 ju chi shuang gai jue

*Diplazium saposhanense* Ching.

Rhizome erect, black, 4–5 cm tall, robust, woody, stiff, with dense stiff, long, thick roots, apex densely scaly; scales black, lanceolate, 2–3 × ca. 0.4 mm at base, thick, small serrate at margin; fronds caespitose. Fertile frond ca. 75 cm; stipe black-brown at base, upward stramineous or green-stramineous, 30–45 cm, 2.5–3 cm in diam., stiff, base with sparse scales, upward glabrous, shallowly grooved adaxially; rachis stramineous, glabrous; lamina 1-imparipinnate, elliptic, 30–40 × 10–20 cm; lateral pinnae 1–5 pairs, equal in size, lower pinnae opposite or subopposite, with stalk 0.3–1 cm; upper pinnae mostly alternate, sessile, oblique, elliptic-lanceolate, 11–18 × 2.2–4 cm, base broadly cuneate, symmetrical or asymmetrical, base of apical pinna usually narrowed, pinna margin shallowly serrate or shallowly repand throughout, incurved when dry, gradually narrowed to long acuminate at apex, slightly subfalcate; costae raised, rounded, shallowly grooved on adaxial side; veinlets prominent on both surfaces or visible on adaxial side, oblique, 3 or 4 per veinlet group, thin, reaching margin of lamina. Lamina thinly papery when dry, green or brown-green. Sori long or shortly linear, variable in length, oblique, from costa to pinna margin, on 2 or 3 veinlets per veinlet group, sori on acroscopic veinlet longest, all double, other sori short, single, not reaching vein endings.

Tropical rain forests, beside streamlets; 100–900 m. Guangxi, Hainan, Yunnan [Vietnam (Shaba)].

The fertile fronds of *Diplazium serratifolium* sometimes only have 3 pinnae, so attention to this is needed for proper identification.

**10. *Diplazium basahense*** Ching, Acta Phytotax. Sin. 9: 351. 1964.

白沙双盖蕨 bai sha shuang gai jue

Rhizome erect, apex with dense scales; scales brown, lanceolate, small, thinly serrate at margin; fronds caespitose. Fertile frond ca. 60 cm; stipe pale brown, stramineous, shiny, ca. 30 cm, ca. 3 mm in diam.; rachis pale brown-stramineous, shallowly broadly grooved adaxially; lamina 1-imparipinnate, elliptic, ca. 30 × 18 cm; pinnae often 4 pairs, subequal in size, alternate, 4–5 cm apart, oblique, stalked (stalk ca. 3 mm), narrowly lanceolate, 11–13 × 2–2.4 cm, base broadly cuneate, margin entire or weakly densely serrate above middle, apex acuminate to caudate, incurved when dry; costae raised, rounded abaxially, shallowly grooved adaxially; veinlets prominent on adaxial side, inconspicuous on abaxial side, oblique, 3 or 4 per veinlet group, thin, spreading, parallel, reaching pinna margin. Lamina thick, papery, green when dry. Sori and indusia long linear, oblique, 1 or 2 in each veinlet group, sori on acroscopic veinlet usually longer, double, other sori single.

• Dense forests; ca. 900 m. Hainan (Qiongzong, Wuzhi Shan).

**11. *Diplazium splendens*** Ching, Bull. Fan Mem. Inst. Biol. 2: 205. 1931.

粤北双盖蕨 yue bei shuang gai jue

Rhizome robust, erect, ca. 10 cm tall, with dense fleshy thick roots, apex densely scaly; scales yellow-brown, linear-lanceolate, ca. 12 × 1 mm, membranous, margin black, thin,

toothed; fronds caespitose. Fertile frond more than 1 m; stipe brown at base, upward green-stramineous, robust, ca. 50 cm, ca. 7 mm in diam., base densely scaly like rhizome, upward gradually glabrous, shallowly grooved adaxially; rachis green-stramineous or pale brown-stramineous, with sparse brown or dark brown linear scales, shallowly broadly grooved on adaxial side; lamina 1-imparipinnate, elliptic, more than 80 × 30 cm; lateral pinnae 12 pairs, subequal in size, lower pinnae opposite or subopposite, upper pinnae alternate, oblique, with stalk ca. 5 mm, elliptic-lanceolate, ca. 22 × 5.5 cm, base cuneate, margin entire or repand, margin in distal part of pinna occasionally shallowly crenate, incurved when dry, apex long acuminate, usually subfalcate; base of apical pinna asymmetrical, oblique, occasionally 1 or 2 auriculate or nearly free pinnatilobate; costae prominent, rounded on abaxial side, shallowly grooved on adaxial side, sparsely scaly with scales red-brown linear abaxially; veinlets prominent on both surfaces, oblique, 4 or 5 per veinlet group, thin, reaching margin of lamina. Lamina papery, grass-green or brown-green when dry. Sori and indusia long linear, sori on acroscopic veinlets longest, double, from midrib to near margin of pinna, 1–3 per veinlet group. Spores reniform, perispore hyaline, with some rugate, inconspicuous, granular projections.

Evergreen broad-leaved forests in valleys, beside streamlets; 100–500 m. N Guangdong, Guangxi, S Hunan, SE Yunnan [Vietnam].

The fertile fronds of young plants of *Diplazium splendens* have only 3–5 pinnae.

**12. *Diplazium stenolepis*** Ching, Acta Phytotax. Sin. 9: 352. 1964.

狭鳞双盖蕨 xia lin shuang gai jue

Rhizome erect, black, robust, woody, stiff, apex with dense scales; scales black, linear, 3–8 mm, thickly membranous, margin thin, dentate; fronds caespitose. Fertile frond ca. 1 m; stipe black at base, upward stramineous or pale brown-stramineous, 24–55 cm, ca. 4 mm in diam. at base, base with sparse narrowly lanceolate scales, upward glabrous; rachis stramineous, glabrous; lamina 1-imparipinnate, elliptic, 40–45 × 19–25 cm; pinnae 4 or 5 pairs, equal in size, oblique, stalked (stalk 4–8 mm), lanceolate, 20–25 × 4–4.5 cm, gradually narrowed, acuminate at apex, base cuneate, margin entire or dentate near apex, often incurved when dry; costae raised, rounded abaxially, shallowly grooved adaxially; veinlets prominent abaxially, visible adaxially, oblique or slightly oblique, 3 or 4 per veinlet group, straight, parallel, reaching margin of lamina. Lamina subleathery, dark green or brown-green when dry. Sori and indusia linear, 2 or 3 per veinlet group, brown, longest, double on acroscopic veinlet, basal sori long and close to costa, distal sori shorter.

Dense forests, beside streamlets; ca. 1000 m. S Guangxi, Hainan [N Vietnam].

*Diplazium stenolepis* is similar to *D. hainanense* but differs by the pinnae lanceolate, scales linear, and upper part of stipe and rachis glabrous.

**13. *Diplazium donianum*** (Mettenius) Tardieu, Asplén. Tonkin, 58. 1932.

双盖蕨 shuang gai jue

Rhizome long creeping or creeping to oblique, 3–4(–8) mm in diam., with black, dense, fleshy, robust roots, apex densely scaly; scales brown to dark brown, lanceolate, thick, margin toothed; fronds caespitose or approximate. Fertile fronds up to ca. 80 cm; stipe brown-black at base, upward stramineous or brown-yellow-stramineous, 25–50 cm, 2–3 mm in diam., base densely scaly, upward gradually glabrous, grooved abaxially; rachis gray-brown-stramineous, glabrous; lamina 1-imparipinnate, elliptic or ovate-elliptic, 25–40 × 15–25 cm; lateral pinnae usually 2–5 pairs, all equal in size, subopposite or upper pinnae alternate, oblique, basal pinnae with short stalk 2–4 mm, upper pinnae sessile, ovate-lanceolate or elliptic, 10–20 × 3–5 cm, long acuminate at apex, often spreading or slightly subfalcate, base rounded-cuneate or subrounded, margin entire, repand, or lobed, apex serrate or crenate, incurved when dry; costae raised, rounded abaxially, shallowly grooved on adaxial side; veinlets 3–5 per group, straight. Lamina leathery or thickly papery, gray-green or brown-green when dry. Sori and indusia long linear, oblique or slightly oblique, often from midrib to laminar margin, on all veinlets, single or double. Spores semicircular in equatorial view, perispore hyaline, wide, with few rugate, not prominent granular projections.

Evergreen broad-leaved forests, beside streamlets; 100–1600 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan [Bhutan, N India, Japan, Myanmar, Nepal, Vietnam].

- 1a. Terminal pinna lobed at base ..... 13c. var. *lobatum*  
 1b. Terminal pinna simple, similar  
 to lateral pinnae.  
 2a. Veins visible underneath ..... 13a. var. *donianum*  
 2b. Veins inconspicuous  
 underneath ..... 13b. var. *aphanoneuron*

### 13a. *Diplazium donianum* var. *donianum*

双盖蕨(原变种) *shuang gai jue* (yuan bian zhong)

*Asplenium donianum* Mettenius, Abh. Senckenberg. Naturf. Ges. 3: 177, n. 198b. 1859; *A. bantamense* Baker, p.p.

Veins visible underneath; simple terminal pinna similar to lateral pinnae.  $2n = 328 (8x)$ .

Evergreen broad-leaved forests, beside streamlets; 100–1600 m. Anhui (Shexian), Fujian, Guangdong, Guangxi, Guizhou (Libo, Sandu), Hainan, Taiwan, Yunnan [Bhutan, N India, Japan, Myanmar, Nepal, Vietnam].

**13b. *Diplazium donianum* var. *aphanoneuron*** (Ohwi) Tagawa, Acta Phytotax. Geobot. 20: 215. 1962.

隐脉双盖蕨 *yin mai shuang gai jue*

*Diplazium aphanoneuron* Ohwi, J. Jap. Bot. 31: 137. 1956.

Pinnae thick, veins comprising 3(or 4) veinlets inconspicuous underneath, sori usually on acroscopic veinlets of each group.  $2n = 369 (9x)$ .

Broad-leaved forests, forest margins; 300–500 m. Hainan (Diaolu Shan), Taiwan [Japan (Ryukyu Islands, Yakushima)].

**13c. *Diplazium donianum* var. *lobatum*** Tagawa, Acta Phytotax. Geobot. 10: 290. 1941.

顶羽裂双盖蕨 *ding yu lie shuang gai jue*

*Diplazium lobatum* (Tagawa) Tagawa.

Terminal pinna pinnatilobate at base.

Wet areas of dense forests; 100–600 m. Taiwan, Yunnan (Meng-lun, Xishuangbanna) [Japan].

**14. *Diplazium bellum*** (C. B. Clarke) Bir in Mehra & Bir, Res. Bull. Panjab Univ. Sci., n.s., 15: 148. 1964.

美丽双盖蕨 *mei li shuang gai jue*

*Asplenium bellum* C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 496. 1880; *Allantodia bella* (C. B. Clarke) Ching; *Asplenium umbrosum* Schrader var. *bellum* (C. B. Clarke) Hosseus; *Athyrium bellum* (C. B. Clarke) Ching.

Plants evergreen, large. Rhizome ascending to erect, up to 30 cm tall, ca. 5 cm in diam., apex and base of stipe with brown lanceolate scales; scales up to 15 mm, margin entire; fronds caespitose. Fertile fronds longer than 2 m; stipe light brown, up to 1 m, ca. 6 mm in diam., scaly in lower part, rough; lamina bipinnate-pinnatipartite below apex, deltoid, up to 1 m × 70 cm wide at base, apex acuminate and pinnatipartite; pinnae up to 18 pairs, lower pinnae opposite, upper pinnae alternate, spreading; lower pinnae ca. 10 cm apart, oblong-lanceolate, up to 40 × 20 cm, subsessile, base truncate, apex acuminate; pinnules ca. 15 pairs per pinna, spreading, ca. 10 × 2 cm, with stalk ca. 1 mm, base truncate, pinnatipartite, apex long acuminate; pinnule lobes up to 14 pairs per pinnule, slightly oblique, contiguous, slightly falcate, oblong, up to 1.2 × 5 mm, margin regularly shallowly toothed, apex rounded or acute; veins not distinct, pinnate, veinlets 7 or 8 pairs per lobe, 2 per tooth, bifurcate, oblique. Lamina leathery, glabrous on both surfaces; rachis and costae light brown or green-brown, sulcate on adaxial side. Sori 4 or 5 pairs per lobe, near midribs, elliptic, 1–1.5 mm; indusia brown, elliptic, vaulted, thickly membranous, irregularly dehiscent on back surface when mature. Spores brown, elliptic, perispores indistinct, with granular ornamentation.

Valley forests; 1400–2100 m. Yunnan [Bhutan, India, Myanmar].

**15. *Diplazium ovatum*** (W. M. Chu ex Ching & Z. Y. Liu) Z. R. He, **comb. nov.**

卵果双盖蕨 *luan guo shuang gai jue*

Basionym: *Allantodia ovata* W. M. Chu ex Ching & Z. Y. Liu, Bull. Bot. Res., Harbin 4(3): 12. 1984, not *Diplazium cavalerianum* (Christ) M. Kato, Bot. Mag. (Tokyo) 90: 31. 1977 [*Allantodia cavaleriana* Christ, Bull. Acad. Int. Géogr. Bot. 16: 243. 1906]; *Allantodia cavaleriana* (Christ) Ching (1964); *Athyrium cavalerianum* Christ.

Plants medium-sized. Rhizome creeping, ca. 1 cm in diam., apex densely scaly; scales brown, lanceolate, ca. 1 cm, membranous, margin entire; fronds distant to caespitose. Fertile fronds up to 1.1 m; stipe dark brown at base, upward light brown to dark stramineous, up to 50 cm, up to 5 mm in diam., base densely scaly, upward glabrous; lamina 2-pinnate with pinnatipartite pinnules, deltoid, ca. 40 cm, apex acuminate; pinnae 10–15 pairs, mostly opposite or subopposite, shortly stalked, slightly ascending, lower pinnae broadly oblong-lanceolate or

slightly asymmetrical (basiscopic pinnules longer), up to 25 × 13 cm, upper pinnae lanceolate, 3–10 cm × 7–30 mm; pinnules ca. 15 pairs, mostly alternate, spreading, contiguous, sessile or subsessile, lanceolate, up to 7 × 1.8 cm, base broadly cuneate or slightly shallowly cordate, apex acuminate; basal 1 or 2 pairs of pinnules short, sometimes quite short, 1-pinnatifid to 2/3–3/4 to costule; pinnule lobes up to ca. 15 pairs, contiguous, ascending, oblong or rectangular, slightly oblique, margin sparsely serrate or subentire, apex rounded to truncate; veins pinnate, prominent abaxially, veinlets up to 7 pairs per lobe, simple or forked, ascending. Lamina thinly herbaceous when dry, green, glabrous; rachis and costa light brown to dark stramineous, glabrous, shallowly grooved adaxially. Sori elliptic-orbicular, slightly longer than wide, up to 6 pairs, costular; indusia gray, thinly membranous, vaulted when mature, irregularly ruptured at back. Spores bean-shaped, perispore not prominent, with ridge-shaped ornamentation.

Evergreen broad-leaved forests in valleys, beside streamlets; 800–2400 m. Chongqing, Guizhou, Sichuan, Yunnan [Vietnam].

**16. *Diplazium dulongjiangense*** (W. M. Chu) Z. R. He, **comb. nov.**

独龙江双盖蕨 *du long jiang shuang gai jue*

Basionym: *Allantodia dulongjiangensis* W. M. Chu, Acta Bot. Yunnan., Suppl. 5: 38. 1992.

Plants evergreen, medium-sized to large. Rhizome erect, dark brown, up to 3 cm in diam., apex with sparse adpressed scales; fronds caespitose. Fertile fronds up to 1.6 m; stipe dark black at base, upper part (and rachis) light brown or dark stramineous, up to 70 cm, up to 1 cm in diam., with dense scales and light brown, adpressed, uniseriate, thin, nodose hairs when young, then scales and hairs mostly deciduous; scales brown or chestnut-black, shiny, lanceolate or ovate-lanceolate, base deeply cordate, contiguous, attached to stipe and rachis with variably long stalk or stalkless, margin sparsely serrate or irregularly toothed, apex acuminate or abruptly narrowed and caudate; scale stalks dark brown, flat-linear, upper stalks gradually narrowed, mostly persistent, bristlelike after scales deciduous, irregularly adpressed; lamina 2-pinnate with pinnatilobate to pinnatisect pinnules, deltoid, up to 90 × 70 cm, apex acuminate; pinnae up to 18 pairs, alternate, slightly ascending, apex acuminate; lower pinnae broadly oblong-lanceolate, up to 50 × 17 cm, with stalk up to 5 cm; upper pinnae reduced, shortly stalked to sessile, broadly lanceolate to lanceolate, uppermost pinnae only ca. 3 cm × 5 mm; pinnules 15 pairs, alternate, spreading or slightly ascending, lanceolate, oblong-lanceolate, or narrowly ovate, up to 10 × 2 cm, base shallowly cordate or broadly cuneate, usually asymmetrical (basal acroscopic lobe slightly narrow), shortly stalked or sessile, pinnatifid to pinnatisect, apex acuminate or shortly acuminate to acute, sometimes subrounded; pinnule lobes often ca. 10 pairs, sometimes 15 pairs, subspreading, oblong or subrectangular, slightly falcate, margin sparsely shallowly serrate, apex rounded-cuneate; 1 basal basiscopic lobe usually pinnatilobate; veins pinnate, not prominent adaxially, slightly visible adaxially, veinlets ascending, mostly forked, up to 6 pairs per lobe. Lamina herbaceous, rachis and lower part of costa light brown

when dry, upper part of costa stramineous; pinnules light brown, glabrous adaxially; both surfaces of rachis and adaxial surface of costa with sparse scales similar to those on stipe, but stalked scales few; costule abaxially with sparse ovate or broadly ovate-lanceolate, brown or chestnut, shiny, deeply cordate, marginally sparsely irregularly toothed, membranous scales, veins abaxially usually with light brown, thin, nodose hairs. Sori oblong, up to 6 pairs per lobe, densely contiguous, mostly single, basal acroscopic sori double; indusia light brown, entire, membranous, vaulted, opening acroscopically. Spores subreniform, perispore hyaline, projections few, rugate.

• Evergreen broad-leaved forests; 1400–2000 m. NW Yunnan (Gongshan).

*Diplazium dulongjiangense* is one of two species of *Diplazium* with stalked scales; it differs from the similarly scaled *D. kawakamii* in the rhizome erect, stipe and rachis often light brown, lamina with thin pale brown nodose hairs and remaining scales irregularly adpressed, and sori densely contiguous when mature.

**17. *Diplazium kawakamii*** Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30: 435. 1911.

柄鳞双盖蕨 *bing lin shuang gai jue*

*Allantodia kawakamii* (Hayata) Ching; *A. kingpingensis* Ching, not *A. jinpingensis* W. M. Chu; *Athyrium allantocarpum* Rosenstock; *A. kawakamii* (Hayata) C. Christensen.

Plants evergreen, medium-sized to large. Rhizome creeping, dark brown, up to 1 cm in diam., apex with adpressed scales; scales brown or black-brown, broadly ovate, cordate, attached to basal sinus; fronds approximate. Fertile fronds up to 1.7 m; stipe dark stramineous, up to 80 cm, ca. 8 mm in diam., with dense long-stalked scales when young; scales brown or chestnut, shiny, ovate or ovate-cordate, entire or slightly sparsely toothed, attached to stalk with cordate sinus base on apex, deciduous; stalk of scale linear-cylindrical when fresh, slightly flattened after dry, brown, rough hairlike when deciduous, all recurved adpressed on stipe; lamina 2-pinnate with pinnatifid to pinnatisect pinnules, deltoid, up to 90 × 70 cm, apex acuminate; pinnae up to 15 pairs, alternate, ascending, often slightly asymmetrical (basiscopic pinnule longer), apex acuminate; lower pinnae broadly lanceolate, stalked, basal pinnae largest, up to 50 × 20 cm, stipe up to 4 cm, upper pinnae lanceolate, shortly stalked or sessile; pinnules of lower pinna up to 15 pairs, alternate, spreading, oblong-lanceolate, lanceolate, or narrowly ovate to ovate, base broadly cuneate or shallowly cordate on basiscopic side, shortly stalked or sessile, 1-pinnate pinnatifid to pinnatisect or pinnule lobes pinnatifid to pinnatifid, apex long acuminate, acuminate, or acute to rounded; pinnules asymmetrical (middle basiscopic lobes longer) to nearly symmetrical; pinnule lobes up to ca. 10 pairs, alternate, subspreading, oblong, margin sparsely dentate or pinnatifid to pinnatifid, apex rounded; veins not prominent on adaxial side, visible abaxially, 1- or 2-pinnate, veinlets ascending, mostly forked or simple. Lamina herbaceous, pale green abaxially, gray-green when dry, glabrous; rachis, costa, and costule sparsely scaly, scales light brown, lanceolate or ovate-lanceolate, base cordate, membranous. Sori oblong, up to 7 pairs per lobe, mostly single or sometimes double on bas-

al acroscopic veinlets, subcostular-inframedial; indusia light brown, oblong, membranous, entire, vaulted, opening acroscopically or irregularly ruptured on back. Spores subreniform, perispore hyaline, with sometimes few rugate, few granular projections.

Wet evergreen broad-leaved forests, beside streamlets; 1300–2400 m. Taiwan, SE Yunnan [Japan].

*Diplazium kawakamii* shares with *D. dulongjiangense* the long-stalked, deciduous scales on the stipe and rachis.

1a. Stipe with dense long-stalked scales .... 17a. var. *kawakamii*  
1b. Stipe without long-stalked scales

..... 17b. var. *subglabratum*

**17a. *Diplazium kawakamii* var. *kawakamii***

柄鳞双盖蕨(原变种) bing lin shuang gai jue (yuan bian zhong)

Stipe with dense long-stalked scales.

Wet evergreen broad-leaved forests, beside streamlets; 1300–2400 m. Taiwan, SE Yunnan [Japan].

**17b. *Diplazium kawakamii* var. *subglabratum*** Tagawa, J. Jap. Bot. 12: 538. 1936.

花莲双盖蕨 hua lian shuang gai jue

Stipe without long-stalked scales.

• Broad-leaved forests; 1400–2400 m. Taiwan (Hualian).

**18. *Diplazium medogense*** (Ching & S. K. Wu) Fraser-Jenkins, Taxon. Revis. Indian Subcontinental Pteridophytes, 260. 2008.

墨脱双盖蕨 mo tuo shuang gai jue

*Allantodia medogensis* Ching & S. K. Wu, Fl. Xizang. 1: 150. 1983.

Plants evergreen, medium-sized. Rhizome usually ascending to erect, sometimes creeping, erect, up to 20 cm tall, ca. 4 cm in diam.; fronds caespitose. Fertile fronds up to 60 cm; stipe black-brown at base, upward light brown, up to 1 cm in diam. at base, with sparse dark brown, ovate, adpressed scales, upward glabrous or slightly rough, occasionally scaly; lamina 2-pinnate, pinnules pinnatifid to pinnatisect, or nearly 3-pinnate, deltoid, up to 85 × 85 cm, apex acuminate; pinnae up to 15 pairs, alternate or basal pinnae subopposite, slightly ascending, stalked, apex acuminate; lower pinnae deltoid or broadly oblong-lanceolate, up to 45 × 20 cm, with stalk up to 5 cm, often nearly 2-pinnate; upper pinnae gradually shorter, lanceolate; pinnules up to 15 pairs, alternate, broadly oblong-lanceolate or lanceolate, up to 15 × 5 cm, lower pinnules shortly stalked, upper pinnules sessile, base broadly cuneate or subtruncate, pinnatifid to pinnatisect, sometimes base with 1 pair of free pinnule lobes, apex acuminate; costa prominently broadly grooved adaxially; pinnule lobes up to 15 pairs or more, subspreading, narrowly oblong, up to 3 × 1 cm, margin usually dentate, sometimes subentire or shallowly pinnatifid, apex rounded or subtruncate, rarely acute; one basal acroscopic lobe usually smaller; veins pinnate, veinlets forked or pinnate. Lamina thickly papery when dry, light brown-green, dark on adaxial

surface, glabrous on both surfaces; rachis and costa light brown or light stramineous. Sori often 3–6 pairs per lobe, oblong, close to midrib; indusia brown, membranous, vaulted, irregularly ruptured when mature. Spores reniform, perispore prominent and hyaline, wide, not rugate, with some granular projections.

• Evergreen broad-leaved forests; 1300–1900 m. Xizang, Yunnan.

*Diplazium medogense* is similar to *D. spectabile* but differs by the rhizome erect, stipe and rachis yellow-brown when dry, pinnules up to 15 × 5 cm, pinnule lobes sickle-shaped oblong, serrate at margin, not pinnatifid, and sori not contiguous when mature.

**19. *Diplazium sikkimense*** (C. B. Clarke) C. Christensen, Contr. U.S. Natl. Herb. 26: 304. 1931.

锡金双盖蕨 xi jin shuang gai jue

*Asplenium sikkimense* C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 500. 1880; *Allantodia sikkimensis* (C. B. Clarke) Ching; *Diplazium brevicarpium* Ching.

Plants evergreen, large. Rhizome erect, robust, up to 6 cm in diam., with fleshy thick roots; fronds caespitose. Fertile fronds up to 3 m or longer; stipe dark stramineous to light brown, up to 1.5 m, up to 1.4 cm in diam., with sparse brown, broadly ovate, adpressed, peltate scales; lamina 2-pinnate with pinnules pinnatifid, deltoid, up to 1.5 m or longer, base up to 1.5 m wide, apex acuminate; pinnae up to ca. 10 pairs, alternate, ascending, with stalk up to ca. 10 cm, oblong-lanceolate, up to 75 × 23 cm, base truncate, apex acuminate; pinnules up to 17 pairs, subopposite, spreading, subsessile, lanceolate, up to 12 × 3 cm (to base), base truncate, margin pinnatifid to 4/5 to costule, apex acuminate; basal pair of pinnule lobes slightly reduced; pinnule lobes up to 16 pairs, spreading, oblong, up to 1.4 cm × 6 mm, slightly oblique, margin slightly serrate, apex rounded; veins visible adaxially, prominent abaxially, pinnate, veinlets 5–8 pairs per lobe, bifurcate, ascending. Lamina papery, green abaxially, gray-green adaxially when dry, both surfaces glabrous; rachis dark stramineous, costa and costule stramineous or green-stramineous, prickly and scaly abaxially; scales brown, broadly ovate, cordate, adpressed. Sori very short, ovate or oblong, slightly longer than wide, up to 1 mm, up to 6 pairs per pinnule lobe, mostly single, some double; indusia brown, ovate, thickly membranous, vaulted, irregularly ruptured on back. Spores reniform, perispore prominent, subglabrous on surface.  $2n = 82$ .

Rain forests, beside streamlets; 400–1100 m. Yunnan [India (Sikkim), Myanmar].

**20. *Diplazium muricatum*** (Mettenius) Alderwerelt, Malayan Ferns, 829. 1909.

高大双盖蕨 gao da shuang gai jue

*Asplenium muricatum* Mettenius, Ann. Mus. Bot. Lugduno-Batavi 2: 239. 1866; *Allantodia muricata* (Mettenius) W. M. Chu & Z. R. He; *A. procera* (Wallich ex C. B. Clarke) Ching; *A. yaoshanicola* Ching; *Asplenium procerum* Wallich ex C. B. Clarke; *A. umbrosum* Schrader var. *procerum* (Wallich ex C. B. Clarke) Baker; *Athyrium procerum* (Wallich ex C. B.

Clarke) Milde; *Diplazium wangii* Ching (1940), not Ching (1936).

Plants large. Rhizome creeping, black-brown, apex sparsely scaly; scales brown, ovate, thickly membranous, entire, adpressed; fronds distant. Fertile frond up to 2 m or longer; stipe green-stramineous, up to 80 cm, densely scaly; scales similar to those on rhizome, attached by peltate base, some scales borne on stiff, conical, shortly aculeate processes, stipe prickly after scales fallen; lamina 3-pinnate with pinnatifid secondary pinnules, deltoid, up to 1.2 × 1 m, apex acuminate; pinnae up to ca. 10 pairs, alternate or subopposite, ascending, ovate or deltoid, up to 80 × 30 cm, base truncate, with stalk ca. 6 cm, apex acuminate; primary pinnules up to 14 pairs, alternate, subspreading, with stalk up to 3 cm, oblong-lanceolate, up to 25 × 10 cm, base truncate, apex acuminate; secondary pinnules up to ca. 10 pairs, alternate, spreading, lanceolate, up to 6 × 2.5 cm, base broadly cuneate, slightly asymmetrical, shortly stalked, remainder decurrent, pinnatifid, apex usually acute, occasionally acuminate; lobes of secondary pinnules up to ca. 8 pairs, ascending, oblong, up to 1 cm × 4 mm, margin pinnatifid or serrate, sometimes shallowly repand, apex rounded; upper ones subentire; veins pinnate; veinlets forked or simple, rarely trifurcate. Lamina thinly herbaceous or membranous, green when dry, glabrous on both surfaces; rachis and costa stramineous, sparsely prickly abaxially, shallowly grooved adaxially. Sori ovate, 1 per ultimate lobe, usually single, few double; indusia gray, ovate, bullate, thinly membranous, irregularly ruptured on back, disappearing. Spores reniform, perispore hyaline, without rugate, granular ornamentation.

Evergreen broad-leaved forests, beside streamlets; 1000–2600 m. Guangxi, Xizang, Yunnan [India, Myanmar, Nepal].

**21. *Diplazium doederleinii*** (Luerksen) Makino in C. Christensen, *Index Filic.* 231. 1906.

光脚双盖蕨 *guang jiao shuang gai jue*

*Asplenium doederleinii* Luerksen in Engler, *Bot. Jahrb. Syst.* 4: 358. 1883; *Allantodia doederleinii* (Luerksen) Ching; *Asplenium nudicaule* (Copeland) Dunn & Tutcher; *Athyrium doederleinii* (Luerksen) Ohwi; *A. nudicaule* Copeland; *Diplazium aridum* Christ; *D. costalisorum* Hayata; *D. inflatorum* Hayata; *D. morii* Hayata; *D. nudicaule* (Copeland) C. Christensen.

Plants evergreen, medium-sized. Rhizome creeping, dark brown, 1–1.5 cm in diam., apex with sparse adpressed brown scales, elsewhere glabrous; fronds sparse or approximate. Fertile fronds up to 1.7 m; stipe black-brown at base, upward green-stramineous or light brown-stramineous, up to 80 cm, 4–5 mm in diam., base usually with few fleshy processes, upward sparsely scaly along length; scales deciduous, often adpressed, brown, ovate, broadly lanceolate, or lanceolate, membranous, margin sparsely serrate, sometimes prominently black; lamina 2-pinnate with pinnatifid pinnules, deltoid, up to 90 × 60 cm, apex acuminate; pinnae up to ca. 10 pairs, alternate, ascending, lower pinnae broadly oblong-lanceolate, pinnate, stalked, basal 2 pairs largest, up to 40 × 20 cm, with stalk up to 5 cm; pinnules up to ca. 15 pairs, alternate, subspreading, lanceolate or broadly oblong-lanceolate, up to 11 × 3 cm, base

asymmetrical, shallowly cordate or truncate on basiscopic side, broadly cuneate on acroscopic side, shortly stalked, margin pinnatifid to pinnatifid, apex acuminate; pinnule lobes up to ca. 10 pairs, ascending, oblong or suboblong, margin entire or sparsely shallowly crenate, apex rounded or rounded-cuneate; veins visible, pinnate, 7 pairs per pinnule lobe, ascending, forked or simple, occasionally 3- or 4-furcate. Lamina thinly papery or papery when dry, olive-green or brown-green, dark colored adaxially, both surfaces glabrous; rachis and costa green-stramineous, glabrous, grooved adaxially. Sori shortly linear or oblong, 5 pairs per lobe, mostly single, few double, costular; indusia membranous, light brown, vaulted, irregularly ruptured on back. Spores bean-shaped, perispore prominent, few rugate.  $2n = 246$  (apomictic).

Broad-leaved forests in wet valleys; 300–2300 m. Fujian, Guangdong, Guangxi, Guizhou, Hunan, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Vietnam].

**22. *Diplazium spectabile*** (Wallich ex Mettenius) Ching, *Lingnan Sci. J.* 15: 278. 1936.

密果双盖蕨 *mi guo shuang gai jue*

*Asplenium spectabile* Wallich ex Mettenius, *Abh. Senckenberg. Naturf. Ges.* 3: 240 (seors. 196). 1859; *Allantodia spectabilis* (Wallich ex Mettenius) Ching; *Athyrium spectabile* (Wallich ex Mettenius) C. Presl; *Diplazium jerdonii* Beddome.

Plants evergreen, medium-sized. Rhizome creeping, black-brown, ca. 1 mm in diam., apex like base of stipe, slightly scaly; scales brown or black-brown, ovate or ovate-lanceolate, entire, base subpeltate, adpressed, few borne on stiff conical shortly aculeate protuberances; stipe slightly rough when scales fallen; fronds distant or approximate. Fertile fronds up to 1.2 m; stipe black-brown at base, upward stramineous or pale green-stramineous, up to 60 cm, up to 4 mm in diam. at base, upward glabrous; lamina 2-pinnate with pinnatifid pinnules, deltoid, up to 60 × 50 cm, apex acuminate; pinnae up to ca. 12 pairs, mostly alternate, slightly ascending, apex long acuminate; lower pinnae oblong-lanceolate, with stalk up to 3 mm, 1-pinnate; basal pinnae largest, up to 30 × 15 cm; pinnules up to 10 pairs or more, alternate, subspreading; lower pinnules shortly stalked, oblong-lanceolate, lanceolate, or ovate-oblong, up to 9 × 3 cm, base broadly cuneate or shallowly cordate, usually pinnatifid to costa, apex acuminate or rounded; pinnule lobes up to ca. 10 pairs, subspreading, oblong or subrectangular, margin prominently dentate or pinnatifid, apex rounded or truncate; veins pinnate, not prominent, veinlets 8 pairs per lobe, ascending, often forked or simple. Lamina papery or thinly papery when dry; rachis and costa stramineous, with sparse brown ovate scales abaxially, glabrous adaxially. Sori short, sausage-shaped, up to 4 or 5 pairs per pinnule lobe, costular, single or double; indusia brown, membranous, vaulted when mature, often irregularly ruptured on back. Spores subreniform, perispore prominent, projections not rugate, granular.  $2n = 82$ .

Evergreen broad-leaved forests, beside streamlets; 1500–2700 m. Yunnan [Bhutan, India (Sikkim), Nepal].

**23. *Diplazium subspectabile*** (Ching & W. M. Chu) Z. R. He, **comb. nov.**

察隅双盖蕨 *cha yu shuang gai jue*

Basionym: *Allantodia subspectabilis* Ching & W. M. Chu, Fl. Xizang. 1: 148. 1983.

Plants evergreen, medium-sized. Rhizome creeping, black, ca. 1 cm in diam., apex like lower part of stipe, scaly; scales adpressed, black-brown, ovate or ovate-lanceolate, entire, base cordate; fronds approximate. Fertile fronds: lamina 2-pinnate with pinnatifid pinnules, up to 1 m × 45 cm, apex acuminate; pinnae up to ca. 10 pairs, lower pinnae subopposite, upper pinnae alternate, slightly ascending, broadly lanceolate, nearly symmetrical, with stalk up to 2.5 cm, pinnate, apex long acuminate; basal pinnae slightly shortened, second basal pinnae largest, up to 25 × 12 cm; pinnules up to 8 pairs, alternate, subspreading, lanceolate, up to 6 × 2 cm, base broader, symmetrical, subrounded, apex caudate and long acuminate; pinnule lobes up to 10 pairs, ascending, subfalcate, serrate, subtruncate at apex; basal basiscopic lobe larger; veins visible abaxially, not prominent adaxially, veinlets up to 5 pairs per lobe, ascending, usually forked or simple. Lamina papery when dry, dark colored adaxially, glabrous, rachis and costa abaxially with ovate, brown scales. Sori short, sausage-shaped, up to 4 pairs per lobe, costular, mostly single, often double; indusia brown, membranous, vaulted when mature, often irregularly ruptured on back. Spores reniform, perispore wide and hyaline, not rugate, glabrous.

- Hillsides; ca. 2200 m. SE Xizang (Zayü).

**24. *Diplazium conterminum*** Christ, J. Bot. 19: 67. 1905.

边生双盖蕨 *bian sheng shuang gai jue*

*Allantodia allantodioides* (Ching) Ching; *A. contermina* (Christ) Ching; *Diplazium allantodioides* Ching; *D. virescens* Kunze var. *conterminum* (Christ) Sa. Kurata.

Plants medium-sized to large. Rhizome creeping or ascending, black, 1–1.5 cm in diam., up to 5 cm in diam. including remaining stipes, apex and base of stipe densely scaly; scales black or black-brown, slightly shiny, linear-lanceolate to linear, up to 1 cm or longer, thickly membranous, curly at apex, sparsely toothed at margin. Fronds distant to approximate or caespitose; stipe dark brown, green-stramineous, or stramineous at base, 20–100 cm, 2–6 mm in diam., lower part densely scaly, middle and upper part later glabrous; lamina 2-pinnate, deltoid, 30–120 × 25–100 cm, apex acuminate; pinnae 5–10 pairs, alternate, ascending, symmetrical, pinnatifid, lanceolate, 5–10 × 1–3 cm, lower pinnae pinnate; basal pinnae largest, broadly lanceolate to oblong-lanceolate, up to 70 × 33 cm, apex pinnatifid and acuminate; pinnules ca. 13 pairs, alternate, subspreading, slightly separated, nearly symmetrical, lanceolate to oblong, up to 16 × 4 cm, base subcuneate, broadly cuneate, or shallowly cordate, pinnatifid to pinnatifid, apex long acuminate or rounded; basal pinnules slightly shortened, lower pinnules with prominent stalk 3–4 mm; pinnule lobes up to ca. 15 pairs, ascending, oblong, margin shallowly serrate or subentire, apex rounded; veins not prominent on both surfaces or slightly visible abaxially, pinnate; veinlets up to 7 pairs per lobe, usually simple or occasionally forked, ascending. Lamina papery when dry, light green, glabrous adaxially, costules abaxially with sparse light brown linear scales; rachis and costa

green-stramineous or stramineous, glabrous, shallowly grooved adaxially. Sori elliptic, up to 6 pairs per lobe, mostly single, supramedial or inframarginal; indusia gray-white, elliptic or cylindrical, membranous, oblique, vaulted, opening acropically, easily ruptured. Spores subreniform or bean-shaped, perispore not prominent, with short aculeate projections.

Dense valley forests, beside streamlets; 200–1000 m. Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, Thailand, Vietnam].

**25. *Diplazium virescens*** Kunze, Bot. Zeitung (Berlin) 6: 537. 1848.

淡绿双盖蕨 *dan lu shuang gai jue*

Plants evergreen, medium-sized. Rhizome creeping, black, ca. 8 mm in diam., apex densely scaly; scales black-brown, lanceolate, ca. 5 mm, thickly membranous, margin toothed; fronds approximate or distant. Fertile fronds 20–40 cm; stipe 2–4 mm in diam., base black-brown, with sparse black-brown scales remaining, upward stramineous or green-stramineous, glabrous. Lamina deltoid, 30–60 × 25–40 cm, 2-pinnate with pinnatifid to pinnatifid pinnules, apex caudate-acuminate; free pinnae 8–10 pairs, alternate, slightly ascending, symmetrical or nearly symmetrical; lower pinnae broadly deltoid-lanceolate, prominently stalked, apex long acuminate; basal pinnae largest, up to 35 × 20 cm, with stalk ca. 4 cm; upper pinnae gradually shorter, lanceolate, pinnatifid, sessile; pinnules ca. 10 pairs, alternate, spreading, usually lanceolate, sometimes oblong, base wide and asymmetrical (basiscopic lobes large and subcordate, acropical lobes small and truncate), sometimes symmetrical, truncate or broadly cuneate, apex acuminate, sometimes rounded; lower pinnules shortly stalked, ca. 10 × to 3 cm; pinnule lobes mostly less than 10 pairs, subspreading, contiguous, rectangular or oblong, margin serrate or subentire, apex subtruncate or rounded, repand; veins visible abaxially, not prominent adaxially, pinnate; veinlets up to 6 pairs per lobe, simple, forked, or pinnate, ascending. Lamina papery when dry, often green, pale abaxially, glabrous on both surfaces; rachis and costa stramineous or green-stramineous, glabrous, shallowly grooved adaxially. Sori oblong, short and straight, up to 5 pairs per lobe, mostly single or rarely double, medial or subcostular; indusia brown, membranous, opening acropically. Spores reniform or subreniform, perispore thin, aculeate.  $2n = 123$  (apomictic).

Evergreen broad-leaved forests; below 100–1500 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea, Vietnam].

- 1a. Base of pinnules prominently asymmetrical with large basiscopic lobes; veinlets usually forked or pinnate in basiscopic pinnule lobes ..... 25c. var. *sugimotoi*
- 1b. Base of pinnules asymmetrical or sometimes symmetrical; veinlets usually simple, sometimes forked.
  - 2a. Sori on distal veinlets medial ..... 25a. var. *virescens*
  - 2b. Sori on distal veinlets subcostular ..... 25b. var. *okinawaense*

**25a. *Diplazium virescens* var. *virescens***

淡绿双盖蕨(原变种) dan lü shuang gai jue (yuan bian zhong)

*Allantodia virescens* (Kunze) Ching; *Asplenium virescens* (Kunze) Mettenius; *Athyrium virescens* (Kunze) Ohwi; *Diplazium lutchuense* Koidzumi.

Pinnules moderately asymmetrical at base, veinlets simple or sometimes forked; sori medial or suprasedial.

Evergreen broad-leaved forests; below 100–1500 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hubei (Suizhou), Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea, Vietnam].

**25b. *Diplazium virescens* Kunze var. *okinawaense* (Tagawa) Sa. Kurata, J. Geobot. 7: 77. 1958.**

冲绳双盖蕨 chong sheng shuang gai jue

*Diplazium okinawaense* Tagawa, Acta Phytotax. Geobot. 2: 199. 1933; *Allantodia virescens* var. *okinawaensis* (Tagawa) W. M. Chu.

Pinnules with moderately asymmetrical base, veinlets simple or sometimes forked; sori subcostular.

Forests; 400–800 m. Guangdong, Taiwan, Yunnan [Japan].

**25c. *Diplazium virescens* var. *sugimotoi* Sa. Kurata, J. Geobot. 7: 77. 1958.**

异基双盖蕨 yi ji shuang gai jue

*Allantodia virescens* var. *sugimotoi* (Sa. Kurata) W. M. Chu.

Plants robust. Pinnules asymmetrical at base, veinlets forked or pinnate in basicopic pinnule lobes. Perispore ornamentation flakelike and obtuse aculeate.

Evergreen broad-leaved forests in wet valleys; 1200–1500 m. NW Guangdong, Guizhou, Sichuan, Yunnan [Japan (Yakushima)].

**26. *Diplazium multicaudatum* (Wallich ex C. B. Clarke) Z. R. He, comb. nov.**

假密果双盖蕨 jia mi guo shuang gai jue

Basionym: *Asplenium multicaudatum* Wallich ex C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 502. 1880; *Allantodia multicaudata* (Wallich ex C. B. Clarke) W. M. Chu; *Asplenium schimperi* (Mougeot ex Fée) A. Braun var. *multicaudatum* Baker; *Athyrium multicaudatum* (Wallich ex C. B. Clarke) C. Presl; *A. umbrosum* (Aiton) C. Presl var. *multicaudatum* (Wallich ex C. B. Clarke) Beddome; *Diplazium umbrosum* (J. Smith) Beddome var. *multicaudatum* (Wallich ex C. B. Clarke) Beddome.

Plants evergreen, medium-sized to large. Rhizome creeping to ascending, occasionally slender and creeping, apex and stipe base densely scaly; scales loose, brown or red-brown, lanceolate or linear-lanceolate, up to 1 cm, subentire; fronds caespitose or subapproximate, rarely sparse. Fertile fronds up to 1.5 m; stipe dirty-brown at base, stramineous when dry, 30–60 cm, 3–5 mm in diam. at base; lamina 2-pinnate with pinnatifid pinnules, ovate, up to 80 × 60 cm, apex acuminate; pinnae 10–12 pairs, alternate, ascending, nearly symmetrical; lower

pinnae broadly lanceolate, up to 40 × 20 cm, with stalk up to 4 cm, 1-pinnate, acuminate at apex; upper pinnae lanceolate, gradually reduced, pinnatifid or pinnatisect, sessile or subsessile; pinnules up to 15 pairs, alternate, subspreading, lanceolate, up to 13 × 4 cm, base broadly cuneate or shallowly cordate, sessile or shortly stalked, pinnatifid to pinnatifid, apex acuminate or shortly caudate; pinnule lobes up to 15 pairs, slightly ascending, contiguous, sickle-shaped oblong, margin dentate, apex rounded; veins pinnate, veinlets up to 9 pairs per lobe, usually forked or simple, ascending. Lamina herbaceous or thinly herbaceous when dry, green, glabrous on both surfaces; rachis and costa stramineous. Sori oblong, costular, up to 6 pairs per lobe, usually single or double; indusia brown, membranous, entire, when single opening acropically. Spores reniform, perispore with few rugate, granular ornamentation.

Wet evergreen broad-leaved tropical and subtropical forests; 600–1500 m. SE and W Yunnan [India, Myanmar, Nepal].

*Diplazium multicaudatum* is similar to *D. spectabile* and is often treated as conspecific. *Diplazium multicaudatum* differs in the rhizome and base of stipe with loose, lanceolate or linear-lanceolate scales and indusia opening acropically, while in *D. spectabile* the scales at stipe base are adpressed, sparse, ovate, and the indusia irregularly ruptured on the back.

**27. *Diplazium prolixum* Rosenstock, Repert. Spec. Nov. Regni Veg. 13: 126. 1913.**

双生双盖蕨 shuang sheng shuang gai jue

*Allantodia prolixa* (Rosenstock) Ching.

Plants evergreen, large. Rhizome creeping, brown, ca. 1.5 cm in diam., apex densely scaly; scales slightly shiny, linear-lanceolate, ca. 1 cm, 1–1.5 mm in diam., thickly membranous, entire, filiform at apex, slightly curly; fronds approximate. Fertile fronds up to 2 m; stipe brown at base, upward green-stramineous, up to 1 m, up to 7 mm in diam., base with dense linear-lanceolate brown scales, upper part glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnatifid to pinnatisect pinnules, or base 3-pinnate, ovate-deltoid, up to 1 m × 80 cm, apex acuminate; pinnae up to ca. 18 pairs, lower pinnae subopposite; upper pinnae alternate, ascending, broadly ovate-lanceolate or oblong-lanceolate, up to 50 × 30 cm, slightly narrowed to base, base cuneate, stalk up to 6 cm, apex acuminate; pinnules up to ca. 15 pairs, alternate, broadly lanceolate or linear-lanceolate, up to 20 × 6 cm, slightly narrowed to base, base symmetrical, shallowly cordate, with stalk ca. 5 mm, apex long acuminate; secondary pinnules up to ca. 15 pairs, ascending, linear-lanceolate or oblong, up to 4 × 1.2 cm, sessile, pinnatifid to pinnatifid, apex acuminate or acute to rounded; lobes of secondary pinnules up to 8 pairs, ascending, contiguous, oblong, up to 5 × 3 mm, sparsely thinly serrate, rounded or truncate at apex; veins not prominent, pinnate; veinlets 4 or 5 pairs per lobe, mostly simple, occasionally forked, ascending. Lamina herbaceous, gray-green or light green adaxially when dry, glabrous on both surfaces; rachis and costa stramineous, glabrous, shallowly grooved adaxially. Sori oblong, 1–3 pairs per lobe, subcostular-inframedial, single or double on basal veinlets; indusia light brown, thinly membranous, entire, vaulted when mature, usually irregularly ruptured. Spores hemispherical, perispore with irregular aculeate projections.

Sparse valley forests in limestone areas; 500–1600 m. Chongqing, Guangxi, Guizhou, Yunnan (Guangnan) [Vietnam].

**28. *Diplazium pseudosetigerum*** (Christ) Fraser-Jenkins, Taxon. Revis. Indian Subcontinental Pteridophytes, 270. 2008.

矩圆双盖蕨 ju yuan shuang gai jue

*Athyrium pseudosetigerum* Christ, Bull. Acad. Int. Géogr. Bot. 17: 146. 1907; *Allantodia pseudosetigera* (Christ) Ching.

Plants evergreen, medium-sized. Rhizome ascending to erect, brown, ca. 1 cm in diam., densely scaly at apex; scales brown, ovate-lanceolate, 4–5 × 2–2.5 mm, thickly membranous, entire, apex long acuminate; fronds caespitose. Fertile fronds up to 60 cm; stipe brown at base, upward stramineous, 22–30 cm, ca. 2.5 mm in diam., base with sparse lanceolate brown scales, upward glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnatifid pinnules, deltoid, ca. 30 × 22–25 cm at base, apex long acuminate; pinnae 15–18 × 9–12 cm, slightly narrowed to base, base cuneate, with stalk 1–1.5 cm; upper pinnae lanceolate, 1-pinnate, shortly stalked or sessile; pinnules 10–12 pairs, alternate, ascending, sickle-shaped lanceolate, 5–7 × 1–2 cm, base rounded-cuneate, with stalk 1–2 mm, apex long acuminate; basal pinnule lobes nearly free; pinnule lobes ca. 10 pairs, ascending, sessile, oblong, 8–10 × ca. 4 mm, basal 2 or 3 pairs of lobes connected to narrow wing, margin serrate, apex acute. Veins slightly impressed, raised on abaxial side, pinnate; veinlets 5 or 6 pairs per lobe, forked, ascending. Lamina herbaceous, brown-green when dry, glabrous on both surfaces; rachis and costa stramineous, glabrous, shallowly grooved adaxially. Sori 2 or 3 pairs per lobe, medial, oblong, 1–1.5 mm; indusia light brown, oblong, thinly membranous, vaulted when mature, irregularly ruptured on back. Spore reniform, perispore surface with irregularly aculeate, unevenly distributed projections.

At entrances of limestone caves; ca. 700 m. Chongqing, Guangxi, Guizhou [N and NE Vietnam (Liangshan)].

**29. *Diplazium alatum*** (Christ) R. Wei & X. C. Zhang, Lycophytes Ferns China, 393. 2012.

狭翅双盖蕨 xia chi shuang gai jue

*Athyrium alatum* Christ, Bull. Herb. Boissier 6: 963. 1898; *Allantodia alata* (Christ) Ching; *Diplazium divaricatum* Ching.

Plants evergreen, medium-sized to large. Rhizome creeping to ascending, apex like base of stipe, densely scaly; scales dark brown to black, linear-lanceolate, up to 2 cm or longer, entire, apex long caudate and curly; fronds caespitose. Fertile fronds up to 1.5 m; stipe black at base, upward dark stramineous or stramineous, sometimes green-stramineous, up to 75 cm, 3–5 mm in diam., glabrous; lamina 2-pinnate, deltoid, 40–80 × 40–80 cm, apex acuminate; pinnae 13–18 pairs, subspreading, nearly asymmetrical (basiscopically pinnule longer), apex often acuminate; basal to distal pinnae broadly lanceolate to broadly oblong-lanceolate to lanceolate, mostly alternate; basal pinnae often opposite or subopposite, ca. 40 × 20 cm, with stalk 1.5–6 cm; distal pinnae pinnatifid, sessile or slightly shortly stalked, stalk winged; pinnules 10–15 pairs, mostly alternate, shortly stalked, spreading, lanceolate or ob-

long-lanceolate, pinnatifid, slightly asymmetrical (basiscopically lobes longer), 5–15 × 1.5–4.5 cm, base truncate, apex acuminate or shortly caudate; basal lobes usually short; pinnule lobes 10–20 pairs, opposite or alternate, subspreading, oblong-lanceolate, slightly asymmetrical, base connected to narrow wings, 1–3 cm × 3–10 mm, pinnatifid; secondary lobes of pinnule lobes up to 7 pairs, ascending, sickle-shaped oblong, apex entire or few crenate; veins not prominent, mostly pinnate or forked, few simple. Lamina thinly herbaceous, green when dry, glabrous adaxially, costa and base of pinnule lobes abaxially scaly; scales usually 1 or 2 (occasionally 3 or 4), red-brown, broadly ovate, thin; rachis and costa stramineous, shallowly grooved adaxially. Sori oblong or shortly linear, length 2/3–3/4 of veinlet, 1–4 pairs per each lobe, from base to above middle, single or double; indusia brown or gray-brown when mature, thinly membranous, often vaulted, ruptured. Spores subreniform, perispore surfaces with dense irregular aculeate projections.

• Wet broad-leaved forests and beside streamlets in deep valleys; 500–2200 m. S Guangxi, C Guizhou, Yunnan.

**30. *Diplazium nigrosquamosum*** (Ching) Z. R. He, **comb. nov.**

乌鳞双盖蕨 wu lin shuang gai jue

Basionym: *Allantodia nigrosquamosa* Ching, Acta Phytotax. Sin. 36: 380. 1998.

Plants evergreen, medium-sized. Rhizome slender, creeping, densely scaly; scales on rhizome and lower part of stipe ca. 6 mm, brown, membranous, translucent, lanceolate, entire; fronds distant. Fertile fronds ca. 60 cm; stipe gray-stramineous, ca. 25 cm, ca. 2.5 mm in diam., upper half of stipe and lower part of rachis with many black, lanceolate or narrowly lanceolate, entire, thick scales; lamina 1-pinnate, broadly lanceolate, ca. 38 × 12 cm at base, apex acuminate; pinnae ca. 15 pairs, ascending, sickle-shaped lanceolate, shallowly lobed, lobes shallowly serrate; lower pinnae subopposite, 4–4.5 cm apart, 6–7 × ca. 1.5 cm, base asymmetrical, cuneate basiscopically, truncate acropically, auriculate, with stalk ca. 3 mm, apex long acuminate; upper pinnae alternate, sessile, costae (except basal part) narrowly winged; veins pinnate, prominent on both sides, thin, slightly raised, veinlets 5 per veinlet group, ascending, anadromous. Lamina thinly herbaceous when dry, green, glabrous on both surfaces, rachis (especially lower part) with many scales. Sori linear, slightly falcate, ca. 5 mm, medial, single or occasionally double; indusia light brown, linear, membranous, entire, persistent.

• Beside streamlets; ca. 1100 m. NE Yunnan (Suijiang).

*Diplazium nigrosquamosum* is similar to *D. wichurae* in the auriculate pinnae but differs by the stipe and rachis abaxially with dense black lanceolate scales, lamina thinly herbaceous, and lower pinnae 4–4.5 cm apart.

**31. *Diplazium okudairai*** Makino, Bot. Mag. (Tokyo) 20: 84. 1906.

假耳羽双盖蕨 jia er yu shuang gai jue

*Allantodia okudairai* (Makino) Ching; *Athyrium okudairai* (Makino) Ohwi.

Plants evergreen, medium-sized. Rhizome slender, creeping, brown, ca. 3 mm in diam., densely scaly at apex; scales brown, broadly lanceolate, ca. 4 mm, thickly membranous, entire; fronds distant. Fertile fronds up to 90 cm; stipe dark brown at base, upward green-stramineous, 18–35 cm, ca. 2.5 mm in diam., lower part or all parts of stipe with sparse lanceolate brown scales, shallowly grooved adaxially; lamina 1-pinnate, broadly oblong-lanceolate to narrowly ovate, 25–30 × 10–20 cm, apex caudate and acuminate; pinnae up to 12 pairs, subspreading, sickle-shaped lanceolate, 5–15 × 1.5–3 cm, base asymmetrical, cuneate on basiscopic side, deltoid-auriculate on acroscopic side, pinnatilobate, apex caudate and acuminate; lower pinnae with short stalk 2–3 mm, upper pinnae sessile, costa mostly narrowly winged; pinna lobes deltoid, serrate or obtusely toothed; veins visible, pinnate, 4–6 pairs per each lobe, oblique. Lamina herbaceous, green when dry, glabrous on both surfaces; rachis green-stramineous, lower part sparsely scaly; scales brown, narrowly lanceolate, shallowly grooved adaxially. Sori shortly linear, slightly falcate, up to 14 pairs per pinna, single on basal acroscopic veinlet, 2–4 pairs in auricle, infra-medial, single or rarely double; indusia light brown, linear, membranous, entire, persistent. Spores bean-shaped, perispore hyaline, often rugate, sometimes rugate projections united to reticulate ornamentation.  $2n = 82$ .

Broad-leaved forests, on wet rocks; 400–2200 m. Chongqing, Guizhou (Anshun, Guiyang), Hunan (Jishou), Jiangxi (Yongxiu), Sichuan, Taiwan (Nantou), Yunnan (Daguan, Suijiang, Zhenxiang) [Japan, Korea].

**32. *Diplazium wichurae*** (Mettenius) Diels in Engler & Prantl, Nat. Pflanzenfam. 1(4): 226. 1899.

耳羽双盖蕨 *er yu shuang gai jue*

Plants evergreen, small to medium-sized. Rhizome slender, creeping, brown, ca. 3 mm in diam., densely scaly at apex; scales brown, lanceolate, ca. 3 mm, thickly membranous, entire; fronds distant, 5–10 mm apart. Fertile fronds up to 60 cm; stipe dark brown at base, upward green-stramineous, 25–30 cm, ca. 3 mm in diam., base sparsely scaly with brown, linear scales, upward glabrous, narrowly grooved adaxially; lamina 1-pinnate, broadly lanceolate, 30–35 × 8–14 cm, apex caudate and long acuminate; pinnae up to 18 pairs, alternate, subspreading, 1.5–3 cm apart, sickle-shaped lanceolate, 4–9 × 1–1.5 cm, with stalk 1–2 mm, asymmetrical, basiscopic base cuneate, acroscopic base deltoid-auriculate, margin biserrate or uniserrate (var. *parawichurae*), except a few distal pinnae, apex acuminate to caudate or acute or subrounded (var. *parawichurae*); costae narrowly winged; veins raised abaxially, impressed adaxially, unequally forked into 3–5 simple veinlets, anadromous, ascending, all reaching serrate margin. Lamina stiffly papery or subleathery, light green when dry, glabrous on both surfaces; rachis green-stramineous, glabrous, shallowly grooved adaxially. Sori shortly linear, 2.5–7 mm, straight or slightly falcate, up to 16 pairs per each pinna, in 1 row on each side of costa, close to costa, mostly single, rarely double, occasionally 1 or 2 pairs in basal auricle; indusia brown, long, membranous, entire, persistent; spores elliptic in polar view, reniform in equatorial view, perispore hyaline, few flakelike rugate.  $2n = 82$ .

Forests, beside calcareous streamlets, wet valleys; sea level to

2000 m. Anhui, Fujian, Guangdong, Guizhou, Jiangsu, Jiangxi, Sichuan, Taiwan, Zhejiang [Japan, Korea (Chejudao)].

- 1a. Pinna apex usually acuminate to caudate, rarely acute, margin biserrate ..... 32a. var. *wichurae*  
 1b. Pinna apex acute or subrounded, margin uniserrate ..... 32b. var. *parawichurae*

**32a. *Diplazium wichurae* var. *wichurae***

耳羽双盖蕨(原变种) *er yu shuang gai jue* (yuan bian zhong)

*Asplenium wichurae* Mettenius, Ann. Mus. Bot. Lugduno-Batavi 2: 237. 1866; *Allantodia wichurae* (Mettenius) Ching; *Athyrium wichurae* (Mettenius) Ohwi (1956), not Merrill (1918).

Plants large. Pinnae with biserrate margin, apex acuminate.

Forests, beside calcareous streamlets, wet valleys; sea level to 2000 m. Anhui, Fujian, Guangdong, Guizhou, Jiangsu, Jiangxi, Sichuan (Emei Shan), Taiwan, Zhejiang [Japan, Korea (Chejudao)]; widely distributed in E Asia.

**32b. *Diplazium wichurae* var. *parawichurae*** (Ching) Z. R. He, *comb. nov.*

龙池双盖蕨 *long chi shuang gai jue*

Basionym: *Allantodia parawichurae* Ching, Fl. Jiangsu. 1: 465. 1977; *A. wichurae* var. *parawichurae* (Ching) W. M. Chu & Z. R. He.

Pinnae short, with uniserrate margin, apex acute or subrounded.

- Forests in wet valleys. Jiangsu (Yixing).

**33. *Diplazium heterocarpum*** Ching, Lingnan Sci. J. 15: 276. 1936.

异果双盖蕨 *yi guo shuang gai jue*

*Allantodia heterocarpa* (Ching) Ching; *A. yuyangensis* (Ching) Ching; *Athyrium yuyangense* Ching; *Diplazium yuyangense* (Ching) Ching.

Plants small to medium-sized. Rhizome short and erect, apex and base of stipe sparsely scaly; scales brown, broadly lanceolate, thickly membranous, entire; fronds caespitose. Fertile fronds up to 35 cm; stipe green-stramineous, 2–8(–15) cm, upward glabrous, deeply grooved adaxially; lamina 1-pinnate, oblong-lanceolate, 8–15(–20) × 3–6 cm, slightly narrowed to base, apex pinnatilobate and acuminate; pinnae 8–24 pairs, alternate or lower pinnae opposite, subspreading, lanceolate, base asymmetrical, basiscopically cuneate, acroscopically auricles parallel to rachis, with stalk up to 2 mm, margin (especially acroscopically) repand with shallow rounded lobes, lobes thinly serrate, apex acute; veins pinnate, slightly raised on abaxial surface, veinlets 2 or 3 pairs in basal auricle, other veinlets 2 or 3, ascending. Lamina herbaceous, green when dry, glabrous on both surfaces; rachis green-stramineous, glabrous, deeply grooved adaxially. Sori linear, ascending, slightly curved, up to 7 pairs per pinna, sometimes 1 or 2 pairs in auricle, single (occasionally double), not reaching pinna margin; indusia light

brown, linear, membranous, entire, persistent. Spores hemispherical, perispore prominent and broad, few rugate.

• At entrances of limestone caves; 900–1400 m. Chongqing (Youyang), Guizhou.

**34. *Diplazium dushanense*** (Ching ex W. M. Chu & Z. R. He) R. Wei & X. C. Zhang, *Lycophytes Ferns China*, 396. 2012.

独山双盖蕨 du shan shuang gai jue

*Allantodia dushanensis* Ching ex W. M. Chu & Z. R. He, *Acta Phytotax. Sin.* 36: 379. 1998.

Plants small to medium-sized. Rhizome ascending, brown, ca. 5 mm in diam., with fleshy brown roots, apex densely scaly; scales brown, lanceolate, ca. 3 mm, membranous, entire; fronds caespitose. Fertile fronds 25–50 cm; stipe light green-stramineous, up to 23 cm, ca. 2 mm in diam., base with sparse lanceolate brown scales, upward glabrous, grooved adaxially; lamina 1-pinnate with pinnatifid to pinnatipartite pinnules, or base nearly 2-pinnate, ovate-deltoid or subdeltoid, 10–30 × 8–20 cm at base, apex acuminate; pinnae 6–10 pairs, alternate, ascending, lanceolate, up to 11 × 4 cm at base, base asymmetrical, acroscopically auriculate, basiscopically cuneate, with stalk up to 5 mm, pinnatifid to pinnatisect, apex acuminate; pinna lobes 8 pairs, ascending, contiguous, ovate or oblong, lobe margin sparsely thinly dentate, apex rounded or acute; basal pinna lobes up to 2 × 1 cm, sometimes nearly completely free, connate to each other, with narrow wings; veins not prominent adaxially, nearly visible abaxially, pinnate, veinlets in pinna lobe 1–7 pairs, ascending, mostly simple, or basal acroscopic veinlets usually bifurcate. Lamina herbaceous, gray-green when dry, glabrous on both surfaces; rachis green-stramineous, glabrous, shallowly grooved adaxially. Sori linear, slightly curved, 3–6 mm, 2–5 pairs per each lobe, single or double; indusia brown, linear, thickly membranous, entire, persistent. Spores hemispherical, perispore prominent, few rugate.

• Rock crevices on calcareous hills; 600–900 m. Guangxi (Longzhou), Guizhou.

*Diplazium dushanense* is similar to *D. lobulosum* but differs by the pinnae fewer, ca. 8 pairs, pinnatifid to pinnatipartite, and sori 2 or 3 pairs per pinna lobe; in *D. lobulosum* the pinnae are 22 pairs, pinnatilobate, and sorus single in pinna lobe.

**35. *Diplazium lobulosum*** (Wallich ex Mettenius) C. Presl, *Tent. Pterid.* 114. 1836.

浅裂双盖蕨 qian lie shuang gai jue

Lithophytes, evergreen, small to medium-sized. Rhizome erect, brown, ca. 5 mm in diam., up to 2 cm in diam. including remaining stipes, apex densely scaly; scales brown, lanceolate, ca. 6 mm, thickly membranous, entire; fronds caespitose. Stipe brown at base, upward stramineous, light brown-stramineous or green-stramineous, 15–20 cm, ca. 3 mm in diam., base with sparse lanceolate or ovate-lanceolate brown scales, upward glabrous, grooved adaxially; lamina 1-pinnate, broadly oblong-lanceolate, 25–35 × 7–11 cm, apex acuminate; pinnae 16–22 pairs, slightly ascending, lower pinnae subopposite, upper pinnae alternate, all sickle-shaped lanceolate, falcate, base asymmetrical, basiscopic base cuneate, acroscopic base truncate with del-

toid or oblong auricles, shallowly pinnatilobate or serrate, with stalk ca. 2 mm and winged, apex acuminate or long acuminate; middle pinnae 5–8 × 1–2 cm, basal pinnae slightly smaller; pinna lobes broadly deltoid or semicircular, apex serrate or obtusely serrate; veins not prominent adaxially, slightly raised abaxially, veinlets trifurcate, pinnate in auricle, ascending. Lamina herbaceous, gray-green when dry, glabrous on both surfaces; rachis stramineous, pale brown-stramineous or green-stramineous, glabrous, shallowly grooved adaxially. Sori shortly linear, slightly curved, 3–7 mm, 8–14 pairs per each pinna, in single row along costa, 2–4 pairs in auricle, mostly single, rarely double; indusia brown, linear, membranous, persistent; perispore loose and hyaline, few rugate, sparsely spiny.  $2n = 82$ .

Evergreen broad-leaved forests, wet calcareous areas; 1500–2500 m. S Xizang, Yunnan [N India, N Myanmar, Nepal].

- 1a. Pinnae shallowly pinnatilobate ..... 35a. var. *lobulosum*  
1b. Pinnae shallowly and obtusely  
toothed at margin ..... 35b. var. *shilinicola*

**35a. *Diplazium lobulosum* var. *lobulosum***

浅裂双盖蕨(原变种) qian lie shuang gai jue (yuan bian zhong)

*Asplenium lobulosum* Wallich ex Mettenius, *Abh. Senckenberg. Naturf. Ges.* 3: 163. 1859; *Allantodia lobulosa* (Wallich ex Mettenius) Ching; *Asplenium longifolium* D. Don (1825), not Schrader (1824); *Athyrium longifolium* (T. Moore) Milde; *Diplazium longifolium* T. Moore.

Pinnae pinnatilobate.

Evergreen broad-leaved forests, wet calcareous areas; 1500–2500 m. S Xizang (Nyalam), Yunnan [N India, N Myanmar, Nepal].

**35b. *Diplazium lobulosum* var. *shilinicola*** (W. M. Chu & J. J. He) Z. R. He, *comb. nov.*

石林双盖蕨 shi lin shuang gai jue

Basionym: *Allantodia lobulosa* var. *shilinicola* W. M. Chu & J. J. He, *Acta Bot. Yunnan.* 3: 340. 1981.

Pinnae not pinnatilobate, but shallowly and obtusely serrate at margin.

• Wet calcareous areas; ca. 1700 m. Yunnan (Shilin).

**36. *Diplazium mettenianum*** (Miquel) C. Christensen, *Index Filic.* 236. 1905.

江南双盖蕨 jiang nan shuang gai jue

Plants evergreen, small to medium-sized. Rhizome slender, creeping, black-brown, densely scaly at apex; scales black or black-brown, shiny, narrowly lanceolate, ca. 3 mm, thickly membranous, toothed at margin. Fronds distant; stipe brown, base with sparse, narrow lanceolate, brown scales, upward grooved on adaxial side; lamina 1-pinnate or pinnatilobate to pinnatipartite, deltoid, broadly lanceolate-deltoid, or ovate-lanceolate, apex acuminate; pinnae alternate or subopposite, subspreading, sickle-shaped lanceolate or oblong-lanceolate, base truncate or broadly cuneate, stalked or subsessile; veins pinnate, not prominent adaxially, visible abaxially, veinlets simple or

forked in basal lobes, ascending. Lamina papery, green or gray-green when dry, both surfaces glabrous; rachis stramineous, glabrous, grooved adaxially. Sori linear, slightly curved, 2–5(–7) pairs per pinna lobe, single or basal sori usually double, medial; indusia light brown, thinly membranous, entire, persistent. Spores reniform, perispore hyaline, ornamentation slightly rugate, not prominently granular.

Forests, streamlets, on wet rocks; 400–1400 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, N Thailand, N Vietnam].

Knapp (Ferns Fern Allies Taiwan, 450–451. 2011) considers the dubious name *Diplazium agyokuense* Tagawa (Acta Phytotax. Geobot. 7: 80. 1938), described from Taiwan, to be a synonym of *D. mettenianum*. An isotype of *D. agyokuense* in MICH (MICH1190349) was identified as *D. latifrons* Alderwerelt by M. G. Price.

- 1a. Fertile lamina 25–40 × 15–25 cm; pinnae up to 15(–18) × 4 cm, pinnatilobate to pinnatipartite ..... 36a. var. *mettenianum*  
 1b. Fertile lamina 15–20 × 7–10 cm; pinnae usually 4–7 × 1–1.5 cm, shallowly repand or dentate ..... 36b. var. *fauriei*

### 36a. *Diplazium mettenianum* var. *mettenianum*

江南双盖蕨(原变种) jiang nan shuang gai jue (yuan bian zhong)

*Asplenium mettenianum* Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 174. 1867; *Allantodia metteniana* (Miquel) Ching; *A. metteniana* var. *isobasis* (Christ) Ching; *Asplenium textorii* Miquel; *Athyrium mettenianum* (Miquel) Ohwi; *A. mettenianum* var. *isobasis* (Christ) Ohwi; *Diplazium cavaleriei* Christ; *D. isobasis* Christ; *D. japonicum* (Thunberg) Beddome var. *textorii* (Miquel) Christ; *D. lohfaense* C. Christensen ex Wu; *D. mettenianum* var. *isobasis* (Christ) Tagawa; *D. textorii* (Miquel) Makino.

Fronds medium-sized. Lamina 25–40 × 15–25 cm; pinnae up to 15(–18) × 4 cm, pinnatilobate to pinnatipartite; veins pinnate, veinlets 5–7 pairs. Sori 2–5(–7) pairs.

Valley forests; 400–1400 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, N Thailand, N Vietnam].

### 36b. *Diplazium mettenianum* var. *fauriei* (Christ) Tagawa, Acta Phytotax. Geobot. 1(1): 88. 1932.

小叶双盖蕨 xiao ye shuang gai jue

*Diplazium fauriei* Christ, Bull. Herb. Boissier, sér. 2, 1: 1015. 1901; *Allantodia metteniana* var. *fauriei* (Christ) Ching; *Athyrium mettenianum* var. *fauriei* (Christ) Ohwi.

Fronds small; lamina 15–20 × 7–10 cm; pinnae usually 4–7 × 1–1.5 cm, serrate or repand at margin; veinlets 2 or 3 in each pinna lobe. Sori single, occasionally 2 or 3.

Beside streamlets, on wet rocks; 400–500 m. Fujian, Guangdong, Jiangxi, Zhejiang [Japan, N Vietnam].

### 37. *Diplazium hirtisquama* (Ching & W. M. Chu) Z. R. He, comb. nov.

毛鳞双盖蕨 mao lin shuang gai jue

Basionym: *Allantodia hirtisquama* Ching & W. M. Chu, Acta Bot. Yunnan. 3: 335. 1981.

Plants evergreen, medium-sized. Rhizome creeping, black, ca. 5 mm in diam., sparsely scaly; scales brown to black-brown, linear-lanceolate, ca. 5 mm, with marginal and adaxial teeth; fronds distant. Fertile fronds 80–110 cm; stipe black at base, upward light green-stramineous, as long as lamina, 3–5 mm in diam. at base, upward glabrous; lamina 1-pinnate, deltoid, 40–50 × 30–40 cm, apex rather abruptly narrowed and acuminate; pinnae 10–13 pairs, alternate, base rounded, pinnatilobate or subdentate, apex long acuminate; lower pinnae spreading, straight, oblong-lanceolate, symmetrical, up to 20 × 3 cm, with stalk up to 5 mm; upper pinnae slightly ascending, sickle-shaped lanceolate; lobes of lower pinnae 25 pairs, broadly deltoid, margin repand or shallowly serrate, apex oblique; veins visible abaxially, not prominent adaxially, veinlets simple, ascending, up to 4 pairs per lobe. Lamina papery when dry, dark colored adaxially, glabrous on both surfaces. Sori linear, single, up to 3 pairs per each lobe, basal acroscopic sori longer, basal sori borne near costa, upper sori near middle or upper part of veinlet, both ending inframarginally; indusia brown, membranous, entire. Spores oblong, perispore prominent, few rugate.

- Evergreen broad-leaved forests; ca. 900 m. SE Yunnan (Hekou).

*Diplazium hirtisquama* is similar to *D. mettenianum* but differs in the scales toothed marginally and adaxially, lower pinnae straight, broader in middle, rounded at base, and basal pinnae similar to upper pinnae.

### 38. *Diplazium yaoshanense* (Y. C. Wu) Tardieu, Bull. Mus. Natl. Hist. Nat., sér. 2, 6: 115. 1934.

假江南双盖蕨 jia jiang nan shuang gai jue

*Diplazium japonicum* Beddome var. *yaoshanense* Y. C. Wu, Bull. Dept. Biol. Sun Yatsen Univ. 3: 152. 1932; *Allantodia yaoshanensis* (Y. C. Wu) W. M. Chu & Z. R. He; *D. kansiroi* Tagawa.

Plants evergreen, medium-sized. Rhizome slender, creeping, black, with black, lanceolate, marginally sparsely toothed, thinly membranous scales; roots sparse, stiff, black, thick; fronds distant. Fertile fronds up to 1 m; stipe black-brown at base, upward light green-stramineous, as long as lamina, up to 50 cm, ca. 2 mm in diam. at base, base slightly scaly, upward glabrous, shallowly grooved adaxially; lamina 1-pinnate, deltoid or broadly deltoid-lanceolate, up to 50 × 25 cm at base, apex abruptly reduced, acuminate; lateral pinnae 6–8 pairs, subspreading, oblong-lanceolate or sickle-shaped lanceolate, up to 14 × 2.5 cm, base obliquely rounded or shallowly cordate, margin dentate or pinnatilobate, stalk up to 1 cm, upward shortly stalked to sessile or adnate, apex shortly acuminate; pinna lobes semicircular, apex shallowly repand or slightly shallowly serrate; veins pinnate, visible abaxially, not prominent adaxially; veinlets obliquely ascending, simple, basal veinlets slightly curved, occasionally forked. Lamina thickly papery or subleathery, glabrous on both surfaces; rachis light green-stramineous, glabrous, shallowly grooved adaxially. Sori linear, single or basal acroscopic ones double; indusia light brown,

thinly membranous, entire, persistent. Spores subreniform, perispore hyaline, widely rugate.

Guangxi [Japan (Ryukyu Islands), S Vietnam].

*Diplazium yaoshanense* is similar to *D. mettenianum*, particularly var. *fauriei*, and to *D. crassiusculum*. Japanese plants are a hybrid of *D. crassiusculum* and *D. mettenianum* var. *fauriei*.

**39. *Diplazium hirsutipes*** (Beddome) B. K. Nayar & S. Kaur, Companion Beddome's Handb. Ferns Brit. India, 44. 1974.

篦齿双盖蕨 *bi chi shuang gai jue*

*Diplazium stoliczkae* Beddome var. *hirsutipes* Beddome, Handb. Ferns Brit. India, 182. 1883; *Allantodia hirsutipes* (Beddome) Ching; *Asplenium thelypteroides* Michaux; *D. thelypteroides* (Michaux) Beddome (1865), not (Michaux) C. Presl (1836).

Plants evergreen, medium-sized. Rhizome variable in habit, slender and creeping, ascending to erect, erect rhizome with stipe remains ca. 3 cm in diam., apex and stipe base densely scaly; scales black-brown, linear, ca. 1.5 cm, membranous, with black, narrow, sparsely toothed margin; fronds distant or approximate to caespitose. Fertile fronds up to 1 m; stipe brown at base, upward stramineous, 16–30 cm, 3–4 mm in diam., with linear brown scales throughout, upward scales gradually smaller and sparse, shallowly grooved adaxially; lamina 1-pinnate, broadly oblong-lanceolate, up to 50 × 25 cm at middle, apex acuminate; pinnae up to 25 pairs, contiguous, basal 1 or 2 pairs of pinnae slightly shortened, slightly reflexed, sessile, lanceolate, up to 14 × 2 cm at middle, base cuneate, pinnatifid, apex long acuminate; pinna lobes up to 22 pairs, slightly spreading or oblique, oblong, ca. 8 × 4 mm, margin serrate, sometimes entire, apex rounded; veins prominent, pinnate, veinlets ca. 7 pairs, simple, occasionally double, oblique. Lamina papery, brown, glabrous on both surfaces; rachis dark stramineous, grooved adaxially, rachis and costa abaxially with black or brown linear scales. Sori shortly linear, 1–5 pairs per each lobe, inframedial-subcostular, mostly simple, double on basal acroscopic veinlet; indusia brown, thickly membranous, entire, persistent. Spores bean-shaped, perispore hyaline and wide, few rugate.

Evergreen broad-leaved forests; 1800–2700 m. Xizang, Yunnan [Bhutan, India, N Myanmar, Nepal, Vietnam].

*Diplazium hirsutipes* has been treated as a variety of *D. stoliczkae* Beddome from NE India (Kyasya); the latter are large plants, with the pinnae 2.5–3.5 cm wide, basal pinnae longer than upper pinnae, stipe and rachis glabrous, and sori long, extending to margin.

**40. *Diplazium hirtipes*** Christ, Bull. Herb. Boissier 7: 11. 1899.

鳞轴双盖蕨 *lin zhou shuang gai jue*

*Allantodia hirtipes* (Christ) Ching; *Asplenium parallelsorum* Baker; *Diplazium insigne* Ching (1940), not Holttum (1937); *D. parallelsorum* (Baker) C. Christensen; *D. pellucidum* Ching.

Plants evergreen, medium-sized. Rhizome ascending to erect, robust; stipe densely scaly; scales brown, black-brown, or black, shiny, narrowly lanceolate, membranous, toothed at

margin. Fronds caespitose; stipe with dense lanceolate black or black-brown scales, grooved adaxially; lamina 1-pinnate, oblong, apex acuminate; pinnae alternate or opposite, subspreading, lanceolate, base cuneate or broadly cuneate, usually enlarged to auriculate at acroscopic and basicopic bases, sessile, pinnatifid to pinnatifid, apex acuminate; upper pinnae adnate to rachis, lower pinnae slightly shortened; pinna lobes entire or subentire, truncate or rounded, rarely acute at apex; veins not prominent adaxially, visible abaxially, pinnate, veinlets simple, oblique, all reaching laminar margin. Lamina herbaceous, brown-green when dry; rachis stramineous, with dense linear, brown or black scales, grooved adaxially. Sori linear, slightly curved, usually 1–3 per pinna lobe, simple or forked, from midrib to 2/3 of veinlet length; indusia linear, membranous, entire, persistent. Spores hemispherical, perispore hyaline, wide, few rugate, not prominently granular or rugate.

Dense forests in valleys, beside shaded streamlets; 700–2700 m. Chongqing, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Yunnan [N Vietnam].

Plants with dense black glossy scales on the stipe and rachis have been considered a form of this species: ***Diplazium hirtipes* f. *nigropaleaceum*** (Ching ex W. M. Chu & Z. R. He) Z. R. He, **comb. nov.** (Basionym: *Allantodia hirtipes* f. *nigropaleacea* Ching ex W. M. Chu & Z. R. He, Acta Phytotax. Sin. 36: 379. 1998; 黑鳞鳞轴双盖蕨 *hei lin zhou shuang gai jue*). It occurs in dense forests beside streamlets, 700–1700 m, in Guangxi, Guizhou, Hunan, and Yunnan.

**41. *Diplazium changjiangense*** Z. R. He, **nom. nov.**

昌江双盖蕨 *chang jiang shuang gai jue*

Replaced synonym: *Allantodia hainanensis* Ching, Acta Phytotax. Sin. 9: 354. 1964, not *Diplazium hainanense* Ching, Bull. Fan Mem. Inst. Biol. 2: 206. 1931; *A. subsilvatica* Ching (1964), not *D. subsilvaticum* Christ (1901).

Plants small to medium-sized. Rhizome robust, ascending, brown, with dense, fleshy, shortly fibrous roots, densely scaly; scales brown, lanceolate, ca. 5 mm, glandular hairy, thickly membranous; fronds caespitose. Fertile fronds 30–70 cm; stipe brown at base, upward light stramineous, 12–30 cm, 1.5–3 mm in diam., base sparsely scaly, upward glabrous, shallowly grooved adaxially; lamina nearly 1-imparipinnate, ovate-deltoid or oblong, 20–40 × ca. 20 cm; apical pinna large, deltoid-lanceolate, 10–11 × 2–2.4 cm at base, thinly dentate, downward pinnatifid to pinnatipartite into ligulate-shaped oblong lobes, apex of lobes thinly dentate and acuminate; lateral pinnae 4–8 pairs, slightly ascending, lanceolate, 10–18 × 1–2 cm, base rounded or cuneate, margin shallowly lobed, apex acuminate and dentate; lobes orbicular, each with 4 or 5 crenate teeth; basal pinnae opposite, slightly ascending, shortly stalked, upper pinnae sessile, further upper pinnae adnate to rachis; veins pinnate, ascending, sparse. Lamina papery, green or gray-green when dry, glabrous on both surfaces; rachis and costa pale stramineous, glabrous, shallowly grooved adaxially. Sori linear, ca. 5 mm, sparse, slightly curved, from base upward to 2/3–3/4 of veinlet length, 2–4 per pinna lobe, single or double on basal acroscopic veinlet; indusia brown, linear, thinly membranous, persistent.

● Under bushes. Hainan (Changjiang).

**42. *Diplazium wangii*** Ching, Lingnan Sci. J. 15: 281. 1936.

黄志双盖蕨 huang zhi shuang gai jue

*Allantodia wangii* (Ching) Ching; *Diplazium submettenianum* Ching.

Plants evergreen, medium-sized. Rhizome ascending, up to 10 cm, up to 1.5 cm in diam., with dense stiff, black, shortly robust roots, apex scaly; scales dark brown, linear-lanceolate, 4–5 mm, thickly membranous, base rounded, margin entire, apex long acuminate; fronds caespitose. Fertile fronds up to 65 cm; stipe black-brown at base, upward pale green-stramineous, ca. 30 cm, up to 3 mm in diam. at base, base slightly swollen, sparsely scaly, scales similar to those on rhizome, upward glabrous, shallowly grooved adaxially; lamina nearly 1-impinnate, oblong to oblong-oblong, up to 35 × 15 cm at middle; apical pinna larger, lanceolate, up to 14 × 1.8 cm, pinnatilobate to rounded and oblique lobes with small serrate margin, base of apical pinna with usually nearly free oblong lobes, apex acuminate and serrate; lateral pinnae ca. 10 pairs, alternate, ascending, upper pinnae sessile, lower pinnae shortly stalked, lanceolate, up to 12 × 1.5 cm, base cuneate, margin biserrate, apex acuminate; veins prominent, each group 1–4-furcate, veinlets parallel, all reaching pinna margin, ascending; lamina thinly papery, glabrous, gray-green when dry; rachis and costa stramineous, shallowly grooved adaxially. Sori linear, slightly curved, contiguous, from costa to near margin, variably long, longer sori from costa upward to 2/3 of veinlet length; indusia light brown, thinly membranous, persistent.

- Dense forests. Hainan.

**43. *Diplazium incomptum*** Tagawa, Acta Phytotax. Geobot. 3: 35. 1934

疏裂双盖蕨 shu lie shuang gai jue

*Allantodia incompta* (Tagawa) Ching.

Plants evergreen, medium-sized. Rhizome ascending to erect, black-brown, apex like base of stipe, scaly; scales black, ovate-lanceolate, 3–5 × 1.5–2 mm, margin toothed; fronds caespitose. Fertile fronds up to 70 cm, stipe brown at base, upward green-stramineous, 20–35 cm, ca. 3 mm in diam., base sparsely scaly, upward glabrous, grooved adaxially; lamina 1-pinnate with pinnatipartite pinnae, deltoid-oblong, 50–60 × ca. 25 cm at middle, apex acuminate; pinnae ca. 12 pairs, alternate, spreading, lanceolate, base cuneate or cordate, with stalk ca. 5 mm, margin pinnatipartite to costa, apex acuminate or acute; middle pinnae 13–15 × ca. 3 cm, basal pinnae shorter; pinna lobes ca. 10 pairs, spreading, distant, oblong, 1.5–2 cm × ca. 7 mm, base slightly narrowed, crenate, apex rounded, crenate; veins pinnate, veinlets forked, ascending. Lamina herbaceous, dark green adaxially when dry, gray-green abaxially, rachis green-stramineous; rachis and costae abaxially with sparse, lanceolate, dark brown scales. Sori linear, slightly curved, ca. 4 mm, single or double; indusia brown, linear, membranous, entire, persistent.

Broad-leaved forests; 500–700 m. Taiwan (Pingdong, Taibei, Yilan) [Japan].

**44. *Diplazium megaphyllum*** (Baker) Christ, Bull. Herb. Boissier 6: 961. 1898.

大羽双盖蕨 da yu shuang gai jue

*Asplenium megaphyllum* Baker, J. Bot. 28: 264. 1890; *Allantodia megaphylla* (Baker) Ching; *Diplazium macrophyllum* Ching (1929), not Desvaux (1827); *D. megaphyllum* var. *subintegrifolia* Tardieu.

Plants medium-sized to large. Rhizome usually robust and erect, brown, ca. 2 cm in diam., woody, occasionally creeping, apex like base of stipe, densely scaly; scales brown, linear-lanceolate to linear-diamond-shaped, ca. 8 mm, membranous, margin black, sparsely toothed, apex curly and filiform; fronds often caespitose, rarely approximate or sparse. Fertile fronds up to 1.5 m; stipe brown at base, upward green-stramineous, 30–80 cm, up to 1 cm in diam., base densely scaly, upward gradually glabrous, broadly grooved adaxially; lamina 1-pinnate, oblong, 50–90 × 25–50 cm, base mostly pinnatipartite, apex deltoid, abruptly shortened and acuminate; lobes with acuminate or long acuminate apex; upward pinnatifid to pinnatilobate, lobes acute or rounded at apex; lateral pinnae 7–9 pairs, alternate, ascending, with stalk ca. 5 mm, base slightly asymmetrical, shallowly cordate, few nearly symmetrical, rounded-cuneate, margin with few sinuses or serrate, apex acuminate; veins prominent, slightly raised on both surfaces, pinnate, ascending, veinlets 4–6 on either side of main veins, ascending, simple, basiscopic 2 or 3 veinlets not reaching pinna margin. Lamina papery, usually dark green when dry, glabrous on both surfaces; rachis stramineous, glabrous, shallowly grooved adaxially; costa abaxially with sparse linear brown scales. Sori linear, 3–6 mm, 3 or 4 pairs per vein group, mostly single or sometimes double, inframedial or medial; indusia gray, linear, membranous, entire. Spores bean-shaped, perispore prominent, few rugate.

Valley forests, beside streamlets, mostly in calcareous areas; 100–1700 m. Chongqing, Guangxi, Guizhou, Sichuan, Taiwan (Hualian, Nantou), Yunnan [E Myanmar, N Vietnam].

**45. *Diplazium pinnatifidopinnatum*** (Hooker) T. Moore, Index Fil. 334. 1861 [“*pinnatifido-pinnatum*”].

裂羽双盖蕨 lie yu shuang gai jue

*Asplenium pinnatifidopinnatum* Hooker, Sp. Fil. 3: 238. 1860 [“*pinnatifido-pinnatum*”]; *Allantodia pinnatifidopinnata* (Hooker) Ching.

Plants evergreen, medium-sized. Rhizome erect, black, ca. 1 cm in diam., with dense black-brown, stiff, fleshy, long, stout roots, apex scaly; scales dark brown, lanceolate, ca. 4 mm, margin toothed; fronds caespitose. Fertile fronds up to 80 cm; stipe brown at base, upward green-stramineous, up to 40 cm, ca. 3 mm in diam., base sparsely scaly, scales similar to those on rhizome, upward glabrous, shallowly grooved adaxially; lamina 1-pinnate, downward pinnatilobate to pinnatisect, ovate or ovate-oblong, up to 40 × 20 cm, apex abruptly narrowed, acuminate; lateral pinnae up to 10 pairs, alternate, ascending, sickle-shaped lanceolate, up to 15 × 3 cm, base cuneate, symmetrical, margin broadly shallowly serrate, apex acuminate; basal 3 or 4 pairs of pinnae with stalk ca. 2 mm, upward gradually sessile. Veins visible, pinnate, veinlets 3 or 4 pairs per vein,

simple, markedly ascending. Lamina stiffly papery, mostly gray-green on adaxial surface, light gray-green abaxially, glabrous on both surfaces; rachis stramineous or light green stramineous, glabrous, shallowly grooved adaxially. Sori linear, up to 8 mm, usually 2 pairs per vein, simple or double on basal acroscopic veinlet, from base of veinlet or near base upward ascending, not reaching pinna margin; indusia light brown, linear, membranous, entire, persistent. Spores bean-shaped, perispore thin, with prominent and average large aperture ornamentation.

Shaded places in tropical forests; 300–800 m. Hainan, S and SE Yunnan [NE India (Assam), Myanmar, Vietnam].

**46. *Diplazium jinpingense*** (W. M. Chu) Z. R. He, **comb. nov.**

金平双盖蕨 jin ping shuang gai jue

Basionym: *Allantodia jinpingensis* W. M. Chu, Acta Bot. Yunnan. 3: 340. 1981.

Plants evergreen, medium-sized. Rhizome ascending, apex scaly; scales brown, lanceolate, ca. 6 mm, margin black, toothed, apex slightly curly; fronds caespitose. Fertile fronds 80–90 cm; stipe dark brown at base, upward light green, 25–30 cm, 2–3 mm in diam., base sparsely scaly, upward glabrous; lamina 1-pinnate with pinnatifid lobes, deltoid, 55–60 × 30–40 cm, apex acuminate; pinnae 5–8 pairs, ascending, lanceolate, up to ca. 23 × 4 cm, base asymmetrical with basal adaxial and abaxial lobes alternate, pinnatifid to pinnatifid, apex long acuminate; basal pinnae subsimilar to and as long as upper pinnae, with stalk up to 2 cm; pinna lobes up to 15 pairs, ascending, broadly deltoid, margin shallowly crenate or shallowly repand, apex rounded; veins pinnate, veinlets up to 10 pairs, mostly simple or forked, ascending. Lamina papery when dry, green, glabrous adaxially; rachis, costa, and veins abaxially with thin small scales and multicellular short hairs. Sori linear, up to 8 pairs per lobe, from base upward to 1/2 of veinlet length, single or double on basic acroscopic veinlet; indusia brown, membranous, entire. Spores reniform, perispore with thickly anastomosing ornamentation.

- Forests; ca. 1900 m. SE Yunnan (Jinping).

*Diplazium jinpingense* is similar to a 1-pinnate-leaved *D. dilatatum* but differs by the scales lanceolate and apically acute (vs. linear-lanceolate and apically long linear) and by the perispore with thickly anastomosing ornamentation (vs. granular and few rugate).

**47. *Diplazium siamense*** C. Christensen, Contr. U.S. Natl. Herb. 26: 332. 1931.

长羽柄双盖蕨 chang yu bing shuang gai jue

*Allantodia siamensis* (C. Christensen) Ching & W. M. Chu.

Plants evergreen, medium-sized. Rhizome ascending to erect, apex densely scaly; scales dark brown, linear-lanceolate; stipe green-stramineous or stramineous, 35–60 cm, 2–4 mm in diam., upward with narrowly long scales, becoming glabrous; lamina 1-pinnate, oblong, 35–60 × 30–40 cm, apex abruptly narrowed, apical part of lamina up to 20 cm, pinnatifid, long acuminate; lateral pinnae 6–9 pairs, alternate, ascending, 15–25 × 1.5–4 cm, lower pinnae with stalk more than 2 cm; basal pinnae similar to and as long as upper pinnae, pinnatifid to pinnatifid, lanceolate, base slightly narrower than or nearly as

wide as middle part, mostly asymmetrical or nearly symmetrical, broadly cuneate or cuneate, apex long acuminate; basal acroscopic and basicopic lobes mostly opposite or subopposite; pinna lobes up to 20 pairs, ascending, approximate or contiguous, oblong sickle-shaped, dentate or shallowly repand, oblique-rounded at apex; veins pinnate per lobes, veinlets 10 pairs, usually simple, few forked, ascending. Lamina papery when dry, green, dark adaxially, glabrous on both surfaces; rachis stramineous or green-stramineous. Sori linear, from near midrib to around middle of veinlet, up to 8 pairs, often single or double on basal acroscopic veinlet; indusia brown when mature, membranous, entire. Spores subreniform, perispore hyaline and broad, few rugate.

Tropical mountain areas, evergreen broad-leaved forests; 1300–1700 m. S Yunnan (Jinghong, Mengla, Xishuangbanna) [N and NE Thailand].

*Diplazium siamense* is similar to a 1-pinnate-leaved *D. dilatatum* but differs by the lower pinnae nearly symmetrical at base (vs. prominently asymmetrical at base) and apical part of lamina gradually linear-lanceolate (vs. deltoid-lanceolate).

**48. *Diplazium stenochlamys*** C. Christensen, Index Filic. 240. 1905.

网脉双盖蕨 wang mai shuang gai jue

*Allantodia stenochlamys* (C. Christensen) Ching ex W. M. Chu; *Asplenium platyphyllum* Baker (1890), not J. Smith (1859).

Plants evergreen, medium-sized. Rhizome erect, ca. 1.5 cm in diam., woody, apex and stipe base scaly; scales brown, toothed, lanceolate; fronds caespitose. Fertile fronds up to 1 m; stipe brown or light brown, 15–40 cm, 2–8 mm in diam., subfleshy, flattened when dry, upward without scales; lamina 1-pinnate or base 2-pinnate, deltoid or oblong, 20–60 × 15–30 cm, apex acuminate; pinnae 4–7 pairs, alternate, subspreading or ascending, basal 1 or 2 pairs of pinnae oblong, 9–23 × 3.5–7 cm, base subtruncate, with stalk 5–15 mm, pinnatifid 2/3 to costa or only irregularly serrate, apex shortly acute; pinna lobes 4–6 pairs, subspreading, contiguous, narrowly ovate, base occasionally with acroscopic, stalked free pinnule, entire, rounded or acute at apex; veins prominent on both surfaces, pinnate, veinlets usually 7 or 8 pairs, basal 1 or 2 veinlets connected into excurrent veinlets, basal areoles deltoid (pentagonal) or tetragonal. Lamina thinly papery, brown-green when dry, glabrous on both surfaces, rachis green-brown or pale brown. Sori long linear, variably long, from near midrib to pinna margin, single or double; indusia yellow-brown, membranous, persistent. Spores bean-shaped, perispore prominent and hyaline, with granular ornamentation on surface.

Evergreen broad-leaved forests, beside streamlets; 100–900 m. SE Yunnan [N Vietnam].

**49. *Diplazium matthewii*** (Copeland) C. Christensen, Index Filic., Suppl. 1906–1912: 27. 1913.

阔片双盖蕨 kuo pian shuang gai jue

*Athyrium matthewii* Copeland, Philipp. J. Sci., C, 3: 278. 1908; *Allantodia matthewii* (Copeland) Ching; *Diplazium grosselobatum* C. Christensen.

Plants evergreen, medium-sized. Rhizome creeping, brown, 1–2.5 mm in diam., densely scaly at apex, then glabrous; scales brown, lanceolate, ca. 1 cm, membranous, sparsely toothed at margin; fronds approximate. Fertile fronds up to 1 m; stipe brown at base, upward light green-stramineous, up to 40 cm, 6–10 mm in diam., base with sparse lanceolate brown scales, upward glabrous, shallowly grooved adaxially; lamina 1- or 2-pinnate at base, deltoid, up to 70 × 50 cm at base, acuminate; pinnae ca. 8 pairs, alternate, ascending, broadly lanceolate, up to 30 × 12 cm, base broad, slightly asymmetrical, truncate or shallowly cordate, with stalk up to 2 cm, pinnatifid to narrowly ovate or oblong broad lobes, or basal 1 pair of lobes broad and shortly stalked, apex acuminate; pinna lobes up to 12 pairs, alternate, spreading, up to 8 × 2.4 cm, base truncate, basal basiscopic lobe larger, margin crenate or subentire near base, apex shortly acuminate, acute, or rounded; veins not prominent adaxially, visible abaxially, pinnate, veinlets 3–5 pairs, simple, ascending, occasionally 1 basal pair united. Lamina herbaceous, glabrous on both surfaces; rachis light green-stramineous or dark stramineous, glabrous, shallowly grooved adaxially. Sori linear, ascending, 1 or 2 pairs, simple or double, from midrib to 2/3 of veinlet length or nearly to pinna margin; indusia brown, linear, membranous, entire, persistent. Spores hemispherical, perispore prominent, slightly rugate on surface.

Beside streamlets in forests; ca. 300 m. Fujian, Guangdong, Guangxi [N Vietnam].

**50. *Diplazium metcalfii*** Ching, Lingnan Sci. J. 15: 277. 1936.

深裂双盖蕨 shen lie shuang gai jue

*Allantodia metcalfii* (Ching) Ching.

Plants medium-sized. Rhizome short and erect, apex like base of stipe, densely scaly; scales brown, linear-lanceolate, ca. 1 cm, membranous, margin black, toothed; fronds caespitose. Fertile fronds 80–100 cm; stipe brown at base, upward stramineous, 30–40 cm, 4–5 mm in diam., subglabrous, shallowly grooved adaxially; lamina 1-pinnate with pinnatifid pinnules or 2-pinnate at base, deltoid-ovate, up to 60 × 45 cm at base, apex acuminate; pinnae 8–12 pairs, alternate, ascending, ca. 9 cm apart, with stalk ca. 2 cm; lower pinnae narrowly oblong-lanceolate, 30–35 × 5–7 cm, base slightly shortened, truncate, pinnatifid or pinnatisect to costa, apex acuminate; middle to distal parts with shallowly deltoid or dentate lobes; pinna lobes 10–15 pairs, spreading, contiguous, imbricate, ovate-oblong, entire, 2–3 × ca. 1.5 cm, base narrowed and cuneate, adnate to narrow wings, basal 1 pair of pinna lobes sometimes completely free, adnate, apex shortly acuminate; veins prominent, pinnate, veinlets 8–10 pairs, ascending, mostly forked, apical veinlets simple. Lamina thinly herbaceous, dark brown adaxially when dry, glabrous; rachis stramineous, deeply grooved adaxially, rachis and costa abaxially with brown linear scales. Sori linear, up to 1 cm, 6–8 pairs per lobe, ± approximate, ascending, from midrib to near lamina margin; indusia brown, linear, membranous, persistent.

• Forests in wet areas. N Guangdong (Wengyuan).

**51. *Diplazium baishanzuense*** (Ching & P. S. Chiu) Z. R. He, **comb. nov.**

百山祖双盖蕨 bai shan zu shuang gai jue

Basionym: *Allantodia baishanzuensis* Ching & P. S. Chiu, Acta Phytotax. Sin. 36: 375. 1998.

Fertile fronds up to 80 cm; stipe stramineous, up to 33 cm, 1–2 mm in diam., base slightly scaly; scales brown, lanceolate or linear, entire; lamina 1-pinnate with pinnules pinnatifid or base nearly 2-pinnate, ovate-deltoid, up to 45 × 30 cm, base subtruncate, apex acuminate; pinnae up to 10 pairs, alternate or subopposite, slightly ascending; basal pinnae oblong-lanceolate, base slightly cordate, with stalk up to 1 cm; upper pinnae lanceolate, base broadly cuneate, sessile or shortly stalked; basal pinnae larger, up to 20 × 7 cm, pinnatifid to pinnatisect, middle basiscopic lobes longer; lobes oblong or ovate-oblong, margin crenate, sometimes shallowly pinnatifid, apex rounded; veins slightly visible on adaxial surface, prominent abaxially, veinlets up to 10 pairs, simple or forked, sometimes pinnate. Lamina submembranous when dry, green, dark on adaxial surface, glabrous, abaxial side with brown scales. Sori shortly linear, mostly single, medial-intramarginal; indusia brown, membranous, entire.

• S Zhejiang (Baizu Shan, Qingyuan).

*Diplazium baishanzuense* is similar to *D. squamigerum* but differs by the lamina longer than wide, 1-pinnate with pinnatifid pinnules or base nearly 2-pinnate, upper part of stipe and rachis subglabrous, and scales entire.

**52. *Diplazium kansuense*** (Ching & Y. P. Hsu) Z. R. He, **comb. nov.**

甘肃双盖蕨 gan su shuang gai jue

Basionym: *Allantodia kansuensis* Ching & Y. P. Hsu, Fl. Tsinling. 2: 219. 1974.

Plants evergreen, medium-sized. Rhizome ascending, ca. 1.5 cm in diam., apex like base of stipe, sparsely scaly; scales brown, broadly lanceolate, ca. 5 mm, margin sparsely toothed; fronds caespitose. Fertile fronds 60–80 cm; stipe black at base, upward stramineous, 30–40 cm, 2–3 mm in diam.; lamina 2-pinnate with pinnules pinnatifid, deltoid-oblong, as long as stipe, 25–30 cm wide at base, apex acuminate; pinnae 7–10 pairs, alternate, stalked, spreading, broadly lanceolate, basal pinnae as large as second basal pinnae, up to 18 × 6–7 cm at base, apex acuminate; pinnules 8–10 pairs, subopposite, spreading, oblong-lanceolate, basal pinnules larger, 3–4 × ca. 1.5 cm, base asymmetrical, acroscopically auriculate, truncate, parallel to rachis, basiscopically cuneate and decurrent to costa, pinnatifid to pinnatifid, apex acuminate; pinnule lobes subdeltoid, margin serrate; veins prominent, pinnate, simple or forked. Lamina papery, glabrous on both surfaces. Sori linear, 3 or 4 pairs per lobe, single or double on basal acroscopic veinlets, nearly reaching lobe margin; indusia gray-brown, linear, membranous, persistent.

• Forests; ca. 2100 m. Gansu (Tielouhanlingou, Wenxian).

**53. *Diplazium squamigerum*** (Mettenius) C. Hope, J. Bombay Nat. Hist. Soc. 14: 259. 1902.

鳞柄双盖蕨 lin bing shuang gai jue

*Asplenium squamigerum* Mettenius, Ann. Mus. Bot. Lugduno-Batavi 2: 239. 1866; *Allantodia squamigera* (Mettenius) Ching; *Athyrium squamigerum* (Mettenius) Ohwi; *Diplazium yangpieense* Ching.

Plants evergreen, medium-sized. Rhizome creeping or ascending to erect, black-brown, apex densely scaly; scales yellow-brown or black-brown, broadly lanceolate, 7–10 mm, membranous, toothed at margin; fronds distant to caespitose. Fertile fronds 30–80(–110) cm; stipe brown at base, upward stramineous, 20–35(–50) cm, 2–4 mm in diam., base with scales similar to those on rhizome, upward with sparse small scales, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid or not lobate, occasionally 1-pinnate with pinnules pinnatifid, broadly ovate-deltoid, 20–40(–60) × 15–30(–50) cm, apex acuminate; pinnae 5–10 pairs, slightly ascending, broadly oblong-lanceolate or lanceolate, lower pinnae subopposite; basal pinnae largest, oblong or broadly oblong-lanceolate, 10–20(–35) × 5–8(–10) cm at middle, base cuneate, with stalk up to 3 cm, apex long acuminate; upper pinnae alternate, lanceolate, sessile or subsessile; pinnules 5–10 pairs, alternate, spreading, sessile or shortly stalked, ovate or ovate-deltoid to lanceolate, 3.5(–7) × 1.5–2 cm at base, upward gradually narrower, base cuneate, slightly asymmetrical, pinnatifid to pinnatifid, apex shortly acuminate or rounded; basal pinnule lobes small, acroscopic lobe smaller; pinnule lobes oblong, ca. 5 or 6 pairs, ascending, rounded at apex, entire or slightly crenate; veins pinnate, visible abaxially, veinlets dark colored; lamina glabrous on both surfaces; rachis and costae stramineous, shallowly grooved adaxially, sparsely scaly; scales dark brown or yellow-brown, lanceolate. Sori linear, slightly curved, medial-inframedial, single or double on basal acroscopic veinlets; indusia gray-brown, thinly membranous, entire, persistent. Spores reniform, perispore prominent, not rugate.  $2n = 160$ .

Broad-leaved forests, high mountain coniferous forests; 800–3000 m. Anhui, Chongqing, Fujian, Gansu, Guangxi, Guizhou, Henan, Hubei, Jiangsu, Jiangxi, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [N India, Japan, Korea, Nepal].

**54. *Diplazium sibiricum*** (Turczaninow ex Kunze) Sa. Kurata in Namekata, Coll. Cult. Ferns Fern Allies, 340. 1961.

黑鳞双盖蕨 *hei lin shuang gai jue*

Plants evergreen, medium-sized. Rhizome slender, creeping, black, 2–3 mm in diam., apex scaly; scales brown or black-brown, shiny, broadly lanceolate, sparsely toothed at margin; fronds separate or approximate. Fertile fronds up to 80 cm; stipe black at base, upward stramineous, up to 45 cm, lower part with sparse scales similar to those on rhizome; lamina 2-pinnate with pinnules pinnatifid, broadly deltoid, as long as wide, up to 35 cm, apex acuminate; pinnae more than 10 pairs, alternate, slightly ascending, broadly oblong-lanceolate or lanceolate, basal pinnae large, up to 18 × 8 cm, narrowed to base, stalked, apex acuminate; pinnules more than 10 pairs, subspreading, lanceolate or ovate-lanceolate, base broadly cuneate or subtruncate, shortly stalked or sessile, apex usually acuminate; basal 2 or 3 pairs of pinnules shortened, often narrowly ovate, apex obtuse; middle pinnules larger, up to 3.5 × 1 cm, pinnatifid; pinnule lobes up to ca. 10 pairs, oblong, margin

crenate or subentire, occasionally pinnatifid, apex rounded; basal 1 or 2 pairs of lobes sometimes nearly free; veins pinnate, slightly raised and prominent abaxially, visible adaxially, usually purple-brown, veinlets up to ca. 5 pairs per lobe, simple or forked, reaching lobe margin. Lamina herbaceous when dry, green or brown-green; rachis and costae stramineous, costae, costules, and midribs abaxially ± gray-white soft hairy, more densely hairy when young or fronds glabrous. Sori oblong, up to 3 pairs per lobe, medial-supramedial, single or double on basal acroscopic veinlets; indusia light brown, membranous, opening acroscopically, erose at margin, persistent.

Mixed broad-leaved coniferous forests and broad-leaved forests; 1100–3000 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shanxi, Sichuan, Xizang, Yunnan [Japan, Korea, Russia; N Europe].

- 1a. Rachis and costa abaxially with white soft hairs ..... 54a. var. *sibiricum*  
 1b. Lamina abaxially glabrous, without hairs ..... 54b. var. *glabrum*

**54a. *Diplazium sibiricum* var. *sibiricum***

黑鳞双盖蕨(原变种) *hei lin shuang gai jue* (yuan bian zhong)

*Asplenium sibiricum* Turczaninow ex Kunze, Analecta Pteridogr. 25. 1837; *Allantodia crenata* (Sommerfelt) Ching; *Aspidium crenatum* Sommerfelt; *Athyrium crenatum* (Sommerfelt) Ruprecht ex F. Nylander; *A. idoneum* Komarov; *A. mite* Christ.

Rachis and costa abaxially with white soft hairs.

Mixed broad-leaved coniferous forests and broad-leaved forests; 1100–3000 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shanxi [Japan, Korea, Russia; N Europe].

**54b. *Diplazium sibiricum* var. *glabrum*** (Tagawa) Sa. Kurata in Namekata, Coll. Cult. Ferns Fern Allies, 340. 1961.

无毛黑鳞双盖蕨 *wu mao hei lin shuang gai jue*

*Athyrium crenatum* var. *glabrum* Tagawa, Acta Phytotax. Geobot. 11: 238. 1942; *Allantodia crenata* var. *glabra* (Tagawa) W. M. Chu.

Fronds glabrous.

Mixed broad-leaved coniferous forests and broad-leaved forests; 1400–3000 m. Gansu, Henan, Shanxi, Sichuan, Xizang, Yunnan [Japan, Korea].

**55. *Diplazium leptophyllum*** Christ in C. Christensen, Index Filic., Suppl. 1: 103. 1916.

卵叶双盖蕨 *luan ye shuang gai jue*

*Asplenium leptophyllum* Baker, Bull. Misc. Inform. Kew 1906: 10. 1906, not Swartz (1791), nor Lagasca (1802), nor Fée (1857); *Allantodia leptophylla* (Christ) Ching.

Plants evergreen, medium-sized. Rhizome creeping, densely scaly; scales black, linear-lanceolate, ca. 1 cm, entire, apex filiform, slightly curly; fronds approximate. Fertile frond up to 1 m; stipe brown at base, upward stramineous, ca. 40 cm, base sparsely scaly, upward subglabrous; lamina 2-pinnate with

pinnules pinnatifid, deltoid-ovate, up to ca. 50 × 45 cm at base, apex acuminate; pinnae up to 8 pairs, alternate, spreading, lower pinnae 8–10 cm apart; basal pinnae broadly lanceolate, up to 35 × 12 cm, base crenate, with stalk up to 5 cm, apex acuminate; pinnules up to 12 pairs, alternate, slightly ascending, sickle-shaped lanceolate, ca. 10 × 3 cm, base shallowly cordate, with stalk up to 8 mm, pinnatifid, apex acuminate; pinnule lobes up to 10 pairs, oblong, up to 2 × 1.4 cm, margin dentate or shallowly pinnatifid, apex obtuse; basal lobes largest, basiscopic lobe ovate-oblong, nearly pinnatifid; veins prominent, pinnate, veinlets 5 or 6 pairs per each lobe, 2- or 3-furcate, ascending. Lamina herbaceous, yellow-green when dry, glabrous on both surfaces; rachis and costae stramineous, glabrous, shallowly grooved adaxially. Sori linear, 4–6 mm, 6 or 7 pairs per lobe, inframedial, from midrib to near lobe margin, usually double or forked; indusia light brown, linear, membranous, persistent. Spores bean-shaped, perispore indistinguishable, with dense aculeate ornamentation on surface.

Evergreen broad-leaved forests; 1200–1500 m. S and W Yunnan (Longling, Menghai, Tengchong) [Bhutan, Myanmar, N Thailand].

The type specimen is *A. Henry 13106*, recorded as collected from Simao (“Szemao”), S Yunnan, but most likely collected from Xishuangbanna, Menghai. This species is very common in Menghai under secondary mixed broad-leaved coniferous forests and evergreen broad-leaved forests at elevations as high as Henry’s record (5000 ft. = 1524 m).

**56. *Diplazium glingense*** (Ching & Y. X. Lin) Z. R. He, **comb. nov.**

格林双盖蕨 *ge lin shuang gai jue*

Basionym: *Allantodia glingensis* Ching & Y. X. Lin, Acta Phytotax. Sin. 22: 199. 1984.

Plants evergreen, medium-sized to large. Rhizome erect, apex densely scaly; scales dark brown, membranous, margin black, narrow and toothed; fronds caespitose. Fertile frond up to 1 m or longer; stipe black-brown at base, ca. 50 cm, ca. 5 mm in diam., with sparse scales similar to those on rhizome; lamina 2-pinnate, ovate-deltoid, ca. 65 × 45 cm, apex acuminate; pinnae ca. 10 pairs, alternate, slightly ascending, oblong, up to 25 × 12 cm, with stalk up to 2.5 cm, apex long acuminate; lower pinnae pinnatifid, upper pinnae shallowly incised or subentire; fifth or upper pairs of pinnae shallowly lobed into orbicular lobes or entire, lanceolate, gradually shortened to 5 cm, ca. 1.5 cm wide, base broader, asymmetrical, rounded-cuneate; pinnules up to 6 pairs, sessile, shortly lanceolate, up to 7 × 1.5 cm, base slightly asymmetrical, rounded-truncate or subtruncate, entire, apex acuminate; basal 1 or 2 pairs of pinnules slightly shortened; veins pinnate, slightly visible. Lamina brown-green when dry, thickly papery, glabrous adaxially, costules and midribs abaxially with brown, lanceolate scales. Sori and indusia brown, linear, mostly single, few double, inframedial, from midrib to nearly 1/2 of veinlet length, easily deciduous.

- Evergreen broad-leaved forests. SE Xizang (Médog).

**57. *Diplazium petelotii*** Tardieu, Asplén. Tonkin, 66. 1932.

褐柄双盖蕨 *he bing shuang gai jue*

*Allantodia petelotii* (Tardieu) Ching.

Plants evergreen, medium-sized. Rhizome erect, brown, ca. 1 cm in diam., apex like base of stipe, densely scaly, with dense, brown, stiff, fleshy, thick roots; scales brown, linear-lanceolate, 6–7 mm, membranous, entire; fronds caespitose. Fertile frond up to 1.2 m; stipe brown at base, upward green-brown, 35–40 cm, 6–7 mm in diam., base scaly, upward subglabrous, shallowly grooved adaxially; lamina 2-pinnatifid to pinnatisect, or lower part of middle pinnae 1-pinnate, ovate-deltoid, up to 90 × 50 cm, apex acuminate; pinnae up to 12 pairs, slightly ascending, lanceolate, broadly oblong-lanceolate, or broadly deltoid-lanceolate, apex acuminate; basal 1 pair or 2 pairs of pinnae usually shorter; middle pinnae largest, up to 30 × 15 cm, lower 1–5 pairs of pinnules sessile or adnate; pinnules up to 15 pairs, oblong and acute, or lanceolate and long acuminate, up to 7 × 1.5 cm, base broadly cuneate, repand or obliquely crenate, slightly falcate; pinnule lobes mostly shallowly repand; veins visible on both surfaces, pinnate, veinlets 1–3 pairs, simple, ascending. Lamina herbaceous, brown-green when dry, glabrous on both surfaces; rachis green-brown, glabrous, shallowly grooved adaxially; costae abaxially occasionally with linear brown scales. Sori linear, 3–4 mm, up to 6 pairs, inframedial, from midrib to 1/2–2/3 of veinlet length, single or double on basal acroscopic veinlet; indusia brown, linear, membranous, entire, persistent.

Beside streamlets in dense forests; 100–400 m. Guizhou (Libo), SE Yunnan (Hekou, Jinping) [N Thailand, N Vietnam].

**58. *Diplazium subdilatatum*** (Ching) Z. R. He, **comb. nov.**

楔羽双盖蕨 *xie yu shuang gai jue*

Basionym: *Allantodia subdilatata* Ching, Acta Phytotax. Sin. 9: 355. 1964.

Plants evergreen, medium-sized. Rhizome erect, black-brown, apex with sparse scales and verrucose protuberances; scales dark brown, broadly lanceolate, ca. 6 mm, entire; fronds caespitose. Fertile frond up to 1 m or longer; stipe gray-stramineous, up to 60 cm, ca. 5 mm in diam., glabrous, grooved adaxially, base with sparse scales and verrucose processes; lamina 2-pinnate with pinnules pinnatifid, ovate-oblong, up to 80 × 60 cm, apex acuminate; pinnae up to 10 pairs, alternate, ascending, with stalk up to 3 cm, broadly oblong-lanceolate, up to 30 × 18 cm, base truncate, apex long acuminate; pinnules ca. 10 pairs, ascending, alternate, lower pinnules subsessile, upper pinnules ± adnate, deltoid-lanceolate, up to 10 × 2 cm, base wider on both sides, broadly cuneate, pinnatifid 1/4–1/3 from margin, apex long acuminate; pinnule lobes ascending, oblong, up to 6 mm wide, entire or shallowly crenate; veins prominent, pinnate, veinlets simple, up to 5 pairs per lobe, oblique. Lamina papery, light brown when dry, glabrous on both surfaces; rachis and costae glabrous, shallowly grooved adaxially. Sori shortly linear, slightly curved, usually single per lobe (1 or 2 pairs per basal lobe), 3–5 mm, costular from costa to usually 2/3 of veinlet length, opening acroscopically; indusia light brown, linear, membranous, entire, ± persistent when mature.

- Forests. Hainan (Jianshan, Lingshui).

**59. *Diplazium quadrangulatum*** (W. M. Chu) Z. R. He, **comb. nov.**四棱双盖蕨 *si leng shuang gai jue*Basionym: *Allantodia quadrangulata* W. M. Chu, Acta Bot. Yunnan. 3: 333. 1981.

Plants evergreen, large. Rhizome erect, trunk up to 40 cm tall, up to 10 cm in diam., apex densely scaly; scales dark brown, linear-lanceolate, margin black, sparsely toothed; fronds caespitose. Fertile frond up to 2 m; stipe green, shorter than lamina, quadrangular (rachis also quadrangular, costae terete), up to 5 mm in diam., base slightly scaly; lamina 2-pinnate with pinnules pinnatifid, ovate-oblong, up to 1.5 m, apex acuminate; lateral pinnae up to 13 pairs, alternate, slightly ascending, base truncate, apex acuminate; lower pinnae broadly lanceolate or oblong-lanceolate, up to 50 × 20 cm, with stalk up to 5 cm; pinnules up to 14 pairs, lanceolate or oblong-lanceolate, up to 10 × 3 cm, base truncate, pinnatifid or incised, apex acuminate; lower pinnules shortly stalked; pinnule lobes up to 10 pairs, slightly ascending, slightly crenate, truncate at apex; veins pinnate, veinlets 7 pairs per lobe, ascending, simple, occasionally forked. Lamina papery when dry, green, glabrous on both surfaces; rachis and costae green, glabrous. Sori linear, 3 (or 4) pairs per pinnule lobe, inframedial from costule to 1/2–3/4 of veinlet length, single or double on basal acroscopic veinlet; indusia brown, membranous, entire. Spores reniform, perispore with reticulate ornamentation.

- Evergreen broad-leaved forests; 1000–1300 m. S and SE Yunnan.

In some plants, the lamina is 1-pinnate, narrowly deltoid, ca. 35 × 25 cm; and the pinnae are lanceolate, pinnatifid.

*Diplazium quadrangulatum* is distinct in the genus by having a quadrangular stipe and rachis.

**60. *Diplazium dilatatum*** Blume, Enum. Pl. Javae 2: 194. 1828.毛柄双盖蕨 *mao bing shuang gai jue*

*Allantodia crinipes* (Ching) Ching; *A. dilatata* (Blume) Ching; *A. veitchii* (Christ) Ching; *A. yaoshanica* (Ching) Ching & C. H. Wang; *Asplenium dilatatum* (Blume) Hooker; *A. latifolium* D. Don (1825), not Bory (1803); *Athyrium dilatatum* (Blume) Milde; *Diplazium crinipes* Ching; *D. latifolium* T. Moore; *D. veitchii* Christ; *D. yaoshanicum* Ching.

Plants evergreen, large. Rhizome creeping to ascending or erect, erect trunk up to 50 cm tall, up to 10 cm in diam., apex densely scaly; scales dark brown or yellow-brown, linear-lanceolate or linear, margin black and toothed, apex long curly; fronds sparse or caespitose. Fertile frond up to 3 m; stipe black-brown at base, upward green-stramineous or green-brown, robust, up to 1 m, up to 1 cm in diam., base densely scaly; scales similar to those on rhizome; hairs brown, curly, short, soft, deciduous; stipe upward gradually glabrous; lamina 2-pinnate or 2-pinnate with pinnules pinnatifid, deltoid, up to 2 × 1 m, apex acuminate; pinnae up to 14 pairs, alternate, ascending; lower pinnae ovate or broadly lanceolate, up to 70 cm, upper pinnae lanceolate, base shortly stalked or adnate; pinnules up to

15 pairs, alternate, spreading, ovate-lanceolate or lanceolate, up to 20 × 4 cm, shortly stalked or sessile, base shallowly cordate or broadly cuneate, pinnatifid to pinnatifid or incised, apex long acuminate or caudate; pinnule lobes up to 15 pairs, slightly ascending, margin shallowly serrate or subentire, apex rounded or truncate; basal basisopic lobes often prominently large; veins pinnate, veinlets up to 8 pairs per pinnule lobe, simple, ascending, reaching pinnule margin (basal acroscopic veinlets sometimes ending apart from margin). Lamina papery when dry, usually green or dark green on adaxial surface, costae, costules, and midribs with ± white or light brown, subspherical glands, gray-brown abaxially, with brown, linear scales and uniseriate short soft hairs; rachis and costae green-stramineous, glabrous. Sori linear, up to 7 pairs per pinnule lobe, most single, few double, inframedial from costa to 1/2 length of veinlet; indusia brown, membranous, margin ciliate, opening acroscopically, persistent. Spores subreniform, perispore prominent, few rugate.  $2n = 82$ .

Wet broad-leaved forests in tropical mountains; 100–1900 m. Chongqing, S Fujian, Guangdong, Guangxi, E and S Guizhou, Hainan, Sichuan, Taiwan, Yunnan, S Zhejiang [India, Indonesia, S Japan, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam; tropical Australia, Pacific islands (Polynesia)].

*Diplazium dilatatum* is remarkably polymorphic in the genus: rhizome slender and creeping, ascending to robust and erect; lamina less than 1 m, fertile fronds 1-pinnate to 2-pinnate. Plants with 1-pinnate fronds have been separated as *D. veitchii* and *D. yaoshanicum*.

**61. *Diplazium uraiense*** Rosenstock, Hedwigia 56: 336. 1915.圆裂双盖蕨 *yuan lie shuang gai jue*

*Allantodia cycloloba* (Christ) Ching; *A. uraiensis* (Rosenstock) Ching; *Diplazium latifolium* T. Moore var. *cyclolobum* Christ; *D. uraiense* Rosenstock var. *cyclolobum* (Christ) Tagawa.

Plants evergreen, medium-sized to large. Rhizome erect, brown, ca. 1.5 cm in diam., apex like base of stipe, densely scaly; scales dark brown, linear-lanceolate, ca. 1 cm, membranous, margin black, narrow, toothed; fronds caespitose; fertile frond up to 1.4 m; stipe brown at base, upward gradually gray-stramineous, up to 60 cm, ca. 7 mm in diam., upward glabrous, somewhat quadrangular, shallowly grooved adaxially; lamina 2-pinnate, oblong-deltoid, up to 80 × 60 cm; pinnae up to 9 pairs, alternate, slightly ascending, slightly narrowed to base, apex pinnatifid; second basal pinnae largest, oblong, ca. 40 cm; pinnules up to 13 pairs, alternate, slightly ascending, linear-lanceolate, or lower pinnules narrowed, narrowly elliptic to lanceolate, up to 10 cm, base rounded or crenate, symmetrical or nearly symmetrical, sparsely shallowly incised or pinnatifid, apex acuminate; pinnule lobes orbicular, entire or minutely crenate; veins pinnate, visible abaxially, not prominent adaxially, veinlets 4 or 5 pairs per pinnule lobe, simple, ascending. Lamina papery, brown-green when dry, glabrous on both surfaces; rachis brown-stramineous, slightly quadrangular, glabrous, shallowly grooved adaxially; costules abaxially with sparse hairlike red-brown scales. Sori linear, ± falcate, 2–5 pairs per lobe, inframedial from costule to 1/2 or more to margin,

single or double on basal acroscopic veinlets; indusia light brown, linear, membranous, opening acroscopically, persistent.

- Evergreen broad-leaved forests; 500–1000 m. Hainan, Taiwan.

*Diplazium uraiense* is similar to *D. dilatatum* but differs by the pinnule linear-lanceolate, symmetrical at base, and shallowly pinnatifid. Some authors treat this species as a synonym of *D. dilatatum* (e.g., see Knapp, Ferns Fern Allies Taiwan, 449–450. 2011).

**62. *Diplazium forrestii*** (Ching ex Z. R. Wang) Fraser-Jenkins, Taxon. Revis. Indian Subcontinental Pteridophytes, 256. 2008.

棕鳞双盖蕨 zong lin shuang gai jue

*Allantodia forrestii* Ching ex Z. R. Wang, Acta Phytotax. Sin. 32: 82. 1994; *A. subintegra* Ching & Y. X. Lin.

Plants evergreen, large. Rhizome ascending, black-brown, up to 5 cm in diam., apex scaly; scales dense, loose, yellow-brown, slightly shiny, lanceolate or linear-lanceolate, 1–1.5 cm, margin minutely toothed; fronds caespitose. Fertile frond up to 2 m; stipe black-brown at base, upward yellow-brown, up to 1 m, up to 8 mm in diam., base densely scaly; scales similar to those on rhizome, upward sparsely scaly; scales yellow-brown, linear-lanceolate to linear; lamina 2-pinnate, broadly ovate-deltoid or deltoid, up to 1 m × 90 cm; pinnae up to 14 pairs, alternate, ascending; lower pinnae oblong-lanceolate or broadly lanceolate, up to 50 × 25 cm, with stalk up to 3 cm, apex acuminate, distal part shallowly incised; upper pinnae gradually shortened, lanceolate, pinnatifid or entire, similar to and as large as pinnules of lower pinnae; pinnules up to 13 pairs, alternate, subspreading, oblong-lanceolate, up to 12 × 2.5 cm, base shallowly cordate, rounded, or subtruncate, mostly shortly stalked, lobed to rounded-lobed, or incised, apex acuminate or long acuminate, in small plants margin subentire; veins pinnate, veinlets less than 5 pairs, simple, ascending, basal veinlets curved. Lamina thickly papery when dry, green, lighter abaxially; rachis and costae abaxially with sparse linear, yellow-brown scales, costules and midribs abaxially with thin, yellow-brown, membranous scales. Sori linear, 1–6 on either side of midrib, mostly double, from midrib to 2/3 of veinlet length; indusia yellow-brown, membranous, margin entire when young, then gradually erose or lacerate. Spores subreniform, perispore hyaline and prominent, few rugate.

Evergreen broad-leaved forests; 1400–2100 m. ?Taiwan, SE Xizang (Médog), NW and W Yunnan (Fugong, Gongshan, Tengchong) [NE India, N Myanmar].

*Diplazium forrestii* is similar to *D. dilatatum* but differs by the scales yellow-brown, stipe and rachis densely scaly, pinnules incised or subentire, and sori mostly double, linear from midrib to below margin. It is also similar to *D. glingense* (the type of each from Médog) but differs by the scale color.

For further views on *Diplazium forrestii*, see Fraser-Jenkins (loc. cit.: 256–258) and Knapp (Ferns Fern Allies Taiwan, 449–450. 2011).

**63. *Diplazium griffithii*** T. Moore, Index Fil. 330. 1861.

镰羽双盖蕨 lian yu shuang gai jue

*Allantodia griffithii* (T. Moore) Ching; *Athyrium griffithii* (T. Moore) Milde.

Plants evergreen, medium-sized. Rhizome creeping, black-brown, up to ca. 1 cm in diam., apex densely scaly; scales black or black-brown, lanceolate or linear-lanceolate, thickly membranous, distal margin toothed; fronds approximate to caespitose. Fertile frond 0.5–1 m; stipe black-brown at base, upward stramineous or green-stramineous, 20–50 cm, 2–3 mm in diam., base with sparse scales similar to those on rhizome, upward glabrous, shallowly grooved adaxially; lamina 1-pinnate with pinnae pinnatifid to pinnatisect, or lower part 2-pinnate, deltoid, 20–50 × 20–30 cm at base, apex acuminate; pinnae 8–10 pairs, alternate, slightly ascending or spreading, sickle-shaped lanceolate, asymmetrical (wider on basiscopic side), up to 20 × 3–5 cm, stalked (stalk ca. 2 cm), base shallowly cordate or broadly cuneate, pinnatifid or pinnate on basiscopic side, apex caudate or long acuminate; free pinnules of lower pinnae 1 or 2 pairs, pinna lobes up to ca. 15 pairs, subspreading, approximate or contiguous, sickle-shaped lanceolate or suboblong, margin serrate, occasionally pinnatifid, apex shortly acuminate or rounded; veins visible abaxially, not prominent adaxially, pinnate; veinlets of lower pinnae usually 2-furcate, ascending. Lamina firmly herbaceous when dry, gray-green, glabrous on both surfaces; rachis green-stramineous, glabrous, shallowly grooved adaxially. Sori shortly linear, from costule or near costule to below lamina margin, up to 10 pairs per pinna lobe, mostly single or double on basal acroscopic veinlet, or occasionally forked; indusia brown when mature, membranous, entire, opening acroscopically, persistent. Spores bean-shaped, perispore hyaline, few rugate.

Evergreen broad-leaved forests; 1000–1900 m. W Guangxi (Baise), S Guizhou, S Hunan (Wugang), SE Yunnan (Jiping, Maguan, Yuanyang) [NE India, N Vietnam].

**64. *Diplazium petrii*** Tardieu, Asplén. Tonkin, 67. 1932 [“*petri*”].

假镰羽双盖蕨 jia lian yu shuang gai jue

*Allantodia jiulongshanensis* P. S. Chiu & G. Yao ex Ching; *A. petrii* (Tardieu) Ching; *Athyrium petrii* (Tardieu) Ohwi; *Diplazium maximum* (D. Don) C. Christensen var. *formosanum* Rosenstock; *D. triangulare* Tagawa.

Plants evergreen, medium-sized. Rhizome creeping, black, apex densely scaly, with dense black-brown, stiff roots on adaxial side; scales black, linear-lanceolate, thick, margin minutely toothed; fronds approximate. Fertile fronds up to 1.3 m; stipe black at base, upward brown-stramineous or green-stramineous, up to 65 cm, 2–3 mm in diam., base sparsely scaly, scales similar to those on rhizome, upward glabrous, shallowly grooved adaxially; lamina 1-pinnate with pinnae pinnatifid or lower pinnae 2-pinnate, deltoid, up to 65 × 50 cm, apex acuminate; pinnae usually 8–12 pairs, slightly ascending, alternate; lower pinnae usually opposite or subopposite, ovate or ovate-lanceolate, up to 20 × 8 cm, with stalk up to 4 cm, base truncate, pinnatifid or 1-pinnate, apex long acuminate; upper pinnae lanceolate, base broadly cuneate, shortly stalked or sessile, pinnatifid to pinnatifid; free pinnules up to 5 pairs, alternate, sessile, sickle-shaped lanceolate, occasionally oblong, up to 5 cm × 5–15 mm at base, margin dentate or pinnatifid, apex acuminate or rounded; veins pinnate, prominent on adaxial

surface, visible abaxially, veinlets usually forked, ascending, reaching lobe margin. Lamina firmly papery when dry, light green or gray-green abaxially, dark green or pale brown-green adaxially, glabrous on both surfaces; rachis brown-stramineous or green-stramineous, costae and costules green-stramineous, glabrous. Sori shortly linear, usually single or double, ascending, not reaching margin; indusia brown when mature, membranous, entire, opening acropically, persistent. Spores subreniform, perispore prominent, few rugate, with granular ornamentation.

Tropical and subtropical mountains, evergreen broad-leaved forests; 1000–1800 m. Guangxi, Guizhou, Hainan, Taiwan, Yunnan, Zhejiang [S Japan (Ryukyu Islands), Philippines, N Vietnam].

*Diplazium petrii* is similar to *D. griffithii* but differs by the pinnae nearly symmetrical and many free pinnules in the lower pinnae.

**65. *Diplazium tibeticum*** (Ching & S. K. Wu) Z. R. He, **comb. nov.**

西藏双盖蕨 xi zang shuang gai jue

Basionym: *Allantodia tibetica* Ching & S. K. Wu, Fl. Xizang, 1: 147. 1983.

Plants evergreen, medium-sized to large. Rhizome creeping, black-brown; fronds sparse to caespitose. Fertile fronds up to 1.6 m; stipe black-brown at base, upward brown or pale brown, up to 80 cm, up to 7 mm in diam., sparsely scaly; scales brown, lanceolate, thickly membranous, margin sparsely toothed; lamina 2- or 3-pinnate, deltoid, up to 80 × 60 cm, apex acuminate; pinnae 6–10 pairs, alternate; basal 3 pairs of pinnae oblong, slightly ascending, up to 40 × 20 cm, base slightly narrowed, with stalk ca. 1 cm, pinnate, apex acuminate; middle pinnae ovate-lanceolate, pinnatifid to pinnatifid, apex acuminate; upper pinnae lanceolate, margin shallowly incised or subentire, base broader, shallowly cordate or broadly crenate, shortly stalked or sessile, ± auriculate; pinnules 8 pairs, lanceolate or narrowly ovate, up to 10 × 2.5 cm, base broader, broadly cuneate or subtruncate, sessile or subsessile, margin shallowly incised or repand, or entire, apex acuminate; lobes of lower pinnae up to ca. 9 pairs, oblong and rounded, or subdeltoid, slightly falcate, entire, acute at apex; veins prominent abaxially, slightly visible adaxially, veinlets simple, few forked, oblique, up to 6 pairs at base of pinnule. Lamina thinly membranous when dry, pale abaxially, dark brown-green adaxially; rachis, costae, and costules abaxially sparsely scaly; scales brown, lanceolate, toothed. Sori linear, subcostular or inframedial, from costule or near costule to 1/2–2/3 of veinlet length, single or double on basal acropical veinlets; indusia brown, membranous, lacerate, opening acropically when mature. Spores reniform, perispore prominent, few rugate.

- Broad-leaved forests; 900–1900 m. SE Xizang (Médog).

**66. *Diplazium simile*** (W. M. Chu) R. Wei & X. C. Zhang, *Lycophytes Ferns China*, 410. 2012.

肉刺双盖蕨 rou ci shuang gai jue

*Allantodia similis* W. M. Chu, *Acta Bot. Yunnan*. 3: 337. 1981.

Plants evergreen, large. Rhizome ascending, apex with ad-

pressed scales; scales brown, broadly lanceolate, membranous, margin toothed and inconspicuously black; fronds approximate to distant. Fertile frond up to 2 m; stipe black-brown at base, upward pale green, shorter than lamina, base up to 7 mm in diam., with slightly fleshy, green, shortly aculeate or verrucose protuberances throughout stipe, or at lower part of stipe; lamina 2-pinnate with pinnules pinnatifid, ovate-deltoid, up to 1 m × 80 cm, apex acuminate; pinnae up to 12 pairs, alternate, slightly ascending, 1-pinnate, acuminate at apex; lower pinnae broadly oblong-lanceolate, with stalk up to 10 cm, basal pinnae slightly shortened, second basal pinnae largest, up to 70 × 30 cm; pinnules up to ca. 13 pairs, alternate or subopposite, spreading, lanceolate, broadly lanceolate, or broadly deltoid-lanceolate, symmetrical or nearly symmetrical, up to 10(–15) × 2–3(–5) cm, base truncate or broadly cuneate, sometimes slightly cordate, pinnatifid to pinnatifid, apex acuminate or shortly caudate; lower pinnules shortly stalked, upper pinnules sessile; pinnule lobes contiguous, nearly symmetrical, spreading, oblong or rectangular, apex rounded or truncate, rarely acute, entire or shallowly serrate; veins visible abaxially, not prominent adaxially, veinlets up to 11 pairs per lobe, ascending, simple or rarely forked. Lamina thinly papery when mature, green, dark adaxially, costules with granular thin glands adaxially, abaxially minutely scaly; rachis and costae abaxially sometimes with fleshy, green, small verrucose or shortly aculeate protuberances. Sori linear, membranous, entire; spores reniform, perispore hyaline and wide, not rugate, tuberculate.  $n = 41^*$ .

- Tropical rain forests, beside streamlets; 300–1200 m. Yunnan.

In some plants, the lamina is 1-pinnate, ca. 50 × 30 cm; and the pinnae are lanceolate, pinnatifid to pinnatifid.

*Diplazium simile* is similar to *D. maximum* in the lamina shape but differs by the rhizome ascending to erect; scales sparse, adpressed, brown, not shiny, with inconspicuously black margin; stipe and rachis with ± green, fleshy, verrucose or shortly aculeate protuberances; costa and costule with granular thin glands; and spores with prominent wide perispore.

**67. *Diplazium laxifrons*** Rosenstock, *Hedwigia* 56: 337. 1915.

异裂双盖蕨 yi lie shuang gai jue

*Allantodia laxifrons* (Rosenstock) Ching; *A. inaequiloba* Ching; *Diplazium polypodioides* Blume var. *sinense* Christ.

Plants evergreen, medium-sized to large. Rhizome creeping or ascending to erect, sometimes trunk up to 40 cm tall, ca. 10 cm in diam., apex slightly scaly; scales brown and thin, adpressed; fronds approximate to caespitose. Fertile frond up to 2.5 m; stipe dark brown at base, upward brown or green-stramineous, up to 1 m, up to 1 cm in diam., glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid to pinnatifid, deltoid or ovate-deltoid, up to 1.5 × 1 m, apex acuminate; pinnae up to 20 pairs, alternate, ascending; lower pinnae broadly oblong-lanceolate or broadly lanceolate, symmetrical, up to 60 × 20 cm, with stalk up to 6 cm, base black-brown, apex acuminate; upper pinnae lanceolate, slightly asymmetrical (basiscopic lobe longer), base sessile or subsessile, pinnatifid to pinnatifid, apex acuminate; pinnules up to 20 pairs, alternate, spreading, lanceolate, up to 13

× 3 cm, base shallowly cordate, truncate, or broadly cuneate, asymmetrical, acroscopic lobe prominent, pinnatipartite or sub-pinnatisect, apex acuminate or long acuminate; pinnule lobes more than 15 pairs, ascending, oblong or rectangular, margin dentate, sometimes shallowly serrate or subentire, apex rounded or truncate; basal basispic lobes in middle pinnules much larger and shallowly pinnatilobate or dentate; veins not prominent on adaxial side, visible abaxially, pinnate, veinlets up to 9 pairs per lobe, usually 2-furcate or pinnate, sometimes simple, oblique. Lamina herbaceous, green or gray-green when dry, not shiny, rachis and costa green-stramineous or light brown, costae and costules abaxially with deciduous short hairs and small scales. Sori linear or shortly linear, up to 7 pairs per lobe, subcostular, reaching to 2/3 of veinlet length; indusia brown when mature, membranous, persistent. Spores subreniform, perispore prominent and hyaline, not rugate, with granular ornamentation.

Evergreen broad-leaved forests, beside streamlets; 300–2200 m. Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Sichuan, Taiwan, SE Xizang, Yunnan [Bhutan, India, Kashmir, Nepal].

*Diplazium laxifrons* is characterized by the naked base of stipe, stalk of lower pinnae black-brown, and basal basispic lobes of middle pinnules markedly larger and shallowly pinnatilobate.

**68. *Diplazium taquetii*** C. Christensen, Bull. Acad. Int. Géogr. Bot. 21: 69: 1911.

东北双盖蕨 dong bei shuang gai jue

*Allantodia taquetii* (C. Christensen) Ching.

Plants summer-green, medium-sized to large. Rhizome creeping, apex scaly; scales adpressed, brown, ovate-lanceolate. Fertile frond up to 70 cm, ca. 8 mm in diam.; stipe brown at base, scaly; scales fewer but similar to those on rhizome; stipe upward stramineous, deeply grooved adaxially; lamina 2-pinnate with pinnules pinnatipartite, deltoid, up to 70 × 60 cm, apex acuminate; pinnae up to 8 pairs, alternate, ascending, with stalk up to 4 cm, base brown, upward stramineous, basal pinnae largest, broadly lanceolate, up to 40 × 17 cm, slightly narrow to base, base truncate, apex acuminate; pinnules up to 15 pairs, alternate, slightly ascending, with stalk up to 4 mm, lanceolate, up to 9 × 2 cm, base asymmetrical, cordate, pinnatipartite, apex caudate-acuminate; pinnule lobes up to 12 pairs, spreading, deltoid or sickle-shaped lanceolate, ca. 1 cm × 4 mm, apex slightly narrowed, acuminate or subrounded; basal basispic lobe markedly larger, dentate at margin, basal 1 or 2 pairs of pinnule lobes nearly free, upper pinnule lobes connate with narrow wings; veins not prominent on adaxial side, visible abaxially, pinnate, veinlets 8 pairs per pinnule lobe, mostly forked, ascending. Lamina light brown, submembranous when dry, costules abaxially with sparse light brown glands; rachis and costa stramineous, shallowly grooved adaxially. Sori linear, up to 3 mm, 6 pairs per pinnule lobe, from costule upward to 2/3 of veinlet length, single or double on basal acroscopic veinlets; indusia light brown, linear, thinly membranous, persistent. Spores reniform, perispore with densely aculeate ornamentation.

Forests. Liaoning (Liaodong Peninsula) [Korea].

**69. *Diplazium amamianum*** Tagawa, Acta Phytotax. Geobot. 3: 35. 1934.

奄美双盖蕨 yan mei shuang gai jue

*Allantodia amamiana* (Tagawa) W. M. Chu & Z. R. He.

Plants evergreen, large. Rhizome erect, up to 50 cm tall, up to 6 cm in diam., apex scaly; scales sparse, loose; fronds caespitose. Fertile frond up to 1.5 m; stipe up to 50 cm, up to 7 mm in diam. at base, sparsely scaly; scales rust-colored, ovate-lanceolate, membranous, deciduous; stipe upward glabrous, grooved adaxially; lamina 2-pinnate with pinnules pinnatipartite to pinnatisect, broadly ovate-deltoid, up to 1 m × 80 cm, apex acuminate; pinnae ca. 17 pairs, alternate, spreading, oblong-lanceolate, up to 45 × 17 cm, base truncate, with stalk ca. 4 cm, apex acuminate; pinnules spreading or subspreading, lanceolate, up to 10 × 2 cm, base broadly cuneate or subtruncate, sessile or lower pinnules shortly stalked, pinnatipartite to pinnatisect, obliquely dentate, acuminate at apex; pinnule lobes up to 15 pairs, subspreading or ascending, oblong, ca. 10 × 4 mm, margin dentate, apex rounded; veins pinnate, prominent abaxially, visible adaxially; veinlets 6 pairs, simple or forked, ascending. Lamina thickly herbaceous when dry, light green abaxially, dark green adaxially; rachis pale brown, grooved adaxially, abaxially with sparse verrucose processes; costae deeply grooved adaxially, abaxially glabrous or with small verrucose processes; costules grooved adaxially, glabrous or with sparse small glandular hairs abaxially. Sori linear, up to 7 pairs per pinnule lobe, from middle of veinlet or close to midrib to 2/3–4/5 of veinlet length, mostly single or double on basal acroscopic veinlet; indusia brown, linear, flattened, margin shallowly lacerate, persistent. Spores reniform, perispore few rugate.  $2n = 82$ .

Taiwan (Nantouxitou) [Japan].

*Diplazium amamianum* was tentatively treated as a synonym of *D. laxifrons* by Fraser-Jenkins (Taxon. Revis. Indian Subcontinental Pteridophytes, 267. 2008) and subsequently by Knapp (Ferns Fern Allies Taiwan, 450. 2011).

**70. *Diplazium asperum*** Blume, Enum. Pl. Javae 2: 195. 1828.

粗糙双盖蕨 cu cao shuang gai jue

*Allantodia aspera* (Blume) Ching; *Asplenium asperum* (Blume) Mettenius ex Hooker; *Athyrium asperum* (Blume) Milde; *Diplazium polypodioides* Beddome; *Microstegia aspera* (Blume) C. Presl.

Plants evergreen, large. Rhizome erect, black-brown, robust, trunklike, apex densely scaly; scales brown, linear or linear-lanceolate, up to 2 cm, thickly membranous, margin toothed, with narrow black band; fronds caespitose. Fertile fronds up to 4 m; stipe brown at base, upward dark stramineous or light brown, robust, up to 2 m, up to 2 cm in diam., base densely scaly, scales similar to those on rhizome, upward with many stiff short aculeate protuberances, with similar processes on rachis; lamina 2-pinnate with pinnules pinnate, ovate-oblong, up to 2 × 1.4 m, apex acuminate; pinnae 24 pairs, alternate, ascending, broadly oblong-lanceolate, up to 85 × 25 cm, base truncate, stipe up to 7 cm, apex acuminate; pinnules up to 30 pairs, alternate or subopposite, spreading, nearly symmetrical; lower pinnules often shortly stalked, lanceolate or linear-lanceolate, up to 13 × 2.5 cm, base truncate, slightly asymmetrical

(acroscopic lobe smaller), pinnatipartite to costa, apex acuminate; pinnule lobes or secondary pinnules up to 20 pairs or more, sickle-shaped oblong, slightly oblique, margin regularly serrate, apex rounded or subacute; veins visible, pinnate, veinlets simple, ascending, up to 14 pairs per pinnule lobe. Lamina stiffly papery when dry, usually gray-green, occasionally gray-brown, paler abaxially; rachis and costa stramineous or light brown, abaxial side with shortly aculeate protuberances, adaxially shallowly grooved, with light brown short hairs. Sori linear or suboblong, up to ca. 10 pairs per pinnule lobe, often single or double on basal acroscopic veinlets, costal-inframedial, from costule to 1/2 of veinlet length or longer, often contiguous when mature; indusia brown when mature, lacerate, membranous, opening acroscopically, persistent. Spores subreniform, perispore hyaline and wide, few rugate.  $2n = 82$ .

Tropical mountain valleys, rain forests, beside streamlets; 300–1200 m. Hainan, Taiwan (Taidong), SE and SW Yunnan [Cambodia, S India, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam].

**71. *Diplazium viridescens*** Ching, Acta Phytotax. Sin. 8: 167. 1959.

草绿双盖蕨 cao lü shuang gai jue

*Allantodia obtusipinnula* Ching; *A. truncatula* Ching; *A. viridescens* (Ching) Ching.

Plants evergreen, medium-sized. Rhizome erect, black-brown, short, up to 3 cm in diam., with many black-brown, stiff, long and thick roots, apex slightly scaly; scales dark brown, ovate-lanceolate, 3–5 mm, membranous, entire, apex acuminate; fronds few, caespitose. Stipe black-brown at base, upward green-stramineous or pale brown, shorter than lamina, 2–4 mm in diam., base with sparse scales similar to those on rhizome, upward glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatilobate, ovate-deltoid, up to 80 × 50 cm; pinnae up to 10 pairs or more, usually alternate, slightly ascending, symmetrical, upper pinnae lanceolate and pinnatilobate, other pinnae broadly oblong-lanceolate or broadly lanceolate, pinnate, with stalk of basal pinnae up to 3.5 cm; pinnules up to ca. 10 pairs, spreading, alternate, often lanceolate, occasionally narrowly ovate-orbicular, symmetrical or nearly symmetrical, sessile or lower pinnules shortly stalked, apex acuminate or rounded; pinnule lobes up to 10 pairs, ascending, oblong or rectangular, base occasionally reduced, margin entire or shallowly repand to shallowly pinnatilobate, apex rounded or subtruncate; veins prominent abaxially, slightly visible adaxially, pinnate, veinlets simple or forked, up to ca. 7 pairs per pinnule lobe. Lamina grass-green, darker on adaxial surface, thinly papery or papery when dry, with glandular hairs in adaxial grooves except on rachis, elsewhere glabrous; rachis, costae, and costules abaxially usually with brown lanceolate scales. Sori usually linear, inframedial-medial, from costule or near costule up to 3/4 of veinlet length, single or double on basal acroscopic veinlets; indusia light brown when mature, membranous, entire, persistent. Spores bean-shaped, perispore prominent and hyaline, surface glabrous.

• Tropical rain forests; 700–1200 m. Guangxi, Hainan [?Vietnam (near border)].

*Diplazium viridescens* is variable ontogenetically: small lamina only 30 cm, 1-pinnate pinnatipartite, or lower part 2-pinnate, pinnules rounded at apex.

**72. *Diplazium jinfoshanicola*** (W. M. Chu) Z. R. He, **comb. nov.**

金佛山双盖蕨 jin fo shan shuang gai jue

Basionym: *Allantodia jinfoshanicola* W. M. Chu, Acta Phytotax. Sin. 21: 221. 1983.

Plants large. Rhizome creeping, black-brown, ca. 2 cm in diam., apex densely scaly; scales dark brown, broadly lanceolate, entire, central cells prominently larger than marginal cells; frond approximate. Fertile frond ca. 1.4 m; stipe dark brown at base, upward pale brown to stramineous, ca. 65 cm, ca. 5 mm in diam. at base, with sparse repand scales, upward glabrous; lamina 2-pinnate with pinnules pinnatifid to pinnatipartite, deltoid, ca. 75 × 65 cm, apex acuminate; pinnae ca. 8 pairs, alternate or subalternate, slightly ascending, lower pinnae broadly oblong-lanceolate, base slightly narrowed, stalked, nearly symmetrical, apex acuminate; basal pinnae large, ca. 40 × 15 cm, with stalk up to 4 cm; pinnules of lower pinnae up to 10 pairs, alternate, subspreading, up to 8 × 2.5 cm, base asymmetrical, subspreading on basicopic side, apex acuminate; lower pinnules shortly stalked; pinnule lobes up to 10 pairs, slightly ascending, oblong, margin crenate, apex rounded; basal acroscopic lobe smaller; veins visible abaxially, not prominent adaxially, veinlets up to 7 pairs per pinnule lobe, ascending, forked or simple, few pinnate. Lamina thinly herbaceous when dry, green abaxially, dark green adaxially, glabrous, rachis and costae with brown short glandular hairs. Sori linear, from near costule to apart from pinnule margin, single or double; indusia light brown, membranous, persistent. Spores orbicular, perispore prominent, few rugate.

• Valleys, broad-leaved forests; ca. 1500 m. Chongqing (Jinfo Shan).

*Diplazium jinfoshanicola* is similar to *D. hachijoense* but differs by the lamina thinly herbaceous when dry, cells in the center of scales prominent, larger than those in the margin, sori close to midrib, and spores orbicular.

**73. *Diplazium chinense*** (Baker) C. Christensen, Index Filic. 229. 1905.

中华双盖蕨 zhong hua shuang gai jue

*Asplenium chinense* Baker in Hooker & Baker, Syn. Fil. 237. 1867; *Allantodia chinensis* (Baker) Ching; *Diplazium naganumamum* Makino; *D. orientale* Rosenstock.

Plants summer-green, medium-sized. Rhizome creeping, black-brown, 5–8 mm in diam., apex densely scaly; scales brown to black-brown, lanceolate, 5–8 mm, membranous, entire, apex long acuminate; fronds approximate. Fertile frond up to ca. 1 m; stipe black-brown at base, upward dark stramineous, 20–50 cm, 2–3 mm in diam., base sparsely scaly, upward glabrous; lamina 2-pinnate with pinnules pinnatipartite to pinnatisect, deltoid, 30–60 × 25–40 cm, apex acuminate; pinnae up to 13 pairs, ascending, mostly alternate, asymmetrical (basicopic pinnules larger), apex acuminate; basal pinnae largest,

subopposite or opposite, broadly oblong-lanceolate, 20–30 × 10–12 cm, with stalk 1–3.5 cm; upper pinnae reduced, lanceolate, pinnatifid, slightly shortly stalked or sessile; pinnules up to ca. 13 pairs, spreading, mostly alternate, symmetrical or nearly symmetrical, shortly stalked or sessile, lanceolate to oblong, 5–8 × 1.5–2 cm, pinnatifid to costa, connate to each other, with narrow wings, base broadly cuneate to shallowly cordate, apex acuminate; pinnule lobes up to 15 pairs, ascending, lobes of lower pinnules slightly free, lobes of upper pinnules approximate or contiguous, oblong to linear-lanceolate, margin dentate, or lower lobes pinnatifid, apex rounded or acute; veins pinnate, visible abaxially, not prominent adaxially, veinlets 6–8 pairs per pinnule lobe, ascending, mostly forked or simple, rarely 3-furcate or pinnate. Lamina herbaceous, grass-green or brown-green when dry, glabrous on both surfaces; rachis and costae stramineous, glabrous, shallowly grooved adaxially. Sori 5 or 6 pairs per lobe, shortly linear, occasionally narrowly elliptic to elliptic, borne from middle of veinlet or near midrib to 1/2–2/3 of veinlet length, mostly single, partly double; indusia light brown when mature, membranous, opening acropically, persistent or partly remaining. Spores subreniform, perispore not prominent, with irregular aculeate ornamentation.  $2n = 82, 164$ .

Valley forests, wet broad-leaved forests, beside streamlets, rock crevices, in shade; sea level to 800 m. Anhui, Chongqing (Youyang), Fujian, Guangxi, Guizhou, S Jiangsu, Jiangxi, Shanghai, Sichuan, Taiwan (Pingdong, ?Taidong), Zhejiang [Japan, Korea, N Vietnam].

**74. *Diplazium hachijoense*** Nakai, Bot. Mag. (Tokyo) 35: 148. 1921.

薄盖双盖蕨 bao gai shuang gai jue

*Allantodia hachijoensis* (Nakai) Ching; *A. omeiensis* (Ching) Ching; *Athyrium hachijoense* (Nakai) Ohwi; *Diplazium omeiense* Ching; *D. siroyamaense* Tagawa.

Plants medium-sized to large. Rhizome creeping, black-brown, 5–10 mm in diam., apex densely scaly; scales brown to black-brown, lanceolate, 5–8 mm, thickly membranous, entire; fronds often approximate. Stipe of fertile frond black-brown at base, upward stramineous, dark stramineous, or pale brown, up to 70 cm, 2–5 mm in diam., base often with sparse scale remains, upward subglabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid, deltoid or ovate-deltoid, up to 80 × 70 cm at base, apex acuminate; pinnae ca. 10 pairs, alternate, ascending, lower pinnae short and broadly lanceolate, pinnae below apex 1-pinnate with pinnules pinnatifid, stalked; upper pinnae lanceolate, pinnatifid, shortly stalked or sessile; basal pinnae largest, up to 50 × 20 cm at middle, with stalk up to 5 cm; pinnules ca. 10 pairs, alternate, spreading, sessile or lower pinnules very shortly stalked, often lanceolate, up to 12 × 3 cm, sometimes shorter, 1.5–3 × 0.5–1 cm, oblong-ovate, base broadly cuneate or subtruncate, sometimes shallowly cordate, slightly asymmetrical, pinnatifid to pinnatifid, apex acuminate or rounded; pinnule lobes 10 pairs or more, subspreading, contiguous, oblong or obliquely rectangular, slightly oblique, entire or sparsely shallowly serrate, rounded or truncate; veins pinnate, prominent abaxially, visible adaxially, veinlets ca. 7 or 8 pairs per pinnule lobe, usually

simple or forked, occasionally 3-furcate, ascending. Lamina thickly herbaceous when dry, green, darker adaxially or nearly concolored on both surfaces; rachis and costa green-stramineous or light brown-stramineous, shallowly grooved adaxially, with many thin glands in groove, abaxially with deciduous multicellular short glandular hairs and sparse lanceolate brown small scales; costules and veins abaxially with similar glands and scales. Sori shortly linear or oblong, 5 or 6 pairs per pinnule lobe, median, single or double; indusia light brown, membranous, entire, opening acropically when mature, persistent. Spores bean-shaped, perispore prominent, slightly hyaline, often rugate.  $n = 123$ .

Broad-leaved forests; 400–1700 m. Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Zhejiang [Japan, Korea].

**75. *Diplazium wheeleri*** (Baker) Diels in Engler & Prantl, Nat. Pflanzenfam. 1(4): 227. 1899.

短果双盖蕨 duan guo shuang gai jue

*Asplenium wheeleri* Baker, Ann. Bot. (Oxford) 5: 309. 1891; *Allantodia wheeleri* (Baker) Ching.

Plants evergreen, medium-sized. Rhizome creeping, ca. 1 cm in diam., apex like base of stipe, densely scaly; scales brown, linear-lanceolate, ca. 4 mm, thickly membranous, entire; fronds approximate. Fertile frond up to ca. 1 m; stipe brown at base, upward stramineous, 40–50 cm, ca. 4 mm in diam., base sparsely scaly, upward glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid to pinnatifid, deltoid-ovate, 50–60 × ca. 50 cm at base, apex acuminate; pinnae ca. 8 pairs, alternate, ascending; basal pinnae largest, broadly lanceolate, 25–30 × ca. 11 cm at middle, slightly narrowed to base, base truncate, with stalk ca. 3 cm, apex acuminate; pinnules 10–12 pairs, alternate, spreading, lanceolate, ca. 7 × 1.5 cm, base truncate, shortly stalked, pinnatifid to pinnatifid, apex acuminate; pinnule lobes 8–10 pairs, subspreading, contiguous, subrectangular, ca. 6 × 5 mm, rounded or rounded-truncate, distal margin subentire or few serrate, lateral margin entire; veins visible abaxially, not prominent adaxially, pinnate, veinlets ca. 6 pairs per each lobe, simple or occasionally forked, ascending. Lamina gray-green when dry, herbaceous, glabrous on both surfaces; rachis and costa stramineous, glabrous, shallowly grooved adaxially. Sori shortly linear, 1–2.5 mm, 4 or 5 pairs per each lobe, inframedial or medial, single or double; indusia brown, linear, membranous, persistent; spores reniform, perispore few rugate.

Mountain forests, beside streamlets; 100–1000 m. Guangdong, Sichuan, Zhejiang [Japan].

**76. *Diplazium nipponicum*** Tagawa, Acta Phytotax. Geobot. 2: 197. 1933.

日本双盖蕨 ri ben shuang gai jue

*Allantodia nipponica* (Tagawa) Ching; *Athyrium nipponicola* Ohwi.

Plants medium-sized to large. Rhizome creeping, ca. 1 cm in diam., apex with loose scales; scales black-brown, narrowly lanceolate, ca. 5 mm, thickly membranous, margin toothed;

fronds approximate. Fertile frond 80–140 cm; stipe brown at base, upward stramineous, 40–60 cm, ca. 8 mm in diam. at base, with dense scales similar to those on rhizome, upward glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid to pinnatisect, 60–80 × ca. 50 cm at base, apex acuminate; pinnae 8–10 pairs, alternate, ascending, lower pinnae ca. 10 cm apart, with stalk ca. 3 cm; basal pinnae largest, broadly lanceolate, ca. 40 × 10 cm, narrowed to base, base cuneate, apex acuminate; pinnules 10–12 pairs, alternate, spreading, ca. 2 cm apart, shortly stalked, lanceolate, ca. 7 × 2 cm, base cuneate, pinnatifid, apex acuminate; pinnule lobes ca. 8 pairs, ascending, oblong, ca. 6 × 5 mm, slightly narrowed to obtuse apex, margin minutely serrate, lateral margin entire; veins pinnate, not prominent, veinlets ca. 5 pairs per pinnule lobe, simple or forked, ascending. Lamina gray-green or gray-brown when dry, herbaceous, glabrous on both surfaces; rachis stramineous, glabrous, shallowly grooved adaxially, costae occasionally with linear brown scales. Sori linear, 2–6 mm, 2–4 pairs per pinnule lobe, borne from costule to near pinnule margin, single or double on basal acroscopic veinlet; indusia light gray, linear, membranous, persistent. Spores reniform, perispore prominent, rugate.

- Shaded places in valley forests, beside streamlets; ca. 800 m. Zhejiang.

**77. *Diplazium axillare*** Ching, Lingnan Sci. J. 15: 277. 1936.

褐色双盖蕨 he se shuang gai jue

*Allantodia himalayensis* Ching; *Asplenium polypodioides* Blume var. *vestitum* C. B. Clarke; *Diplazium himalayense* (Ching) Panigrahi; *D. polypodioides* Blume var. *vestitum* (C. B. Clarke) C. Christensen.

Plants evergreen, large. Rhizome erect, robust, up to 70 cm tall, up to 20 cm in diam., apex densely scaly; scales brown, linear or linear-lanceolate, 1.5–2 cm, membranous, margin with black narrow band, toothed, apex filiform, curly; fronds caespitose. Fertile frond more than 2.5 m; stipe dark brown, 60–120 cm, 8–15 mm in diam., base with dense scales similar to those on rhizome; lamina 2-pinnate with pinnules pinnatifid, deltoid or ovate-deltoid, 1–1.5 m × 80–120 cm, apex acuminate; pinnae 15–20 pairs, up to 60 × 25 cm, alternate, ascending, symmetrical or nearly symmetrical; upper pinnae 7 or 8 pairs, lanceolate, 1-pinnate, sessile or subsessile; lower pinnae mostly broadly lanceolate, with stalk up to 6 cm, apex acuminate; basal pinnules broadly oblong-lanceolate, shorter; pinnules ca. 20 pairs, alternate, spreading, lanceolate, up to 14 × 4 cm, pinnatifid to near costule, base asymmetrical, shallowly cordate at basiscopic side, subtruncate at acroscopic side, margin subentire to pinnatifid, apex shortly caudate; veins not prominent on adaxial surface, visible abaxially, pinnate, veinlets 7–10 pairs per pinnule lobe, mostly forked or pinnate, sometimes simple, ascending. Lamina herbaceous, lower parts of costules and midrib of lower pinnule lobes abaxially often with linear or linear-lanceolate brown scales, glabrous adaxially; rachis and costae dark brown, with dense dirty glandular hairs and few small scales. Sori shortly linear, 7 or 8 pairs per pinnule lobe, costular from midrib to ca. 1/2 of veinlet length, single or double on basal acroscopic veinlets; indusia brown, membra-

nous, margin irregularly incised, opening acroscopically, gradually ruptured and part remaining. Spores reniform, perispore slightly hyaline and narrow, not rugate, prominent and average granular ornamentation.

Evergreen broad-leaved forests; 800–2400 m. N Guangxi, S Guizhou, SW Sichuan, SE Xizang, SE and W Yunnan [India, Myanmar].

**78. *Diplazium kappanense*** Hayata, Icon. Pl. Formosan. 8: 143. 1919.

台湾双盖蕨 tai wan shuang gai jue

*Allantodia kappanensis* (Hayata) Ching; *A. taiwanensis* (Tagawa) Ching; *Diplazium taiwanense* Tagawa; *D. virescens* Kunze var. *taiwanense* (Tagawa) Sa. Kurata.

Plants evergreen, medium-sized. Rhizome ascending to erect, brown, densely scaly at apex; scales black-brown to black, shiny, linear-lanceolate, ca. 1.5 cm, thickly membranous, margin with black, narrow band, toothed, apex filiform; fronds caespitose. Fertile frond up to ca. 1 m; stipe brown at base, upward green-stramineous, 30–45 cm, ca. 6 mm in diam., base densely scaly; scales brown, linear-lanceolate, upward glabrous, grooved adaxially; lamina 2-pinnate with pinnules pinnatifid, deltoid to ovate-deltoid, 50–70 × 40–60 cm, apex acuminate; pinnae ca. 10 pairs, alternate, slightly ascending, with stalk up to 4 cm, 1-pinnate with pinnules pinnatifid; basal pinnae largest, oblong, 25–30 × 15–20 cm, slightly narrowed to base, base truncate, apex acuminate; pinnules 10–12 pairs, alternate, spreading, with stalk ca. 5 mm, lanceolate, ca. 10 × 2 cm, base slightly wider, truncate or broadly cuneate, pinnatifid to 1/3 from margin, apex long acuminate; pinnule lobes up to 10 pairs, subspreading, oblong, ca. 5 mm wide, margin minutely serrate, apex rounded or subtruncate; veins pinnate, veinlets 4 or 5 pairs, simple, ascending. Lamina dark green when dry, herbaceous, glabrous on both surfaces; rachis green-stramineous, shallowly grooved adaxially, costae and costules abaxially with sparse, linear diamond-shaped, brown, small scales or subglabrous. Sori oblong, short, straight, 1–2 mm, 1 or 2 pairs per lobe, medial; indusia brown, oblong, membranous, opening acroscopically, persistent. Spores hemispherical, perispore with acute protuberances on surface.

Broad-leaved forests; below 100–500 m. Taiwan [S Japan].

*Diplazium kappanense* and *D. taiwanense* were considered to be different species with forked or simple veinlets; however, here they are treated as conspecific.

**79. *Diplazium nanchuanicum*** (W. M. Chu) Z. R. He, **comb. nov.**

南川双盖蕨 nan chuan shuang gai jue

Basionym: *Allantodia nanchuanica* W. M. Chu, Acta Phytotax. Sin. 21: 219. 1983; *A. anshunica* P. S. Wang.

Plants evergreen, medium-sized to large, up to 2 m tall. Rhizome erect, ascending, or decumbent, to 54 cm, surrounded by dense aerial roots, 10 cm in diam. (including aerial roots), densely scaly at apex; scales dark brown to black, lanceolate to linear-lanceolate, margin denticulate, apex long acuminate;

fronds approximate or caespitose, rarely distant. Fertile frond 60–150 cm; stipe light green, blackish at base, 18–57 cm, 2–5 mm in diam., covered with scales; scales lanceolate, often easily deciduous leaving greenish long-conical stalklets, base cordate, margin densely denticulate, apex long acuminate; lamina 2-pinnate, broadly ovate-deltoid, 50–100 × 30–60 cm, apex acuminate; pinnae 8–10 pairs, mostly alternate, rarely subopposite, ascending; lower pinnae broadly oblong-lanceolate, up to 46 × 19 cm, with stalk up to 4 cm, apex acuminate; pinnules up to 10 pairs, alternate, spreading, lanceolate to broadly lanceolate, up to 8 × 2 cm, base truncate, symmetrical or nearly symmetrical, sessile, pinnatifid to pinnatifid, apex acuminate; pinnule lobes up to 10 pairs, contiguous, ascending, margin entire or slightly crenate, apex rounded; veins pinnate, veinlets up to 7 pairs per pinnule lobe, ascending, mostly simple, rarely forked. Lamina thinly papery when dry, green, darker adaxially, subglabrous on both surfaces; rachis and costa light green. Sori shortly linear, less than 4 pairs per lobe, basal sori long, inframedial from midrib to 3/4 length of veinlet, other sori shorter, medial, mostly single or double on basal acroscopic veinlets; indusia brown when mature, membranous, entire. Spores reniform, perispore not prominent, glabrous on surface.

• Calcareous mountains, beside streamlets; 600–800 m. Chongqing (Jinfo Shan), Guizhou (Anshun).

*Diplazium nanchuanicum* is similar to *D. simile* but differs by the narrow lamina, linear-lanceolate, loose scales, and glabrous costae and costules. *Allantodia anshunica* P. S. Wang (Pterid. Fl. Guizhou, 64, 2001), with aerial roots on rhizome and stalklets on stipe scales, characters not present in the protologue of *D. nanchuanicum*, is confirmed to be a synonym of *D. nanchuanicum* by reviewers P. S. Wang and W. M. Zhu.

**80. *Diplazium calogrammoides*** (Ching ex W. M. Chu & Z. R. He) Z. R. He, **comb. nov.**

拟长果双盖蕨 ni chang guo shuang gai jue

Basionym: *Allantodia calogrammoides* Ching ex W. M. Chu & Z. R. He, Acta Phytotax. Sin. 36: 377. 1998.

Plants evergreen, large. Rhizome creeping to ascending, brown, up to 5 cm in diam. including remaining stipe bases, apex like base of stipe, densely scaly; scales brown, lanceolate, ca. 1 cm, membranous, margin black, regularly toothed, base subcordate; fronds approximate. Fertile fronds up to 1.8 m; stipe brown at base, upward light brown stramineous, up to 70 cm, ca. 8 mm in diam., upward glabrous, shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid to pinnatisect, deltoid, more than 1 m × 80–90 cm, apex acuminate; pinnae 10–12 pairs, alternate, ascending, nearly symmetrical, apex long acuminate; upper 5 or 6 pairs of pinnae broadly lanceolate or sickle-shaped lanceolate, acroscopic base broadly cuneate, basiscopic base cordate, shortly stalked or sessile, pinnatifid to pinnatifid, apex ascending, sickle-shaped; middle and lower pinnae oblong-lanceolate, pinnate, stalked; basal pinnae largest, up to 60 × 20 cm, with stalk 2–3 cm; pinnules up to ca. 15 pairs, spreading, alternate, shortly stalked or upper pinnules not stalked, broadly lanceolate or lanceolate, up to 11 × 3 cm, acroscopic base truncate or broadly cuneate, basiscopic base

shallowly cordate, sometimes both sides of base cuneate or truncate, basal acroscopic pinnule lobe often shorter, incised ca. 1.5 cm from margin, apex acuminate or long acuminate; pinnule lobes up to ca. 10 pairs, subspreading, alternate, contiguous, broadly oblong, ca. 1 cm wide, margin shallowly crenate or repand, apex rounded; veins visible abaxially, not prominent adaxially, pinnate, veinlets up to 8 pairs per pinnule lobe, usually forked or simple, occasionally 3-furcate or pinnate, ascending. Lamina herbaceous, dark green when dry, glabrous, gray-green abaxially, with slightly small pale brown scales; rachis and costa stramineous, glabrous, shallowly grooved adaxially, costule glabrous abaxially. Sori linear, substraight, up to 6 pairs per pinnule lobe, mostly borne from midrib to 2/3–4/5 of veinlet length, basal acroscopic sori longest, single or double; indusia light brown when mature, thinly membranous, opening acroscopically, persistent. Spores reniform, perispore broad and hyaline, sometimes few rugate, few inconspicuous granular ornamentation.

• Evergreen forests in valleys; 2100–2200 m. Yunnan (Jingdong, Wuliang Shan).

*Diplazium calogrammoides* is similar to *D. calogrammum* but differs by the dense scales with black margin, cordate pinnule base, and smooth costa abaxially without green fleshy aculeate processes.

**81. *Diplazium viridissimum*** Christ, Notul. Syst. (Paris) 1: 45. 1909.

深绿双盖蕨 shen lü shuang gai jue

*Allantodia austrochinensis* Ching; *A. phaeolepis* (Tagawa) Ching; *A. pseudodoederleinii* (Hayata) Ching; *A. viridissima* (Christ) Ching; *Diplazium phaeolepis* Tagawa; *D. pseudodoederleinii* Hayata.

Plants evergreen, large, but ontogenetically variable and even small plants fertile. Rhizome ascending to erect, robust, up to 40 cm tall, up to 10 cm in diam., apex densely scaly; scales loose, brown to dark brown, linear-lanceolate, more than 3 cm, membranous, margin black and sparsely toothed, apex linear and long caudate; fronds caespitose. Fronds more than 2 m; stipe black at base, upward stramineous or green-stramineous when dry, usually shorter than lamina, up to 1.2 m, up to 1.5 cm in diam., base with dense scales similar to those on rhizome, upward shallowly grooved adaxially; lamina 2-pinnate with pinnules pinnatifid, deltoid, up to 1.5 × 1.3 m; pinnae to ca. 15 pairs, alternate, slightly ascending, symmetrical or nearly symmetrical, mostly narrowly lanceolate, basiscopic 2 pairs of pinnae largest, up to 70 × 25 cm, with stalk up to 6 cm; upper pinnae gradually narrowed to lanceolate, sessile, 1-pinnate pinnatifid; pinnules up to ca. 15 pairs, alternate or nearly so, spreading, deltoid-lanceolate or lanceolate, symmetrical, base broadly cuneate or subtruncate, sometimes slightly shallowly cordate, apex often acuminate to long acuminate; middle pinnules up to 15 × 4 cm, lower pinnules often stalked, stalk up to 3 mm, pinnatifid to pinnatifid; pinnule lobes up to ca. 15 pairs, slightly ascending, ovate-oblong, slightly oblique, margin shallowly serrate, apex rounded or subtruncate; veins visible abaxially, not prominent adaxially, pinnate per pinnule lobes, veinlets up to 9 pairs, ascending, usually forked or simple, occasionally 3- or 4-furcate. Lamina herbaceous or thinly

herbaceous, gray-green abaxially, green or dark green adaxially, glabrous, costules and midribs with light brown or gray-white small glands; rachis and costa green-stramineous or stramineous, with sparse brown linear scales. Sori shortly linear, from midrib to ca. 2/3 of veinlet length, up to 7 pairs per pinnule lobe, often single or double on basal acroscopic veinlets; indusia ruptured before sori mature. Spores subreniform, perispore prominent, not rugate.  $2n = 82$ .

Broad-leaved forests, beside streamlets; 400–2200 m. Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Xizang, Yunnan [Himalaya, NE India, NE Myanmar, Nepal, Philippines, Vietnam].

The curly tender laminae are used as a wild vegetable in W and NW Yunnan.

*Diplazium viridissimum* is similar to *D. giganteum* but differs by the rhizome ascending to erect, often subarborescent, and the pinnules often deltoid-lanceolate, symmetrical or nearly so at base.

**82. *Diplazium calogrammum*** Christ, Notul. Syst. (Paris) 1: 45. 1909.

长果双盖蕨 chang guo shuang gai jue

*Allantodia calogramma* (Christ) Ching.

Plants evergreen, large. Rhizome creeping, scales at apex sparse and adpressed; scales dark brown, lanceolate or broadly lanceolate, margin black, small toothed; fronds approximate. Fertile fronds more than 2 m; stipe slightly brown or black-brown at base, upward dark stramineous or green-stramineous when dry, shorter than lamina, 60–90 cm, ca. 1 cm in diam., lower part sparsely scaly; scales similar to those on rhizome apex, deciduous, upward glabrous; lamina 2-pinnate with pinnules pinnatifid to pinnatipartite, ovate-deltoid, 110–120 × 70–80 cm, apex acuminate; pinnae more than 15 pairs, alternate, ascending, apex pinnatipartite, acuminate; lower pinnae oblong-lanceolate or broadly lanceolate, 30–50 × 10–20 cm, pinnate, with stalk 2–5 cm; upper pinnae lanceolate, pinnatilobate or pinnatipartite; pinnules 8–15 pairs, often alternate, spreading or slightly ascending, not contiguous, lanceolate, 3–12 × 1–3 cm, symmetrical or nearly so, base broadly cuneate, shortly stalked, pinnatipartite to pinnatifid, apex caudate; pinnule lobes 8–15 pairs, slightly ascending, not contiguous, margin subentire or few sparsely serrate, apex often rounded; veinlets pinnate in pinnule lobe; veinlets 9 pairs, often simple, rarely forked, ascending, not reaching margin, apex slightly swollen. Lamina thinly herbaceous, green; rachis and costa green-stramineous; costae and costules abaxially with prominent fleshy green aculeate processes, and few brown lanceolate scales, glabrous adaxially. Sori linear, often as long as veinlets, 8 pairs per pinnule lobe, often single or double on basal acroscopic veinlet; indusia brown when mature, membranous, entire. Spores reniform, granular ornamentation on surface.

Wet evergreen broad-leaved forests; 1400–1700 m. SE Yunnan [Vietnam].

*Diplazium calogrammum* is similar to *D. simile* but differs by the costa and costule abaxially with many fleshy green aculeate processes.

**83. *Diplazium succulentum*** (C. B. Clarke) C. Christensen, Index Filic. 240. 1905.

肉质双盖蕨 rou zhi shuang gai jue

*Asplenium succulentum* C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 502. 1880; *Allantodia succulenta* (C. B. Clarke) Ching.

Plants evergreen, large. Rhizome creeping, robust, brown, up to 5 cm in diam. including remaining stipe bases, apex densely scaly; scales brown, lanceolate, membranous, margin black, toothed; fronds approximate. Fertile frond up to 2.5 m; stipe brown at base, upward green-stramineous, up to 1 m, up to 1 cm in diam., upward glabrous; lamina 2-pinnate with pinnules pinnatipartite, deltoid, up to 1.5 × 1.2 m at base, apex acuminate; pinnae up to ca. 10 pairs, alternate, ascending, slightly asymmetrical, basicopic pinnules longer; basal pinnae largest, oblong-lanceolate, up to 60 × 30 cm, base slightly narrowed, stalked, broadly lanceolate, apex acuminate; pinnules up to 15 pairs, alternate, spreading, broadly lanceolate or oblong-lanceolate, up to 16 × 6 cm, pinnatifid to pinnatipartite; lower pinnules stalked, symmetrical or basicopic lobes longer, base truncate or basicopically shallowly cordate, apex acuminate or caudate long acuminate; lobes of lower pinnules up to 15 pairs, slightly ascending, oblong or oblong-lanceolate, apex mostly acute; lobes of upper pinnules gradually narrowed, rounded at apex, sparsely crenate or pinnatilobate; veins pinnate, prominent abaxially, veinlets up to 13 pairs per pinnule lobe, ascending, simple to pinnate. Lamina subfleshy when fresh, thickly papery when dry, grass-green, darker adaxially; rachis and costae green-stramineous, shallowly grooved adaxially, costae and costules with often ± deciduous, finely sandy glands in grooves on adaxial side, with linear or linear-lanceolate brown scales abaxially; scales on abaxial side of rachis black and toothed at margin. Sori linear, up to 12 pairs per pinnule lobe, borne from costule to more than 2/3 of veinlet, often close to pinnule margin, mostly single or double on basal acroscopic veinlet; indusia light brown, membranous, entire, opening acroscopically, persistent. Spores reniform, perispore hyaline and prominent, reticulate ornamentation.

Evergreen broad-leaved forests, beside streamlets; 600–2100 m. Guizhou, Yunnan [India].

**84. *Diplazium maximum*** (D. Don) C. Christensen, Index Filic. 235. 1905.

大叶双盖蕨 da ye shuang gai jue

*Asplenium maximum* D. Don, Prodr. Fl. Nepal. 8. 1825; *Allantodia maxima* (D. Don) Ching; *Asplenium diversifolium* Wallich; *Diplazium diversifolium* (Wallich) J. Smith.

Plants evergreen, large. Rhizome creeping, robust, up to 3 cm in diam., with dense loose scales at apex; scales brown or chestnut, slightly shiny, lanceolate or broadly lanceolate, up to 1.5 cm, thickly membranous, margin with black band, toothed; fronds subapproximate. Stipe of fertile frond black-brown at base, upward green-stramineous, up to 1.2 m, up to 1 cm in diam., base with sparse scales similar to those on rhizome, upward glabrous, smooth or sparsely verrucose; lamina 2-pinnate with pinnules pinnatifid to pinnatipartite, deltoid, up to 1.8 × 1 m, apex acuminate; pinnae 8–13 pairs, alternate, ascending; basal pinnae largest, broadly lanceolate, up to 65 × 23 cm, with

stalk up to 5 cm; pinnules up to ca. 10 pairs, alternate, subspreading, broadly lanceolate or deltoid, up to  $15 \times 4$  cm, lower pinnules often shortly stalked, base subtruncate, slightly asymmetrical, pinnatifid to pinnatisect, apex long acuminate; pinnule lobes up to 15 pairs, slightly ascending, contiguous or approximate, oblong or subrectangular, shallowly crenate or entire, apex rounded or subtruncate, rarely acute; veins pinnate, veinlets up to 10 pairs per pinnule lobe, mostly simple, ascending, reaching pinnule margin. Lamina herbaceous when dry, pale abaxially, glabrous on both surfaces; rachis and costa green-stramineous. Sori linear, often occupying whole length of veinlet, up to 6 pairs per lobe, often single or double; indusia brown when mature, membranous, entire, opening acropically. Spores bean-shaped, without perispore, tuberculate ornamentation.

Valleys, evergreen broad-leaved forests, beside streamlets; 900–1800 m. Fujian, Guangxi, Guizhou, Hainan, Jiangxi, Yunnan [Bhutan, India, NE Myanmar, Nepal].

The authors have not seen material of *Diplazium maximum* var. *brevisorum* Rosenstock (Repert. Spec. Nov. Regni Veg. 13: 129. 1914), described from Guizhou (Pinfa).

“*Allantodia verruculosa*” (Ching & W. M. Chu, Fl. Fujian. 1: 107. 1982) is a nomen nudum and was not therefore validly published (*Melbourne Code*, Art. 38.1(a)).

**85. *Diplazium giganteum*** (Baker) Ching in C. Christensen, *Index Filic.*, Suppl. 3: 73. 1934.

大型双盖蕨 da xing shuang gai jue

*Gymnogramma gigantea* Baker, *J. Bot.* 27: 177. 1899; *Allantodia gigantea* (Baker) Ching; *A. sungshienensis* Ching & Y. P. Hsu; *Diplazium falceidum* Christ.

Plants summer-green, large. Rhizome creeping, apex densely scaly; scales brown, narrowly lanceolate or linear-lanceolate, membranous, margin sparsely toothed, often black (sometimes black margin discontinuous or not prominent), apex linear, caudate; fronds caespitose. Fertile frond more than 2 m; stipe dark brown at base, upward stramineous or green-stramineous, up to 90 cm, up to 1 cm in diam., base densely scaly, scales similar to those on rhizome, upward gradually glabrous, deeply grooved adaxially; lamina 2-pinnate with pinnatifid pinnules, deltoid, up to  $1.5 \times 1$  m, apex acuminate; pinnae ca. 15 pairs, alternate, slightly ascending, mostly broadly oblong-lanceolate; apex acuminate; basal 2 pairs of pinnae largest, up to  $60 \times 20$  cm, with stalk 2–6 cm, pinnate; upper pinnae reduced to lanceolate, pinnatifid, sessile or subsessile; pinnules up to 20 pairs, alternate or subopposite, spreading or subspreading, lanceolate or oblong-lanceolate, base asymmetrical (basiscopic side shallowly cordate, acropscopic side broadly cuneate or subtruncate, acropscopic lobes often smaller), shortly stalked or

sessile, pinnatifid to pinnatifid, apex acuminate or shortly acuminate; middle pinnules up to  $15 \times 5$  cm; pinnule lobes up to ca. 15 pairs, slightly ascending, oblong, margin entire or crenate, apex rounded or subtruncate; veins visible abaxially, inconspicuous adaxially, pinnate, veinlets up to 9 pairs per pinnule lobe, ascending, often forked or simple, sometimes 3- or 4-furcate. Lamina herbaceous or thinly herbaceous when dry, pale green to gray-green abaxially, green adaxially, glabrous, veinlets with light brown or gray-white thin glands and pale brown small scales, midribs of pinnule lobes abaxially glandular; rachis and costae stramineous or green-stramineous, abaxially with pale brown short nodose hairs and many small scales, then glabrous. Sori mostly shortly linear, medial-inframedial, from base of midrib or near base to more than 2/3 of veinlet length, sometimes short, up to 7 pairs per pinnule lobe, often single or double on basal acropscopic veinlets (often forked along veinlets); indusia brown when mature, membranous, opening acropically, often part remaining, sometimes deciduous. Spores subreniform, perispore prominent, not rugate, granular ornamentation.  $2n = 82$ .

Broad-leaved forests, beside streams; 400–2600 m. Chongqing, Guizhou, W Henan, W Hubei, S Jiangxi, Sichuan, Xizang, Yunnan [E Himalaya: Bhutan, NE India].

**86. *Diplazium latipinnulum*** (Ching & W. M. Chu) Z. R. He, **comb. nov.**

阔羽双盖蕨 kuo yu shuang gai jue

Basionym: *Allantodia latipinnula* Ching & W. M. Chu, *Fl. Xizang*, 1: 150. 1983.

Plants large. Fertile frond up to 2 m; lamina 2-pinnate with pinnatifid pinnules; rachis to 1 cm in diam.; pinnae alternate, ascending, middle pinnae broadly oblong-lanceolate, up to  $80 \times 30$  cm, base slightly narrowed, with stalk up to 3 cm, apex acuminate; pinnules up to ca. 15 pairs, subspreading, basal pinnules slightly reduced, oblong-lanceolate, up to  $17 \times 5$  cm, base truncate, slightly asymmetrical (acropscopic lobes smaller), subsessile, pinnatifid to pinnatifid, apex acuminate; pinnule lobes up to 18 pairs, oblong, subspreading, margin crenate, apex rounded; veins visible abaxially, inconspicuous adaxially, veinlets up to 12 pairs per pinnule lobe, forked or simple, basal veinlets curved, not forked, basal acropscopic veinlet running to sinus between pinnule lobes, basal acropscopic veinlet running above sinus. Lamina thinly herbaceous, green, darker adaxially, glabrous on both surfaces. Sori long linear, medial, from near midrib to more than middle of veinlet; indusia brown, membranous, entire, opening acropically.

- Evergreen broad-leaved forests; ca. 800 m. SE Xizang (Médog).

*Diplazium latipinnulum* is similar to *D. giganteum* but differs by the oblong-lanceolate, glabrous pinnules.