

WOODSIACEAE

岩蕨科 yan jue ke

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Plants epilithic, sometimes xerophytic (growing in dry habitats), small or medium-sized. Rhizomes short, erect, decumbent, or ascending, simple dictyostelic, covered with scales. Fronds clustered, monomorphic, deciduous or sometimes evergreen; stipe mostly shorter than lamina, ± scaly and hairy, articulate or not articulate; lamina 1-pinnate to bipinnatifid, elliptic-lanceolate to narrowly lanceolate, herbaceous or papery, frequently covered with articulate multicellular hairs, sometimes with glandular hairs or capitate glands. Veins free, pinnate, usually ending in enlarged hydathodes. Sori orbicular, consisting of 3–18 sporangia, borne at middle or apex of veinlets; indusia inferior, saucer-shaped to cup-shaped, margin long ciliate, or indusia absent, degenerated into curly, multicellular hairs (*Woodsia*), or sphaeropteroid (bladderlike) with openings at tip (*Protowoodsia*), sometimes also covered with false indusia, i.e., reflexed leaf margins (*Cheilanthesis*). Spores ellipsoid or somewhat spherical, monolete, wall surface folded, cristate, tuberculate, or echinate.

About four genera (including the Caucasian *Hymenocystis* C. A. Meyer) and ca. 43 species: widely distributed in the N temperate and frigid zones, rarely in Central and South America, Africa (Angola, South Africa), and Madagascar; three genera and 24 species (nine endemic) in China.

The current classification of the genera requires evaluation by molecular phylogenetic evidence.

Wu Shiew-hung. 1999. Woodsiaceae. In: Wu Shiew-hung, ed., *Fl. Reipubl. Popularis Sin.* 4(2): 166–191.

- 1a. Stipe obviously articulate; indusia saucer- to cup-shaped, margin long ciliate 3. *Woodsia*
1b. Stipe continuous; indusia spherical or degenerated into curly, multicellular hairs.
2a. Indusia platelike with unequal lobes or dissected with filiform lobes 3. *Woodsia*
2b. Indusia spherical, tearing when mature.
3a. Lamina glabrous or with few glandular trichomes, margin flat, not reflexed; pinnae not articulate to rachis 1. *Protowoodsia*
3b. Lamina pubescent, margin reflexed to form false indusia (usually fallen later); pinnae articulate to rachis 2. *Cheilanthesis*

1. PROTOWOODSIA Ching, *Lingnan Sci. J.* 21: 36. 1945.

膀胱蕨属 pang guang jue shu

Plants epilithic, small. Rhizomes erect, short, apex densely scaly; scales brown, lustrous, ovate-lanceolate or lanceolate, entire. Fronds clustered or subclustered, usually diverging; stipe short, not articulate, brittle, usually lower parts persistent; lamina 1-pinnate-pinnatifid, lanceolate, much longer than stipe, herbaceous, glabrous or glandular hairs sparse. Veins free, pinnate, not reaching laminar margin. Sori small, orbicular, consisting of 6–12 sporangia, medial or submarginal; indusia inferior, spherical or bladderlike, completely wrapping sporangia, tearing apically at maturity. Spores ellipsoid, monolete, perispores corrugate, exospore glabrous on surface. $x = 33$.

One species: Asia.

1. *Protowoodsia manchuriensis* (Hooker) Ching, *Lingnan Sci. J.* 21: 37. 1945.

膀胱蕨 pang guang jue

Woodsia manchuriensis Hooker, *Sec. Cent. Ferns*, t. 98. 1861; *Diacalpe manchuriensis* (Hooker) Trevisan; *Physematium manchuriense* (Hooker) Nakai.

Plants (8–)15–20 cm. Rhizomes short, erect; scales brown, lustrous, ovate-lanceolate or lanceolate, entire. Fronds clustered; stipe brownish stramineous, 2–2.5 cm, less than 1 mm in diam., brittle, usually breaking, sparsely short glandular hairy, with few scales in lower part; lamina 1-pinnate-pinnatifid,

lanceolate, 12–18 × 1.5–4 cm, herbaceous, sparsely glandular hairy, base attenuate, apex acuminate; pinnae (12–)16–20 pairs, oblique, sessile; middle pinnae largest, ovate-lanceolate, 1–1.5 × up to 1 cm, pinnatifid, apex obtuse; lower pinnae shorter than above, widely separate; basal pair of pinnae ovate or flabellate; ultimate segments oblong, undulate or dentate. Veins free, pinnate, not reaching laminar margin. Sori consisting of 6–8 sporangia, medial or submarginal; indusia prominent, spherical, thinly membranous. $n = 66$.

On rocks in forests; 200–4000 m. Anhui, Guizhou, Hebei, Heilongjiang, Henan, Jiangxi, Jilin, Liaoning, Shandong, Sichuan, Zhejiang [Japan, Korea, Russia].

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2. CHEILANTHOPSIS Hieronymus, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 7: 409. 1920.

滇蕨属 dian jue shu

Plants epilithic, medium-sized or small. Rhizomes ascending or decumbent, apex covered with brown, membranous, lanceolate scales. Fronds clustered; stipe short, brittle, usually broken, base or lower portion scaly, upper portion pubescent; lamina 1-pinnate-pinnatifid, lanceolate, gradually tapering to both ends, herbaceous, covered with multicellular glandular hairs; pinnae lanceolate, sessile, articulate to rachis; ultimate segments hemielliptic. Veins free, pinnate, not reaching laminar margin. Sori small, consisting of 4–10 sporangia, submarginal, at veinlet endings, orbicular; indusia inferior, subspherical, sometimes not fully developed, thinly membranous; false indusia formed by pale, thin, reflexed laminar margins. Spores ellipsoid, monolete, wall surface folded, granular. $x = 37, 41$.

Three species: Bhutan, China, India, Myanmar, Nepal; three species (one endemic) in China.

- 1a. Articulate hairs dense on both surfaces of lamina; indusia not large, false indusia conspicuous, orbicular-hemiovate, nearly reaching midvein 1. *C. indusiosa*
 1b. Articulate hairs sparse on both surfaces of lamina; indusia large, globose, false indusia small, reniform or cordate, far from midvein.
 2a. Stipe densely scaly at base, upward with dense articulate hairs, rachis also articulate hairy 2. *C. elongata*
 2b. Stipe sparsely scaly, rachis with dense glandular hairs 3. *C. kangdingensis*

1. Cheilanthopsis indusiosa (Christ) Ching, Sinensia 3: 154. 1932.

滇蕨 dian jue

Woodsia indusiosa Christ in Lecomte, Notul. Syst. (Paris) 1: 44. 1909; *Cheilanthes straminea* Brause; *Cheilanthopsis straminea* (Brause) Hieronymus ex Copeland.

Plants 25–50 cm. Rhizomes ascending, apex densely covered with scales; scales brown, broadly lanceolate, up to 1 cm, entire. Fronds clustered; stipe stramineous, 3–11 cm, 1–2 mm in diam., brittle, densely covered with scales, articulate hairs sparse when young, deciduous, middle and upper parts glabrous; lamina 1-pinnate-pinnatifid, lanceolate, 25–40 × 5–6.5 cm, herbaceous, densely covered with articulate hairs and glands on both surfaces, base attenuate, apex acuminate; rachis pale stramineous, with articulate hairs and sparse brown, narrowly lanceolate scales; pinnae 25–30 pairs, spreading or slightly oblique, sessile; lower pinnae reduced to lobes, lobes triangular, ligulate or auriculate, remote; middle pinnae largest, lanceolate, 2–3.5 cm × 3–10 mm, base truncate, margin pinnatifid, apex obtuse; lobes 7–12 pairs, opposite, spreading, hemielliptic; basal lobes largest, 3–5 mm, undulate. Veins free, obscure. Sori consisting of 4–8 sporangia, located at vein endings, submarginal; indusia not conspicuous, thinly membranous; false indusia orbicular-hemiovate, large, membranous, nearly reaching midvein, fimbriate. $2n = 74$.

On rocks in broad-leaved forests; 2100–3200 m. SW Sichuan, NW Yunnan [Bhutan].

2. Cheilanthopsis elongata (Hooker) Copeland, Univ. Calif. Publ. Bot. 12: 395. 1931.

长叶滇蕨 chang ye dian jue

Woodsia elongata Hooker, Sp. Fil. 1: 62. 1844; *Physematium elongatum* (Hooker) Trevisan.

Plants 25–28 cm. Rhizomes prostrate, apex densely covered with scales; scales brown, broadly lanceolate, 4–6 mm,

membranous, entire. Fronds clustered; stipe stramineous, 3–6 cm, 1–2 mm in diam., brittle, base densely covered with scales, upward and rachises densely covered with articulate hairs, and with few brown lanceolate scales; lamina 1-pinnate-pinnatifid, lanceolate, 18–22 × 2.5–4 cm, thinly herbaceous, both surfaces with sparse articulate hairs and glands, base attenuate, apex acuminate; pinnae 17–21 pairs, remote, spreading; lower pinnae shortened to deltoid-ovate to auricular lobes; middle pinnae largest, broadly lanceolate, 1.2–2 cm × 6–10 mm, base truncate, margin pinnatifid, apex obtuse; lobes 5 or 6 pairs, opposite, spreading, hemielliptic; basal lobes slightly larger, 3–5 × 1.5–3 mm, margin undulate. Sori consisting of 4–6 sporangia, terminal at vein tips, submarginal; indusia globose, thinly membranous; false indusia broadly reniform or cordate, small, membranous, remote from each other and from midvein. $2n = 82$.

Rock crevices in forests; 3200–3400 m. Xizang, NW Yunnan [Bhutan, India, Myanmar, Nepal].

3. Cheilanthopsis kangdingensis (H. S. Kung, Li Bing Zhang & X. S. Guo) Shmakov in Chandra & Srivastava, Pteridol. New Millennium, 64. 2003.

康定岩蕨 kang ding yan jue

Woodsia kangdingensis H. S. Kung, Li Bing Zhang & X. S. Guo, Acta Bot. Yunnan. 17: 421. 1995.

Plants 16–23 cm. Rhizome erect, apex scaly; scales brown, ovate-lanceolate, 4–6 mm, margin entire. Fronds clustered; stipe stramineous, 2–4 cm, glabrous, sparsely scaly; scales brown, lanceolate or narrowly ovate, entire; lamina 2-pinnatifid, narrowly lanceolate, 12–20 × 1.8–3 cm, base attenuate, apex acuminate; rachis with dense short glandular hairs; pinnae 14–19 pairs, subopposite, triangular-ovate, 8–18 × 4–8 mm, obtuse, base subequal, margin pinnatifid; pinna lobes 4–7 pairs, herbaceous, obtusely dentate. Veins inconspicuous. Sori orbicular; indusia globose, membranous, apex erose.

● On rocks and in rock crevices in forests; 3400–3800 m. Sichuan.

3. WOODSIA R. Brown, Prodr. 158. 1810 [“*Woodia*”].

岩蕨属 yan jue shu

Plants small, usually epilithic. Rhizomes short, erect or ascending, rarely decumbent, scaly; scales lanceolate or linear-lanceolate, membranous. Fronds clustered; stipe shorter than lamina, articulate at various levels, i.e., from top to near base, or continuous in some species; lamina 1-pinnate or 1-pinnate-pinnatifid, lanceolate, herbaceous or subpapery, usually with articulate hairs or scales, rarely glabrous, base gradually tapering. Veins free, pinnate, not reaching laminar margin. Sori small, consisting of 3–18 sporangia, orbicular, on veinlets or at veinlet tips; indusia inferior, various, usually saucer- to cup-shaped, dissected into ciliate platelike segments or reduced into curly, multicellular hairs, sometimes exindusiate. Spores ellipsoid, monolete, perispore folded with granular, echinate or tuberculate ornamentations on surface. $x = 39, 41$.

About 38 species: widely distributed in N temperate regions and higher elevations of tropical America, Africa, and Madagascar; 20 species (eight endemic) in China.

The following taxon is excluded from the present treatment, pending further research: *Woodsia shennongensis* D. S. Jiang & D. M. Chen (J. Hunan Agric. Univ. 26(2): 88. 2000), described from Hubei (Shennongjia).

- 1a. Stipe continuous, i.e., not articulate; indusia reduced into curly, multicellular hairs or apparently sori exindusiate (*W.* subg. *Eriosorus* (Ching) Shmakov).
- 2a. Rhizome ascending or decumbent; lamina 1-imparipinnate, pinnae entire, slightly undulate, or crenate-lobed to pinnatifid.
- 3a. Pinnae entire or slightly undulate; sori exindusiate or with much-reduced indusia hidden 19. *W. cycloloba*
- 3b. Pinnae crenate-lobed to pinnatifid; indusia consisting of pale, long, crested hairs 20. *W. okamotoi*
- 2b. Rhizome erect, occasionally ascending; lamina 1-paripinnate or bipinnatifid, apical pinna absent, pinnae not entire; sori covered by curly, long multicellular hairs.
- 4a. Lamina 1-pinnate.
- 5a. Rachis with sparse long hairs, occasionally with 1 or 2 scales; pinnae ovate, both surfaces sparsely shortly hairy 13. *W. macrospora*
- 5b. Rachis densely covered with scales; pinnae oblong-ovate, both surfaces densely covered with loose long hairs 14. *W. cinnamomea*
- 4b. Lamina bipinnatifid.
- 6a. Plants 2–10 cm tall (usually ca. 5 cm tall); stipe and rachis chestnut or brown or brown-stramineous; lamina covered with hairs and/or scales abaxially; pinnae 4–10 pairs.
- 7a. Stipe and rachis chestnut; pinnae sessile; lamina covered with hairs and scales abaxially 15. *W. lanosa*
- 7b. Stipe and rachis brown or brown-stramineous; pinnae stalked to 1 mm; lamina covered with hairs only abaxially 16. *W. guizhouensis*
- 6b. Plants to 25 cm; stipes brown or brown-stramineous; lamina densely covered only with loose ferruginous hairs; pinnae 6–15 pairs.
- 8a. Pinnae ovate, basal pinnae not reduced or slightly reduced; indusia composed of glandular-tipped hairs 17. *W. andersonii*
- 8b. Pinnae elliptic, lower pinnae obviously reduced; indusia composed of ciliate platelike lobes 18. *W. rosthorniana*
- 1b. Stipe articulate at various levels; indusia cup- or saucer-shaped, fimbriate, long ciliate.
- 9a. Stipe articulate at or below middle (*W.* subg. *Woodsia*).
- 10a. Lamina covered with long hairs and scales; stipes robust, castaneous or castaneous-brown.
- 11a. Lamina subglabrous, with sparse long hairs and scales on rachis; pinnae short, triangular-ovate or ovate, pinnatifid 4. *W. alpina*
- 11b. Lamina sparsely long hairy, rachis and costae scaly beneath; pinnae long, ovate-lanceolate, pinnatifid nearly to costa 5. *W. ilvensis*
- 10b. Lamina glabrous or with long hairs, without any scales; stipes slender, substramineous.
- 12a. Lamina sparsely hairy abaxially, hairs long; pinnae shortly stalked 3. *W. shensiensis*
- 12b. Lamina glabrous; pinnae sessile.
- 13a. Pinnae triangular-ovate, apex obtuse, 3–5 mm 1. *W. glabella*
- 13b. Pinnae subrhombic, apex acuminate or acute, up to 8 mm 2. *W. hancockii*
- 9b. Stipe articulate at top, or sometimes at upper parts.
- 14a. Indusia platelike; pinna base usually symmetrical or \pm symmetrical (*W.* subg. *Woodsia*).
- 15a. Stipe 4–8 cm, brown or light castaneous; pinnae to 2 cm, pinnatifid 11. *W. subcordata*
- 15b. Stipe 1–3 cm, stramineous; pinnae 4–6 mm, pinnatifid into 3–5 segments 12. *W. sinica*
- 14b. Indusia cup-shaped; pinna base asymmetrical or rarely symmetrical (*W.* subg. *Acrolysis* Nakai).
- 16a. Pinnae below laminar apex free, elliptic-lanceolate or falcate-lanceolate; midvein scaly abaxially.

- 17a. Pinnae entire or undulate 6. *W. polystichoides*
 17b. Pinnae pinnatilobate on both sides 7. *W. pilosa*
 16b. Upper pinnae adnate, triangular-lanceolate or elliptic; midvein without scales or with few scales only abaxially.
 18a. Only basal pinnae free, upper pinnae adnate, base symmetrical; rachis densely covered with long hairs, but without scales 8. *W. macrochlaena*
 18b. Lower pinnae free, upper pinnae adnate, base asymmetrical; rachis covered with hairs and scales.
 19a. Pinnae sparsely hairy, herbaceous 9. *W. oblonga*
 19b. Pinnae densely hairy on both surfaces, subpapery 10. *W. intermedia*

1. *Woodsia glabella* R. Brown ex Richardson in Franklin, Narr. Journey Polar Sea, 754. 1823.

光岩蕨 *guang yan jue*

Woodsia alpina (Bolton) Gray var. *glabella* (R. Brown ex Richardson) D. C. Eaton; *W. hyperborea* (Liljebld) R. Brown var. *glabella* (R. Brown ex Richardson) Watt; *W. lapponica* Ångström; *W. yazawai* Makino.

Plants 5–10 cm tall. Rhizomes compact, ascending, scaly as stipe base; scales concolorous, brown, lanceolate or ovate-lanceolate, 2–3 mm, membranous, margin entire. Fronds clustered; stipe brown-stramineous, slender, 1–2 cm, brittle, articulate below middle, glabrous or rarely with few brown, linear scales on apical portion; lamina 1-pinnate-pinnatifid, linear-lanceolate, 3–6 cm × 7–11 mm, thinly herbaceous, both surfaces glabrous or with occasional hairs, base attenuate, apex acuminate; rachis glabrous; pinnae 4–9 pairs, well separated, sessile, spreading; lower pinnae shorter than above, basal one flabellate; medial pinnae largest, deltoid-ovate, 3–5 × 2–5 mm, base truncate, margin pinnatifid, with 1–3 pairs of pinnules, apex obtuse; pinnules elliptic or tongue-shaped, proximal pairs largest, ca. 3 mm, undulate or apically crenulate. Veins pinnate, visible. Sori consisting of few sporangia, submarginal; indusia saucer-shaped, fimbriate, thinly membranous, brittle, usually fallen when mature. $2n = 78$.

Rock crevices in needle-leaved forests and mixed forests; 2100–3700 m. Gansu, Hebei, Jilin, Qinghai, Xinjiang, Yunnan [Japan, Russia; Europe, North America].

2. *Woodsia hancockii* Baker, Ann. Bot. (Oxford) 5: 196. 1891.

华北岩蕨 *hua bei yan jue*

Woodsia gracillima C. Christensen; *W. tsurugisanensis* Makino.

Plants 3–10 cm tall. Rhizomes short, erect, scaly; scales concolorous, brown, ovate-lanceolate or elliptic, membranous. Fronds clustered; stipe stramineous, 1–2 cm, brittle, articulate below middle; lamina 1-pinnate-pinnatifid, lanceolate, 2–8 cm × 3–12 mm, thinly herbaceous, both surfaces glabrous, base attenuate, apex acuminate; pinnae 7–14 pairs, sessile, spreading or slightly oblique; lower pinnae shorter than above, remote from each other; middle pinnae largest, subrhombic or obliquely ovate, 4–8 × 3–5 mm, base broadly cuneate or truncate, margin pinnatifid, with 2 or 3 pairs of segments, apex acuminate or acute; pinna segments obovate or tongue-shaped; basal pair largest, ca. 2 mm, undulate or with 1 or 2 crenations at tip. Veins pinnate, not reaching laminar margin. Sori orbicular, con-

sisting of a few sporangia, located at veinlet tips or on veinlets, usually 1–3 per segment; indusia saucer-shaped, thinly membranous, margin with flexuose brown articulate long hairs.

Wet shaded rock crevices in forests; 1700–2200 m. Hebei, Heilongjiang, Jilin, Nei Mongol, Shaanxi, Shanxi [N India, Japan, Korea, Nepal, Russia].

Woodsia hancockii is similar to *W. glabella* in the slender and glabrescent fronds but differs from it in the more slender lamina, trapeziform pinnae, and much larger indusia fringed with long hairs.

3. *Woodsia shensiensis* Ching, Sinensia 3: 141. 1932.

陕西岩蕨 *shan xi yan jue*

Plants 10–15 cm tall. Rhizomes short, erect, scaly; scales light brown, lanceolate, ca. 3 mm, membranous, margin entire. Fronds clustered; stipe stramineous, 3–5 cm, articulate at lower part, scaly at base, upward sparsely scaly; scales narrowly lanceolate; lamina 1-pinnate-pinnatifid to 2-pinnate, lanceolate, 7–10 × 1.5–2.9 cm, thinly herbaceous, abaxially with few brown articulate hairs, adaxially glabrous, base attenuate, apex acuminate; rachis, costae, and leaf margin also with few similar hairs; pinnae 8–10 pairs, ca. 1 cm apart, shortly stalked, slightly oblique; lower pinnae shorter than above; middle pinnae largest, ovate-rhombic, 1–1.5 cm × 7–10 mm, base broadly cuneate, margin pinnatifid or pinnate, with 2 or 3 pairs of pinnules, apex acute; pinnules obovate, basal pair largest, ca. 7 mm, serrate or crenate. Veins pinnate, distinct. Sori suborbicular, usually terminal at ends of veinlets, 2–4 per segment; indusia saucer-shaped, with long-villous margin.

● On rocks in forests; 2000–2900 m. Nei Mongol, Shaanxi, E Sichuan.

4. *Woodsia alpina* (Bolton) Gray, Nat. Arr. Brit. Pl. 2: 17. 1821.

新疆岩蕨 *xi jiang yan jue*

Acrostichum alpinum Bolton, Fil. Brit. 76. 1790; *A. hyperboreum* Liljebld; *Polypodium arvicum* Withering; *Woodsia himalaica* Ching & S. K. Wu; *W. hyperborea* (Liljebld) R. Brown; *W. ilvensis* (Linnaeus) R. Brown var. *alpina* (Bolton) Watt.

Plants 8–12 cm tall. Rhizomes compact, ascending, with cluster of persistent stipe bases of ± equal length; scales concolorous, brown, lanceolate, ca. 5 mm, membranous, fimbriate. Fronds clustered; stipe reddish brown, lustrous, 1–2 cm, ca. 1 mm in diam., articulate below middle, sparsely scaly, and scales later fallen; lamina 1-pinnate-pinnatifid, lanceolate, 5.5–9 × 1–

1.7 cm, herbaceous or thinly herbaceous, both surfaces glabrous, base attenuate, apex acuminate; rachis with sparse long hairs and linear-lanceolate scales; pinnae 9–11 pairs, separate, oblique; lower pinnae shorter than above, ovate, 2–3 mm; middle pinnae largest, ovate or deltoid-ovate, 5–9 × 4–7 mm, pinnatifid, with 3 or 4 pairs of lobes, apex acute; pinna lobes hemi-elliptic, 2–3 mm, margin usually involute when dried. Veins pinnate, ending in hydathodes close to laminar margin, obvious adaxially. Sori orbicular; indusia saucer-shaped, with fimbriate long-ciliate margin. $2n = 156$.

Rock crevices; ca. 4000 m. Xizang [Russia; Europe, North America].

H. C. Levinge's collection is the only record of *Woodsia alpina* from NW Himalaya. It is closely comparable to N European forms. It has always been identified as *W. subcordata*, or other allied species, and cited by some authors in the flora of N and NE China and the vicinity.

5. *Woodsia ilvensis* (Linnaeus) R. Brown, Prodr. 158. 1810.

岩蕨 yan jue

Acrostichum ilvense Linnaeus, Sp. Pl. 2: 1071. 1753; *Nephrodium rufidulum* Michaux; *Polypodium ilvense* (Linnaeus) Villars; *Woodsia rufidula* (Michaux) L. C. Beck.

Plants 12–17 cm tall. Rhizomes erect or ascending, scaly; scales concolorous, brown, broadly lanceolate, ca. 4 mm, membranous, margin entire. Fronds clustered; stipe castaneous, lustrous, 3–7 cm, ca. 1 mm in diam., with long hairs and linear-lanceolate scales, articulate below middle; lamina 1-pinnate-pinnatifid, lanceolate, 8–11 × 1.3–2 cm, herbaceous, covered with articulate hairs, especially abaxially, base gradually attenuate, apex acuminate; rachis and costae with brown, linear scales and long articulate hairs; pinnae 10–20 pairs, sessile, well separated, oblique; middle pinnae largest, ovate-lanceolate, 8–11 × 4–8 mm, pinnatifid, with 3–5 pairs of lobes, apex acute; pinna lobes elliptic, basal pair largest, 2–4 mm, entire or irregularly undulate. Veins pinnate, veinlets not reaching laminar margin. Sori orbicular and attached at ends of veinlets, submarginal; indusia saucer-shaped, membranous, margin long ciliate. $2n = 78(82)$.

Cliffs, rocky slopes; 200–2200 m. Hebei, Heilongjiang, Jilin, Nei Mongol, Xinjiang [Kazakhstan, Mongolia, Russia; Europe, North America].

6. *Woodsia polystichoides* D. C. Eaton, Proc. Amer. Acad. Arts 4: 110. 1858.

耳羽岩蕨 er yu yan jue

Physematium polystichoides (D. C. Eaton) Trevisan; *Woodsia brandtii* Franchet & Savatier; *W. polystichoides* var. *incisa* Ching & Y. T. Hsieh; *W. polystichoides* var. *nudiuscula* Hooker; *W. polystichoides* f. *veitchii* (Hance) Kitagawa; *W. polystichoides* var. *veitchii* Hance.

Plants 15–30 cm tall. Rhizomes short, erect, scaly; scales brown, lanceolate or ovate-lanceolate, ca. 4 mm, membranous, margin entire. Fronds clustered; stipe stramineous or brown-stramineous, slightly lustrous, 4–12 cm, 1–1.5 mm in diam., articulate at or near top, with linear or linear-lanceolate scales and long multicellular hairs; lamina 1-pinnate, linear-lanceolate

or narrowly lanceolate, 10–23 × 1.5–3 cm, papery or herbaceous, abaxially with mixture of linear scales and long hairs, adaxially glabrous or with few long hairs, base attenuate, apex acuminate; rachis long hairy; pinnae 16–30 pairs, sessile, spreading or slightly oblique, entire or undulate; lower 3 or 4 pairs of pinnae reduced and reflexed downward, basal pair of pinnae triangular; middle pinnae largest, elliptic-lanceolate, slightly falcate, 8–20 × 4–7 mm, base asymmetrical, acroscopically auriculate, truncate, basicopically cuneate, apex acute. Veins obvious, pinnate, veinlets 2-forked, ending in submarginal hydathodes. Sori orbicular, terminal at tips of acroscopic veinlets, submarginal; indusia cup-shaped, shallowly lobed, ciliate. $2n = 82$.

Crevices of shaded rocks; 200–2700 m. Widely distributed in C, E (including Taiwan, but not in Fujian), N, NW, and SW (Sichuan, Yunnan) China [Japan, Korea, Russia].

7. *Woodsia pilosa* Ching, Fl. Tsinling, 2: 222. 1974.

嵩县岩蕨 song xian yan jue

Plants ca. 20 cm tall. Rhizomes erect, scaly at apex; scales light brown, lanceolate, 4–5 mm, thinly membranous, fimbriate. Fronds clustered; stipe light stramineous, lustrous, 5–7 cm, ca. 1.2 mm in diam., articulate at top, base densely scaly, upward glabrous; lamina 1-pinnate-pinnatifid, linear-lanceolate, 11–12 × 1.6–1.8 cm, herbaceous, both surfaces densely covered with articulate hairs and occasionally abaxially with elongate scales along midvein, apex acuminate; rachis with mixture of linear scales and multicellular hairs; pinnae 15–18 pairs, free, sessile, spreading; lower pinnae opposite, slightly shortened; middle pinnae largest, ovate-lanceolate, 7–10 × 3–4 mm, alternate, shallowly pinnatifid, base asymmetrical, ± auriculate, acroscopically truncate, basicopically cuneate, apex obtuse; ultimate segments elliptic, touching each other, entire. Veins pinnate, invisible. Sori orbicular, terminal at tips of acroscopic veinlets, submarginal; indusia cup-shaped, margin ciliate, shallowly lobed into 3 segments at maturity.

• Rock crevices. Henan (Songxian).

8. *Woodsia macrochlaena* Mettenius ex Kuhn, J. Bot. 6: 270. 1868.

大囊岩蕨 da nang yan jue

Woodsia frondosa Christ; *W. japonica* Makino.

Plants 5–16(–20) cm tall. Rhizomes short, erect or ascending, scaly at apex; scales brown, lanceolate, 3–4 mm, membranous. Fronds clustered; stipe stramineous, 1–7.5 cm, ca. 1 mm in diam., articulate at top, with sparse, brown, articulate hairs; lamina 2-pinnatifid, elliptic-lanceolate, 4–10 × 2–3 cm, herbaceous, densely covered with articulate hairs, especially abaxially, base slightly narrowed or not, apex acute; rachis similarly hairy; pinnae 7–10 pairs, connected to each other by wings except for basal pinnae, opposite, spreading or slightly oblique, sessile; middle pinnae slightly longer, elliptic-oblong, 7–11(–22) × 5–12 mm, base symmetrical, margin pinnatifid, lobes entire, apex obtuse. Veins obscure, pinnate, tips often enlarged to form hydathodes. Sori orbicular, terminal at tips of veinlets, submarginal; indusia cup-shaped, membranous, lacinate.

Rock crevices in forests. Hebei, Liaoning, Shandong [Japan, Korea, Russia].

9. *Woodsia oblonga* Ching & S. H. Wu, Fl. Tsinling. 2: 221. 1974.

妙峰岩蕨 miao feng yan jue

Plants 7–18 cm tall. Rhizomes ascending, scaly at top; scales light brown, lanceolate, ca. 3 mm, thinly membranous, margin ciliate. Fronds clustered; stipe brown-stramineous, lustrous, 2–5 cm, ca. 1 mm in diam., articulate at top, with sparse, curly, long hairs and linear scales; lamina 1-pinnate, lanceolate, 6–16 × 2–3.5 cm, herbaceous, both surfaces with sparse, brown, articulate hairs, base slightly attenuate, apex acute; rachis stramineous, with mixture of linear scales and articulate hairs; pinnae 8–18 pairs, sessile, spreading; lower 1 or 2 pairs of pinnae slightly shortened and reflexed downward; middle pinnae larger, elliptic, 1–1.5 cm × 5–8 mm, base asymmetrical, acroscopically truncate, close to rachis, margin subentire or slightly undulate, apex obtuse; upper pinnae connected to each other by wings. Veins pinnate, not reaching laminar margin. Sori orbicular, terminal at ends of veinlets, submarginal; indusia cup-shaped, margin ciliate, shallowly lobed into 2 or 3 segments at maturity.

• Crevices of shaded rocks; 200–1800 m. Hebei, Henan, Shandong.

10. *Woodsia intermedia* Tagawa, Acta Phytotax. Geobot. 5: 250. 1936.

东亚岩蕨 dong ya yan jue

Woodsia subintermedia Tzvelev; *W. taishanensis* F. Z. Li & C. K. Ni.

Plants 10–25 cm tall. Rhizomes short, erect or ascending, scaly; scales brown, lanceolate, ca. 3 mm, membranous, margin subentire or sparsely ciliate. Fronds clustered; stipe brown-stramineous or light chestnut, 3–7.5 cm, ca. 1 mm in diam., articulate at top, with curly, long hairs and brown, linear scales later deciduous; lamina 1-pinnate, lanceolate, 8–18 × 2–3.8 cm, papery, both surfaces densely hairy, base slightly attenuate, apex acuminate or acute; rachis with mixture of linear scales and articulate hairs; pinnae 14–20 pairs, sessile, spreading, well separated from each other; lower pairs of pinnae shorter than above, hemielliptic or deltoid-ovate; middle pinnae largest, deltoid-lanceolate, 1–2 cm × 4–10 mm, base broadly cuneate, asymmetrical, acroscopically obviously auriculate, margin undulate or crenate, apex obtuse; upper pinnae connected to each other by wings. Veins obscure, veinlets oblique, 2- or 3-forked, ending with hydathodes and not reaching laminar margin. Sori orbicular, terminal at vein tips, submarginal; indusia cup-shaped, margin ciliate or hairy.

Crevices of shaded rocks in forests; 500–1800 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Shandong, Shanxi [Japan, Korea, Russia].

11. *Woodsia subcordata* Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 5: 206. 1832.

等基岩蕨 deng ji yan jue

Woodsia conmixta Ching; *W. eriosora* Christ; *W. kitadakensis* Ohwi; *W. longifolia* Tagawa; *W. pilosella* Ruprecht; *W. polystichoides* D. C. Eaton f. *sinuata* (Hooker) Kitagawa; *W. polystichoides* var. *sinuata* Hooker; *W. sinuata* (Hooker) Ching (1902), not Makino (1897); *W. viridis* Ching.

Plants 14–22 cm tall. Rhizomes short, erect or ascending, scaly; scales brown, ovate-lanceolate or broadly lanceolate, ca. 4 mm, membranous, margin ciliate, apex acuminate. Fronds clustered; stipe brownish or brown-stramineous, polished, (2–) 4–8 cm, ca. 1 mm in diam., with oblique or horizontal articulation at top, base scaly, upper parts with sparse articulate long hairs and linear scales, later deciduous; lamina 1-pinnate-pinnatifid, lanceolate, 8–15 × 2–3 cm, papery, both surfaces sparsely hairy and scaly, or occasionally subglabrous, hairs gray or grayish brown, long articulate; scales brown, linear, small; lamina base slightly attenuate, apex obtuse or acuminate; rachis stramineous or tinted castaneous-brown, as hairy and scaly as stipe; pinnae 11–16 pairs, subopposite or alternate, lower 2 or 3 pairs of pinnae gradually shortened, basal pair usually ca. 5 mm; middle pinnae largest, hemielliptic or narrowly triangular-lanceolate, 8–20 × 4–10 mm, base rounded-truncate, acroscopically auriculate, auricles ± overlapping rachis, margin pinnatifid to 1/2, apex obtuse; segments 3 or 4 pairs, hemielliptic, 2–4 mm, entire, rounded. Veins faintly visible, simply pinnate in segments, veinlets oblique, ending with hydathodes. Sori orbicular, terminal at veinlet tips, submarginal; indusia saucer-shaped, margin ciliate.

Rock crevices in forests; 500–3000 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shanxi [Japan, Korea, Mongolia, Russia].

12. *Woodsia sinica* Ching, Sinensia 3: 145. 1932.

山西岩蕨 shan xi yan jue

Plants 8–9 cm tall. Rhizomes short, erect, scaly; scales brown, ovate-lanceolate, ca. 3 mm, membranous, margin ciliate. Fronds clustered; stipe stramineous, 1–3 cm, ca. 1 mm in diam., articulate at top or above middle, with sparse articulate hairs and few lanceolate scales, later fallen; lamina 1-pinnate-pinnatifid, linear-lanceolate, 4.5–6 cm × 8–12 mm, thinly papery, abaxially with few articulate hairs, adaxially glabrous, base slightly attenuate, apex acuminate; rachis sometimes with sparse linear scales; pinnae 12–14 pairs, sessile, well separated from each other; lower 2 pairs of pinnae reduced; middle pinnae equally long, triangular-ovate, 4–6 × 3–4 mm, base rounded-cuneate, margin pinnatifid, apex acute; ultimate segments 3–5 pairs, basal one largest, hemielliptic, undulate, apex rounded. Veins obscure, almost reaching laminar margin. Sori orbicular, terminal at end of veinlets, 3 or 4 per pinna; indusia saucer-shaped, fimbriate.

• Rock crevices. Shanxi (Ningwu).

13. *Woodsia macrospora* C. Christensen & Maxon, J. Wash. Acad. Sci. 17: 499. 1927.

甘南岩蕨 gan nan yan jue

Plants 12–17 cm tall. Rhizomes ascending, scaly; scales brown, lanceolate, ca. 3 mm, membranous. Fronds clustered; stipe dark stramineous, 6–9 cm, ca. 1 mm in diam., brittle, with sparse articulate hairs and few linear scales, upper part of

stipes usually fallen, middle and lower parts persistent, clustered (articulation not seen); lamina 1-pinnate, linear-lanceolate, herbaceous, pubescent, abaxial surface more densely pubescent, gradually attenuate to both ends; rachis with mixture of sparse articulate hairs and linear scales; pinnae 10 or 11 pairs, sessile, well separated, spreading; lower 1 or 2 pairs slightly shortened, ovate, ca. 4 mm; middle pinnae largest, suborbicular-ovate, 5–6 × 3–5 mm, base cuneate, margin irregularly undulate, slightly involute, apex obtuse. Veins obscure, pinnate, nearly reaching laminar margin. Sori orbicular, medial, 3–5 per pinna; indusia consisting of many curly, multicellular hairs.

- Rock cliffs in mountain valleys; 3500–4200 m. S Gansu.

14. *Woodsia cinnamomea* Christ, Bull. Acad. Int. Géogr. Bot. 16: 122. 1906.

赤色岩蕨 *chi se yan jue*

Plants 8–15 cm tall. Rhizomes short, erect, scaly; scales brown, lanceolate, ca. 3 mm, membranous, margin entire, apex acuminate. Fronds densely clustered; stipe brownish stramineous, 2.5–5.5 cm, ca. 1 mm in diam., continuous, base densely scaly, upper part and rachis densely covered with long articulate hairs and brown linear scales, later mostly fallen; lamina 1-pinnate or bipinnatifid, lanceolate, 6–8 × 1.5–2 cm, herbaceous, both surfaces densely covered with brown, articulate hairs, base slightly attenuate, apex acuminate; pinnae in 1-pinnate lamina 9–11 pairs, sessile, well separated, spreading; lower pairs slightly shortened; middle pinnae largest, oblong-ovate, 6–8 × 3–5 mm, close to rachises, base cuneate, margin undulate, apex obtuse; pinnae in bipinnatifid lamina ca. 7 pairs, opposite, obliquely spreading, 1 or 2 lower pairs somewhat shortened; middle ones longest, ovate, ca. 6 × 4 mm, base broadly cuneate, margin pinnatifid, apex obtuse; segments hemielliptic, undulate. Veins obscure, pinnate, nearly reaching laminar margin. Sori orbicular, consisting of a few sporangia, located on veinlets, medial; indusia consisting of many curly, multicellular hairs.

- On rocks; ca. 2800 m. SW Sichuan (Muli).

15. *Woodsia lanosa* Hooker in Hooker & Baker, Syn. Fil. 47. 1866.

毛盖岩蕨 *mao gai yan jue*

Woodsia pellaepsis Handel-Mazzetti.

Plants small, 2–10 cm tall. Rhizomes short, erect, scaly; scales brown, polished, linear, 2–3 mm, margin entire, apex filiform. Fronds clustered; stipe chestnut, slightly lustrous, 1–4 cm, less than 1 mm in diam., brittle, densely covered with brown, linear scales and articulate hairs; lamina downward bipinnatifid, apically pinnatifid, brownish green when dried, lanceolate, 1–7 cm × 4–14 mm, herbaceous, densely covered with brown, curly, articulate hairs and linear scales abaxially, apex acuminate; pinnae 4–10 pairs, sessile, well separated, spreading; basal pair slightly shortened; middle ones equally large, narrowly elliptic, base truncate, margin pinnatifid, apex obtuse; ultimate segments 2–4 pairs, hemielliptic, undulate. Veins obscure, pinnate, oblique, not reaching laminar margin. Sori orbicular, terminal at vein tips, usually 2 or 3 per segment; indusia hairlike, consisting of many curly, multicellular hairs.

On rocks in forests; 3100–4200 m. Sichuan, Xizang, Yunnan [Bhutan, N India, Nepal].

16. *Woodsia guizhouensis* P. S. Wang, Q. Luo & Li Bing Zhang, Novon 22: 191. 2012.

贵州岩蕨 *gui zhou yan jue*

Plants perennial, deciduous, caespitose, 3–8 cm tall. Rhizomes short, erect, with a cluster of persistent stipe bases, sparsely scaly; scales light brown, linear to lanceolate, ca. 2.5 × 0.1–0.6 mm, membranous, sparsely fimbriate; adventitious roots dark brown when dry, to 12 cm, ca. 0.3 mm in diam. Fronds deciduous, 5–10 per rhizome, grayish green when dried; stipe brown-stramineous, not articulate, 0.5–2.2 cm, 0.4–0.6 mm in diam., adaxially canaliculate and green; basal stipe scales light brown, narrowly lanceolate, 1.2–4 × 0.1–0.8 mm, membranous, multicellular, fimbriate, matte; distal stipe scales light brown, narrowly lanceolate, 1.2–3.5 × 0.1–0.7 mm, membranous, multicellular, sparsely fimbriate, matte; lamina 1-pinnate, narrowly elliptic, 2–6 × 0.8–2 cm, slightly contracted toward base, apex obtuse; rachis 0.2–0.5 mm in diam. at midpoint, adaxially sulcate, without proliferous bulbils; rachis scales similar to distal stipe scales; pinnae in 3–8 pairs, herbaceous, lower pinnae ovate, 4–8 × 3–6 mm, shortly stalked to 1 mm, base often shallowly cordate or sometimes rounded, apex obtuse or rounded; middle pinnae longer than lower pinnae but otherwise similar, ovate to oblong, 4–10 × 3–7 mm; terminal pinnae nearly an equilateral triangle, 0.8–1.2 cm, apex obtuse or rounded, with 3 pairs of lobes; lobes of pinnae 3 or 4 pairs, obtusely deltoid, nearly entire to crenate on margins; both surfaces of pinnae densely pubescent, hairs translucent yellowish, 0.53–0.69 mm × 14–22 μm. Veins free, in 4 or 5 pairs from midrib. Sori orbicular, dorsal or subterminal on veinlets, 1–4 per pinna segment; indusia brown, shallowly cup-shaped, inferior, contracted to a jarlike shape when dry, 1–1.2 mm in diam., membranous, often 3-lobed, apices of lobes with multicellular hairs 1.2–1.36 mm × 11–15 μm. Sporangia dehiscing into 4 or 5 portions when mature, each portion ca. 0.45 mm; annuli with 18–20 thickened cells; spores light brown, oblong, with cristate perispore sculpturing.

- Wet and shady limestone crevices or cliffs under broad-leaved forests; 1600–2300 m. W Guizhou (Bijie, Liupanshui, Pu'an).

17. *Woodsia andersonii* (Beddome) Christ, Bull. Soc. Bot. France 52(Mém. 1): 45. 1905.

蜘蛛岩蕨 *zhi zhu yan jue*

Gymnogramma andersonii Beddome, Ferns Brit. India 1: t. 190. 1866.

Plants 10–20 cm tall. Rhizomes short, erect or ascending, scaly; scales dark brown, linear-lanceolate, ca. 3 mm, membranous, margin entire. Fronds clustered; stipe stramineous or brownish stramineous, lustrous, 5–10 cm, ca. 1 mm in diam., continuous, with fibrous small scales and articulate hairs, later partly fallen; rachis sparsely hairy when old, stipes and rachises persistent after pinnae fallen; lamina basally 2-pinnatifid, apically pinnatifid, lanceolate, 5–10 × 1–2 cm herbaceous, both surfaces densely covered with rusty, articulate long hairs, especially when young, base not or slightly shortened, apex acu-

minate; pinnae 6–9 pairs, sessile, lower pairs well separated, not or slightly shortened; middle pinnae ovate or subrhombic, 7–12 mm, base broadly cuneate, margin lobed, apex obtuse; ultimate segments 2–4 pairs, hemielliptic, entire or undulate. Veins obscure, pinnate, veinlets not reaching laminar margin. Sori orbicular, located on acroscopic veinlets, 1–3 per segment, medial or supramedial; indusia consisting of 8–10 long, curly hairs. $2n = 328$.

Rock crevices and cliffs in forests; 2500–4500 m. Gansu, Qinghai, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan [Bhutan, N India, Nepal].

Woodsia andersonii is distributed in SW China and Himalaya. According to Knapp (Ferns Fern Allies Taiwan, 229, 483, 2011), it has been found in two locations in Taiwan. It is densely covered with rusty, long hairs when young, while most of the hairs fall away later.

18. *Woodsia rosthorniana* Diels in Engler, Bot. Jahrb. Syst. 29: 187. 1900.

密毛岩蕨 mi mao yan jue

Woodsia delavayi Christ; *W. jeholensis* Nakai & Kitagawa; *W. lanosa* Hooker var. *attenuata* C. Christensen.

Plants 7–25 cm tall. Rhizomes short, erect, scaly; scales brown, lustrous, linear-lanceolate, 4–5 mm, membranous, margin entire, apex subulate. Fronds clustered; stipe yellowish brown or stramineous, 2–6 cm, less than 1 mm in diam., densely covered with yellow-brown long multicellular hairs and linear scales, stipe and rachis usually curved and \pm S-shaped; rachis as densely hairy and scaly as stipe; lamina basally 1-pinnate-pinnatifid, apically pinnatifid, lanceolate, 7–20 \times 1.5–3 cm, herbaceous, both surfaces densely covered with brownish long articulate hairs, base gradually shortened, apex acute; pinnae 10–15 pairs, spreading, sessile, lower pairs reduced into auricles, well separated; middle pinnae largest, oblong-elliptic or ovate-lanceolate, 8–15 \times 5–8 mm, base broadly cuneate, margin pinnatifid, apex obtuse or rounded; ultimate segments 4 or 5 pairs, hemielliptic, basal pair largest, entire. Veins obscure, pinnate, veinlets nearly reaching laminar margin. Sori orbicular, located at vein endings or on veinlets, submarginal, dispersed throughout abaxial surface of pinnae at maturity; indusia shallowly saucer-shaped, dissected into 3–5 platelike lobes at maturity, margin with curly, unicellular hairs. $2n = 164$.

Rock crevices in forests and in thickets; 1000–3000 m. Hebei, Liaoning, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan].

“Eriosoriopsis rosthorniana” (Ching & S. H. Wu, Fern Fam. Gen. China, 402. 1991) belongs here but was not validly published be-

cause a full and direct reference to the author and place of valid publication of the basionym was not provided (*Melbourne Code*, Art. 41.5).

19. *Woodsia cycloloba* Handel-Mazzetti, Symb. Sin. 6: 19. 1929.

栗柄岩蕨 li bing yan jue

Plants 4–10 cm tall. Rhizomes ascending or prostrate, scaly; scales dark brown, lanceolate, ca. 2 mm, membranous, margin entire or sparsely dentate. Fronds subclustered; stipe castaneous, 2–5 cm, fragile, lower part covered with scales and articulate hairs, upper part and rachis densely covered with articulate knee-jointlike long hairs, hairs later fallen; lamina imparipinnate, elliptic-lanceolate, 3–6 \times 1–2.5 cm, thinly herbaceous, abaxially with articulate hairs along veins and margin, adaxially glabrous; pinnae 5 or 6 pairs, opposite, spreading, sessile, ovate or elliptic, 8–12 \times 5–9 mm, margin entire or slightly undulate, apex rounded. Veins visible, pinnate, veinlets not reaching laminar margin. Sori large, orbicular, located at bifurcations of lateral veins or on acroscopic veinlets; indusia absent or composed of ciliate, platelike, small lobes, hidden. $2n = 328$.

Crevices in granite rocks and schist cliffs; 2900–4600 m. Shaanxi, Sichuan, Xizang, Yunnan [India (Sikkim), Nepal].

20. *Woodsia okamotoi* Tagawa, Acta Phytotax. Geobot. 7: 185. 1938.

冈本氏岩蕨 gang ben shi yan jue

Rhizomes ascending, up to 5 cm, densely covered by persistent stipe remains. Stipes clustered, rigid but fragile, together with rachis ebeneous, relatively polished, sparsely scaly and pubescent, 3–5 mm, up to 1 mm in diam.; hairs pale, articulate, flexuous; scales rust-colored, lanceolate or linear-lanceolate, membranous, gradually attenuate into articulate hairs, hairs not glandular-capitate at apex, scales in lower parts of stipe larger, up to 4 mm; lamina 1-imparipinnate, lanceolate, widest at middle, 4–7 \times 1–2 cm, herbaceous, slightly attenuate to base, apex obtuse; pinnae 6–9 pairs, spreading, \pm remote from each other, ovate or ovate-oblong, both surfaces pubescent, base truncate or finely cordate, sessile, margin crenate-lobed to pinnatifid, apex rounded; margin beneath to costa scaly; middle pinnae largest, 5–10 mm, 3–6 mm wide at base; lobes ca. 4 pairs, entire, rounded; terminal pinna smaller, 3–5 mm long and wide. Sori medial; indusia consisting of pale, long, crested hairs. Spores subellipsoid, surface folded, tuberculate.

• Moss-covered shaded rocks in coniferous forests; 3000–3500 m. Taiwan.