

## DAVALLIACEAE

骨碎补科 gu sui bu ke

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Plants small to moderate-sized, epiphytic, epilithic, or rarely terrestrial. Rhizome long creeping, dorsiventral, densely covered with peltate or basifixed scales; fronds usually in 2 rows. Fronds remote; stipe articulate at base to short or long phyllopodia; lamina simple, imparipinnate, or pinnatifid to 4-pinnate-pinnatifid, firmly herbaceous to leathery, glabrous or sometimes covered with scales or hairs; veins free, usually forked. False veins present in several species. Sporangia typically separately borne in a small discrete sorus terminal on veins, submarginal or sometimes medial [in *Humata undulata* (Alderwerelt) M. Kato & Tsutsumi connate and elongate along lamina margins]; indusium opening toward margin, attached at base and sometimes at sides, orbicular, reniform, or elongate toward margin. Sporangia long stalked, 3-seriate, annulus longitudinal, consisting of 12–16 thickened cells; spores mono-lete, elliptic or narrowly elliptic, translucent, usually without perispore.

Five genera (one according to Nootboom) and ca. 35 species: mostly in tropical and subtropical Asia, a few species extending to Africa, one species in NW Africa, SW Europe, and Macaronesia; four genera and 17 species (three endemic) in China.

One of us (Nootboom) considers that only one genus, *Davallia*, can be recognized in the Davalliaceae. *Paradavallodes multidentata* is nested in *Araiostegia* + *Davallodes*, which is a polymorphic basal clade. Among species examined, *A. hymenophylloides* (Blume) Copeland is the type of *Araiostegia*, and *P. multidentata* is the type of *Paradavallodes*. Therefore, the earliest published—*Davallodes* (Copeland) Copeland—should be used as the generic name. However, from morphology and DNA there are no arguments to recognize this genus. The *Humata* clade looks quite distinct as an entity, although it contains *Davallia corniculata*, renamed to *H. corniculata* by Kato, and in all other systems this is a *Davallia*. Tsutsumi, Zhang and Kato did not analyze *D. wagneriana* Copeland and included it in *Davallia*, but morphologically this is the closest relative of *D. corniculata*. It should belong to *Humata*; or better, *Humata* is part of *Davallia* (Tsutsumi, Zhang & Kato, Syst. Bot. 33: 44–48. 2008).

However, two of us (Xing and Wang) consider that morphological and molecular phylogenetic studies do not support there being only one genus (e.g., Sen, Sen & Holtum, Kew Bull. 27: 217–243. 1972; Kato and Tsutsumi, Acta Phytotax. Geobot. 59: 1–14. 2008; and Tsutsumi, Zhang & Kato, Syst. Bot. 33: 44–48. 2008). A recent study about the leaf epidermis and spore morphology of Davalliaceae (He Chunmei, A taxonomic revision of Davalliaceae in China. Graduate University of Chinese Academy of Sciences, Guangzhou. 2012) also supports *Araiostegia*, *Humata*, and *Paradavallodes* as natural genera.

Polyploidy, through hybridization and polyploidization, has been assessed in the *Humata* group, and these polyploids appeared to be apomictic. This could very well also be the case in other groups. With only cpDNA, the phylogeny of a group like this cannot be assessed. Moreover, in Davalliaceae, incongruence between CpDNA and nrDNA is found on the generic level but is not yet explained (C. W. Chen et al., Insights into Evolutionary History of the *Humata repens* Complex in Taiwan. 5th Symp. Asian Pteridol. Fern Show: Progr. & Abstr. 42. 2010; C. W. Chen & Nootboom, ined.).

Ching Ren-chang, Fu Shu-hsia, Wang Chu-hao & Shing Gung-hsia. 1959. Davalliaceae (excluding *Arthropteris*, *Gymnogrammitis*, *Leucostegia*, and *Nephrolepis*). In: Ching Ren-chang, ed., Fl. Reipubl. Popularis Sin. 2: 280–319, 374–378; Wu Shiewhung. 1999. Davalliaceae (excluding *Leucostegia*). In: Wu Shiewhung, ed., Fl. Reipubl. Popularis Sin. 6(1): 161–197.

- 1a. Lamina lanceolate, both surfaces and/or rachis covered with gray pubescence; basal pinnae similar to upper one ..... 1. *Paradavallodes*  
1b. Lamina usually pentagonal, not covered with gray pubescence; basal pinnae larger than upper one.  
2a. Lamina thinly papery, very finely dissected ..... 2. *Araiostegia*  
2b. Lamina leathery or thickly papery.  
3a. Indusium tubular or cup-shaped, attached at base as well as sides ..... 3. *Davallia*  
3b. Indusium semicircular, often attached at base only ..... 4. *Humata*

### 1. PARADAVALLODES Ching, Acta Phytotax. Sin. 11: 18. 1966.

假钻毛蕨属 jia zuan mao jue shu

Plants small to moderate-sized, growing on moss-covered rocks or old trunks. Rhizome long creeping, densely scaly; scales brown, peltate and lanceolate to ovate-lanceolate, membranous. Fronds remote; stipe articulate to rhizome, glabrous or slightly to densely scaly; lamina tripinnatifid, broadly lanceolate to elliptic-lanceolate, papery, decurrent at base; rachis and sometimes both surfaces of lamina with gray pubescence. Veins forked. Sori submarginal, small, terminal on veinlet; indusium small, semicircular to reniform, attached at base; spores narrowly elliptic, without perispore.  $n = 10$ , (40).

Three species: W and SW China, N India, Myanmar, Nepal, N Vietnam; three species (one endemic) in China.

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- 1a. Pinnae with obvious petiolule; rachis with ovate, large scales abaxially; indusium reniform, base cordate, always deciduous when mature ..... 1. *P. multidentata*  
 1b. Pinnae sessile; rachis without scales abaxially; indusium semicircular, base rounded-truncate, persistent.  
 2a. Lamina thinly papery, densely covered with gray pubescence on both surfaces; rhizome scales with thin, pale border ..... 2. *P. membranulosa*  
 2b. Lamina thickly papery, covered with gray pubescence only on rachis; rhizome scales rufous on margin ..... 3. *P. chingiae*

**1. *Paradavallodes multidentata*** (Hooker) Ching, Acta Phytotax. Sin. 11: 20. 1966.

假钻毛蕨 jia zuan mao jue

*Davallia multidentata* Hooker in Hooker & Baker, Syn. Fil. 91. 1867; *Araiostegia multidentata* (Hooker) Copeland; *Davallodes multidentata* (Hooker) M. Kato & Tsutsumi; *Humata multidentata* (Hooker) Diels; *Leucostegia multidentata* (Hooker) Beddome; *Paradavallodes kansuensis* Ching.

Rhizome ca. 5 mm in diam. (without scales, with scales ca. 10 mm in diam.), not white waxy. Scales brown without pale border, narrowed evenly toward apex, often curling backward, basifixed with cordate base and much overlapping lobes, ca. 6 mm, without multiseptate hairs, lacking marginal setae or teeth, or toothed. Stipe pale or dark brown, adaxially grooved, 17–25 cm, glabrous or with few scales; lamina compound, tripinnate, deltoid and broadest toward base, 30–45 × 17–34 cm, glabrous, not or slightly dimorphic. Longest petiolules 8–10 mm; pinnae linear-triangular; longest pinnae 10–19 × 6–9 cm; pinnules of at least larger pinnae anadromous, narrowly ovate; longest pinnules 40–70 × 15–30 mm; ultimate pinnae linear-oblong, lobed halfway toward midrib; ultimate segments or lobes obtuse or acute without a tooth, 2–4 × ca. 1 mm (often shallowly lobed). Rachises and costae, at least rachises, hairy; hairs 0.1–0.2 mm. Veins in sterile ultimate lobes simple or forked, not reaching margin; false veins not present. Sori separate, frequently single on a segment, at forking point of veins or at bending point of a vein; indusium reniform, attached at narrow, cordate base only, wider than long, ca. 0.5 × 0.6–0.8 mm.

Dense forests, epiphytic on rocks or tree trunks; 1200–2100 m. Gansu, Sichuan, Yunnan [India, Nepal].

In the paper "Notes on Davalliaceae I" (Nooteboom, Blumea 37: 175. 1992), *Paradavallodes kansuensis* was reduced to the synonymy of *Araiostegia pulchra* on the basis of the description. However, after studying the type of *P. kansuensis*, all of the present co-authors agree that it in fact belongs to *P. multidentata*.

**2. *Paradavallodes membranulosa*** (Wallich ex Hooker) Ching, Acta Phytotax. Sin. 11: 20. 1966.

膜叶假钻毛蕨 mo ye jia zuan mao jue

*Davallia membranulosa* Wallich ex Hooker, Sp. Fil. 1: 159. 1845; *Acrophorus membranulosus* (Wallich ex Hooker) T. Moore; *Araiostegia membranulosa* (Wallich ex Hooker) Holttum; *Davallodes membranulosa* (Wallich ex Hooker) Copeland; *Humata membranulosa* (Wallich ex Hooker) Diels; *Leucostegia membranulosa* (Wallich ex Hooker) J. Smith.

Rhizome 2–4 mm in diam., densely covered with scales. Scales brown, red-brown, or nearly black, with pale border

from base to apex, narrowed evenly toward apex, peltate, 5–6 mm, without multiseptate hairs, lacking marginal setae or teeth or those rare. Fronds 1.5–3 cm apart; stipe pale, adaxially grooved, 3–15 cm, 1.5–2 mm in diam., with hairs and/or scales when young; lamina compound, bipinnate toward base and in middle part, elongate, not or hardly narrowed toward base, 12–27 × 5–14 cm, with multicellular hairs, not or slightly dimorphic. Longest petiolules 0.5–1.5 mm; pinnae linear-triangular; longest pinnae 2.6–7 × 1–3 cm; pinnules of at least larger pinnae catadromous or anadromous (but often opposite), linear-oblong (pinnatifid, lobes entire or shallowly lobed); longest pinnules 6–15 × 2–4 mm. Rachises and costae, at least rachises, hairy; hairs 0.4–0.6 mm. Veins in sterile ultimate lobes simple or forked, not reaching margin; false veins not present. Sori separate, frequently single on a segment, at forking point of veins or (rarely) at bending point of a vein; indusium attached at broad base and hardly or not at sides, semicircular or oblong (to circular), longer than wide to wider than long, 0.5–0.8 × 0.5–0.8 mm.

Epilithic or epiphytic in forests; 600–2600 m. Sichuan, Yunnan [Bhutan, India, Myanmar, Nepal, N Thailand, Vietnam].

One of us (Nooteboom) considers that although Ching (Acta Phytotax. Sin. 11: 20. 1966) recognized two species, *Paradavallodes chingiae* and *P. membranulosa*, careful examination of the types leads to the conclusion that there is only one, easily recognizable species, i.e., *P. membranulosa*. However, two of us (Xing and Wang) do not support *P. chingiae* as a synonym of *P. membranulosa* on account of differences in the leaf texture and pubescence. In addition, according to scanning electron microscope observations, the spore ornamentation of *P. chingiae* is lophate, whereas that of *P. membranulosa* is verrucate.

**3. *Paradavallodes chingiae*** (Ching) Ching, Acta Phytotax. Sin. 11: 20. 1966.

秦氏假钻毛蕨 qin shi jia zuan mao jue

*Davallodes chingiae* Ching in S. S. Chien & Chun, Fl. Reipubl. Popularis Sin. 2: 375. 1959.

Rhizome 3–4 mm in diam., densely covered with scales. Scales rufous, without pale border, lanceolate, peltate, 3–4 mm, entire, apex long acuminate, subulate. Fronds 1–2 cm apart; stipe reddish, adaxially thinly grooved, 12–15 cm, 1.5–2 mm in diam., base densely covered with scales; lamina dark green when dry, tripinnatifid, ovate-lanceolate, 25–30 × 10–14 cm, glabrous except on rachis, dimorphic, thickly papery, base cordate to truncate, apex acuminate. Pinnae 12–15 pairs, alternate or basal ones subopposite, sessile, elliptic-lanceolate to broadly lanceolate, 5–7 × 2–3.5 cm, base nearly truncate, rounded-cuneate, apex acuminate, basal pair similar to upper one, pinnatifid to rachis with narrow wing; pinnules 13–15 pairs, approximate, elliptic, 1–1.5 × ca. 0.5 cm, base asymmetrical, apex acute; lobes 6–8 pairs, oblique, falcate-elliptic,

2–3 × 1.5–2.5 mm, base asymmetrical, apex acute. Rachises covered with slightly brown or gray pubescence. Veins visible on both surfaces, veinlets forked. Sori in 1 row on each side of main veins; indusium attached at base, semicircular, wider than

long or ± as wide as long, 0.6–0.8 × 0.6–0.8 mm, thickly membranous, entire, apex rounded.

• Dense forests, epilithic on rocks; 1300–1500 m. SE Yunnan (Malipo).

## 2. ARAIOSTEGIA Copeland, Philipp. J. Sci. 34: 240. 1927, nom. cons.

小膜盖蕨属 xiao mo gai jue shu

*Araiostegiella* M. Kato & Tsutsumi.

Plants moderate-sized, epiphytic or growing on moss-covered rocks or old trunks. Rhizome long creeping, with a ring of 2 larger vascular bundles and 6–10 smaller ones, densely scaly; scales rufous, ovate to lanceolate, peltate, thin. Fronds remote or approximate; stipe purple or slightly purple, glabrous or scaly, with a ring of 2 large bundles and 4 smaller ones; lamina finely dissected, broadly ovate or narrowly ovate, deltoid, thinly papery, glabrous. Sori submarginal, small, terminal on veinlet; indusium small, membranous, semicircular or orbicular-reniform, attached only at base, long stalked; annulus longitudinal, consisting of 12–14 thickened cells; spores elliptic, translucent, usually without perispore.  $n = 10$ , (40).

About ten species: mostly in SW China, west to India and Myanmar; four species (one endemic) in China.

- 1a. Scales of rhizome broadly ovate, apex obtuse ..... 1. *A. pulchra*  
 1b. Scales of rhizome broadly lanceolate, apex acuminate.  
 2a. Fronds 20–35 cm tall, approximate, 2–5 mm apart; lamina tripinnatifid; pinnae articulate to rachis; stipe and rachis persistent and turning black when pinnae fall ..... 2. *A. hookeri*  
 2b. Fronds 40–70 cm tall, remote, 1.5–5 cm apart; lamina 4- or 5-pinnatifid; pinnae not articulate to rachis; stipe and rachis not persistent.  
 3a. Basal pair of pinnules catadromous ..... 3. *A. faberiana*  
 3b. Basal pair of pinnules opposite ..... 4. *A. perdurans*

**1. *Araiostegia pulchra*** (D. Don) Copeland, Philipp. J. Sci. 34: 241. 1927.

美小膜盖蕨 mei xiao mo gai jue

*Davallia pulchra* D. Don, Prodr. Fl. Nepal. 11. 1825; *Acrophorus pseudocystopteris* (Kunze) T. Moore; *A. pulchra* (D. Don) T. Moore; *Araiostegia athamantica* (Christ) Copeland; *A. beddomei* (C. Hope) Ching; *A. delavayi* (Beddome ex C. B. Clarke & Baker) Ching; *A. imbricata* Ching; *A. pseudocystopteris* (Kunze) Copeland; *A. yunnanensis* (Christ) Copeland; *Davallia athamantica* Christ; *D. beddomei* C. Hope; *D. chaerophylla* Wallich ex Hooker; *D. imbricata* (Ching) X. C. Zhang; *D. pseudocystopteris* Kunze; *D. pulchra* var. *delavayi* Beddome ex C. B. Clarke & Baker; *D. pulchra* var. *pseudocystopteris* (Kunze) C. B. Clarke; *D. rigidula* Baker; *D. yunnanensis* Christ; *Davallodes beddomei* (C. Hope) M. Kato & Tsutsumi; *D. imbricata* (Ching) M. Kato & Tsutsumi; *D. pseudocystopteris* (Kunze) M. Kato & Tsutsumi; *D. pulchra* (D. Don) M. Kato & Tsutsumi; *D. yunnanensis* (Christ) M. Kato & Tsutsumi; *Humata chaerophylla* (Wallich ex Hooker) Mettenius; *H. pulchra* (D. Don) Diels; *H. yunnanensis* (Christ) Ching; *Leucostegia delavayi* (Beddome ex C. B. Clarke & Baker) Ching; *L. pseudocystopteris* (Kunze) Beddome; *L. pulchra* (D. Don) J. Smith; *L. yunnanensis* (Christ) C. Christensen.

Rhizome 2–6 mm in diam. (without scales), not white waxy. Scales brown (often grayish), without pale border, broad, ovate to oblong-subdeltoid with rounded to acute apex, appressed to rhizome, usually crisped, margins recurved, basifixed with cordate base and much overlapping lobes, 2–5 mm, without multiseptate hairs, lacking marginal setae or teeth or those

rare. Stipe pale, adaxially grooved, 10–20 cm, glabrous or with few scales (sometimes with more scales); lamina compound, tripinnate or quadripinnate, deltoid and broadest toward base, to elongate, often narrowing toward base, 12–50 × 7–40 cm, glabrous, not or slightly dimorphic. Longest petiolules 3–20 mm; pinnae deltoid or linear-triangular; longest pinnae 5–21 × 3–12 cm; pinnules of at least larger pinnae anadromous, linear-oblong or narrowly ovate; longest pinnules 25–70 × 10–35 mm; ultimate pinnae linear-oblong, lobed almost to midrib (each lobe bilobed again); ultimate segments or lobes obtuse or acute without a tooth, 0.5–3 × 0.6–1 mm. Rachises and costae glabrous. Veins in sterile ultimate lobes frequently simple, not reaching margin; false veins not present. Sori separate, frequently single on a segment, at forking point of veins or at bending point of a vein; indusium reniform or semicircular, attached at narrow, cordate base only, wider than long, 0.5–0.8 × 0.5–1 mm.

Wet forests, epiphytic and epilithic on granite and limestone; 400–3500 m. Guangxi, Guizhou, Sichuan, Xizang, Yunnan [Bhutan, India, Laos, Myanmar, Nepal, Sri Lanka, N Thailand, Vietnam].

Although *Araiostegia pulchra* is rather variable, especially because in different habitats the size may differ greatly, it is always recognizable by the broad, appressed, usually crisped rhizome scales.

After comparing the types of *Davallia pulchra* and *D. yunnanensis*, the current authors consider them to be conspecific because of their similarity.

**2. *Araiostegia hookeri*** (T. Moore ex Beddome) Ching in S. S. Chien & Chun, Fl. Reipubl. Popularis Sin. 2: 291. 1959.

宿枝小膜盖蕨 su zhi xiao mo gai jue

*Acrophorus hookeri* T. Moore ex Beddome, Ferns Brit.

India 1: 95. 1865; *Araiostegia clarkei* (Baker) Copeland; *A. parva* Copeland; *Araiostegiella clarkei* (Baker) M. Kato & Tsutsumi; *A. hookeri* (T. Moore ex Beddome) Fraser-Jenkins; *Davallia clarkei* Baker; *D. hookeri* (T. Moore ex Beddome) X. C. Zhang; *D. subalpina* Hayata; *Humata hookeri* (T. Moore ex Beddome) Diels; *Leucostegia clarkei* (Baker) C. Christensen; *L. hookeri* (T. Moore ex Beddome) Beddome; *L. parva* (Copeland) C. Christensen.

Rhizome 3–4 mm in diam., densely covered with scales, not white waxy. Scales brown, without pale border, narrowed evenly toward apex, basifixed with cordate base and much overlapping lobes, 6–7 mm, without multiseptate hairs, lacking marginal setae or teeth, or those rare, or toothed. Stipe pale, adaxially grooved, 7–15 cm, covered with scales near base, sparsely scaly above base; lamina thinly papery, yellowish green when dry, tripinnate, deltoid and broadest toward base, 15–20 × 6–10 cm, glabrous, not or slightly dimorphic. Petioles ± lacking, generally lowest pinnule inserted at very base of pinna rachis; pinnae deltoid or linear-triangular, 3–6 × 1–2 cm; basal pinnae opposite, alternate distally, sessile, basal pair similar to distal one, elliptic-lanceolate; pinnules 8–10 pairs, subsessile, obliquely ovate, 6–10 × 3–5 mm; ultimate pinnae linear-oblong, lobed almost to midrib; ultimate segments or lobes obtuse or acute without a tooth, narrowly linear, ca. 0.5 mm wide. Rachises and costae glabrous. Rachis with an ovate scale at forking point. Veins in sterile ultimate lobes frequently simple, not reaching margin; false veins not present. Sori separate, frequently single on a segment, terminal on veinlet; indusium semicircular, attached at base, wider than long or ± as wide as long.

Dense mixed forests, epiphytic on tree trunks, also on rocks; 1200–4000 m. Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

One of us (Nootboom) considers both *Araiostegia faberiana* and *A. perdurans* to be conspecific with *A. hookeri*, having seen 113 specimens with duplicates from A, BM, IBSC, K, KUN, KYO, L, P, PE, SING, TI, and UC, as well as the types of *Davallia clarkei* var. *faberiana* and *D. perdurans*, neither of which is different from *A. hookeri*. However, two of us (Xing and Wang) do not agree and consider that *A. hookeri* differs from *A. faberiana* and *A. perdurans* in having lamina tripinnatifid, pinnae articulate to the rachis, and stipes and rachis persistent and turning black when pinnae fall according to field observations and herbarium specimens.

**3. *Araiostegia faberiana*** (C. Christensen) Ching in S. S. Chien & Chun, Fl. Reipubl. Popularis Sin. 2: 293. 1959.

细裂小膜盖蕨 xi lie xiao mo gai jue

*Davallia clarkei* Baker var. *faberiana* C. Christensen, Acta Horti Gothob. 1: 73. 1924; *Araiostegiella faberiana* (C. Christensen) M. Kato & Tsutsumi; *Leucostegia clarkei* (Baker) C. Christensen var. *faberiana* (C. Christensen) C. Christensen; *L. faberiana* (C. Christensen) Ching.

### 3. *DAVALLIA* Smith, Mém. Acad. Roy. Sci. (Turin) 5: 414. 1793.

骨碎补属 gu sui bu shu

*Parestia* C. Presl; *Stenolobus* C. Presl; *Trogostolon* Copeland; *Wibelia* Bernhardt (Oct–Dec 1801), not G. Gaertner, B. Meyer & Scherbius (1801).

Rhizome long creeping, robust, 8–10 mm in diam., densely covered with scales. Scales rufous, ovate-lanceolate, 6–7 mm, membranous, basifixed with cordate base and overlapping lobes, margin with irregular teeth, apex acuminate. Fronds remote, 1.5–3 cm apart; stipe brownish stramineous, adaxially shallowly grooved, 12–15 cm, 2.5–3 mm in diam., base covered with scales similar to rhizome, sparse upward; lamina yellowish green or brown when dry, 5-pinnatifid, ovate, 30–35 × 16–20 cm, base broadly cuneate, apex acuminate. Pinnae 12–15 pairs, alternate or basal one opposite, sessile, basal pair similar to upper one, triangular-lanceolate or narrowly ovate, 15–25 × 4.5–9 cm; pinnules 12–16 pairs, alternate, shortly stalked or subsessile, narrowly ovate, 3–7 × 2–3 cm, base nearly symmetrical, apex obtuse, basal pair of pinnules catadromous; lobes narrowly linear, ca. 0.5 mm wide, acute. Rachis with several large, ovate scales at forking point. Veins inconspicuous, forked, with 1 veinlet in each lobe. Sori numerous, terminal on veinlet; indusium brown, semicircular, entire, attached at base.

Dense mixed forests, epiphytic on tree trunks; 1500–3100 m. Guizhou, Sichuan, Xizang, Yunnan [Myanmar, Thailand].

**4. *Araiostegia perdurans*** (Christ) Copeland, Univ. Calif. Publ. Bot. 12: 397. 1931.

鳞轴小膜盖蕨 lin zhou xiao mo gai jue

*Davallia perdurans* Christ, Bull. Herb. Boissier 6: 970. 1898; *Araiostegia parvipinnula* (Hayata) Copeland; *Araiostegiella perdurans* (Christ) M. Kato & Tsutsumi; *Davallia parvipinnula* Hayata; *Humata perdurans* (Christ) Hieronymus; *Leucostegia parvipinnula* (Hayata) Hayata; *L. perdurans* (Christ) C. Christensen.

Rhizome long creeping, robust, 6–8 mm in diam., densely covered with scales. Scales brown, broadly lanceolate, 6–7 mm, membranous, basifixed with cordate base, margin with irregular teeth, apex acuminate. Fronds remote, 3–5 cm apart; stipe brownish stramineous, adaxially thickly grooved, 25–35 cm, 3–4 mm in diam., base covered with scales, sparse upward; lamina yellowish green or brownish green when dry, 4-pinnatifid, ovate or triangular-ovate, 30–40 × 20–35 cm, base broadly rounded, apex acuminate. Pinnae 10–15 pairs, alternate or basal ones opposite, sessile, basal pair similar to upper one, elliptic or elliptic-lanceolate, 10–21 × 3.5–8 cm; pinnules 12–16 pairs, sessile, basal pair elliptic, 1.5–4.5 × 1–1.5 cm, base nearly symmetrical, apex obtuse; ultimate lobes shortly lanceolate, 1.5–3 mm, apex acute. Rachis with several large, ovate scales at forking point. Veins inconspicuous, forked, with 1 veinlet in each lobe. Sori numerous, terminal on veinlet; indusium brown, dark brown at base, semicircular, entire, attached at base.

• Dense mixed forests, epiphytic on tree trunks; 1900–3400 m. Fujian, Guangxi, Guizhou, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang.

Plants moderate-sized, epiphytic or sometimes terrestrial. Rhizome long creeping, with dark, peltate scales. Fronds remote, long stipitate, monomorphic or dimorphic; stipe articulate to short phyllopodia, terete or slightly winged; lamina bipinnate to 4-pinnate-pinnatifid, deltoid or pentagonal, firmly leathery or sometimes thickly herbaceous, glabrous; ultimate segments with crenate or lobed margins. Veins free, usually forked, terminating in lobes or crenations of cartilaginous margin. Sori terminal on veins, on small oblique lobes or crenations; indusium extrorse, elongate toward margin, attached at base and sides, long stalked; annulus longitudinal, consisting of ca. 14 thickened cells; spores monoletate, elliptic, smooth, translucent; perispore absent.  $n = 10$ , (40).

About 40 species: from Atlantic Ocean islands through Africa and S Asia to Malaysia, Japan, NE Australia, and Pacific islands; six species (one endemic) in China.

The following taxa are excluded from the present treatment, pending further research: *Davallia triangularis* Baker (Ann. Bot. 5: 202. 1891), described from Yunnan, and *D. lorrainii* Hance (Ann. Sci. Nat., Bot., sér. 5, 5: 254. 1866; *D. trichomanoides* Blume var. *lorrainii* (Hance) Holttum) recorded from Yunnan by W. M. Chu & Z. R. He (Acta Bot. Yunnan. 22: 261. 2000).

- 1a. False veins present ..... 1. *D. denticulata*  
 1b. False veins absent.  
 2a. Fronds ca. 1 m tall; lamina 55–100 × 40–90 cm ..... 2. *D. divaricata*  
 2b. Fronds ca. 0.5 m tall; lamina 8–35(–90) × 8–30(–40) cm.  
 3a. Lamina papery; rhizome 4–5 mm in diam., scales gray-brown, shaggy ..... 3. *D. trichomanoides*  
 3b. Lamina leathery or thickly papery; rhizome 8–10 mm in diam., scales dark brown and overlapping.  
 4a. Rhizome scales very dark brown; lamina thickly papery; apex of pinnae obtuse or acute ..... 4. *D. sinensis*  
 4b. Rhizome scales red-brown; lamina thickly leathery; apex of pinnae acuminate.  
 5a. Rhizome scales ovate-lanceolate, with a long subulate apex and ciliate margin; indusia attached along sides, tubular ..... 5. *D. solida*  
 5b. Rhizome scales triangular, with an attenuate to obtuse apex and glabrous margin; indusia basifixed, broadly crateriform ..... 6. *D. napoensis*

**1. *Davallia denticulata*** (N. L. Burman) Mettenius ex Kuhn, Filic. Decken. 27. 1867.

假脉骨碎补 jia mai gu sui bu

*Adiantum denticulatum* N. L. Burman, Fl. Indica, 236. 1768; *Davallia bidentata* Schkuhr; *D. brevisora* Ching; *D. chaerophylloides* (Poiret) Steudel; *D. elegans* Swartz; *D. elegans* var. *bidentata* (Schkuhr) Hooker; *D. elegans* var. *conifolia* Hooker; *D. elegans* var. *edentula* Hooker; *D. elegans* var. *polydactyla* T. Moore; *D. elegans* var. *pulchra* Hooker; *D. elegans* var. *subunidentata* Hooker; *D. impressa* Copeland; *D. patens* Swartz; *Humata chaerophylloides* (Poiret) Desvauz; *H. elata* (G. Forster) Desvauz; *H. elegans* (Swartz) Desvauz; *H. patens* (Swartz) Desvauz; *Parestia elata* (G. Forster) C. Presl; *P. elegans* (Swartz) C. Presl; *Trichomanes chaerophylloides* Poiret; *T. denticulatum* (N. L. Burman) Houttuyn; *T. elatum* G. Forster; *T. elegans* (Swartz) Poiret (1808), not Richard (1792), nor Rudge (1805); *T. lucidum* Roxburgh; *Wibelia chaerophylloides* (Poiret) M. Kato & Tsutsumi; *W. denticulata* (N. L. Burman) M. Kato & Tsutsumi; *W. elata* (G. Forster) Bernhardt.

Rhizome 3–15 mm in diam. (without scales), not white waxy. Scales red-brown or nearly black, with pale border from base to apex or without pale border, narrowed evenly toward apex or flat and nearly acicular, narrowed abruptly from a broad base, often curling backward, peltate, 4–8 × 0.5–1.5 mm, without multiseptate hairs, toothed. Stipe pale, adaxially grooved, 4–50 cm, glabrous or with few scales; lamina compound, bipinnate or quadripinnate toward base and in middle part, deltoid and broadest toward base, 16–90 × 13–50 cm, glabrous, not or slightly dimorphic. Longest petiolules 4–35 mm; pinnae deltoid; longest pinnae 8–45 × 5–30 cm; pinnules of at least larger pinnae anadromous, deltoid; longest pinnules 70–200 × 40–110 mm; ultimate pinnae linear-oblong or narrowly ovate, lobed al-

most to midrib or only shallowly lobed; ultimate segments 5–27 × 2–6 mm. Rachises and costae glabrous. Margins of each pinna not thickened. Veins in sterile ultimate lobes pinnate (or forked in very narrow lobes), reaching margin; false veins present. Sori separate, several per segment, at forking point of veins; indusium also attached along sides, pouch-shaped, oblong, longer than wide or ± as wide as long, 1–1.3 × 0.5–1 mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina generally extending into a tooth at both sides of a sorus.

Epiphytic on many different species of trees and in different types of forests including mangrove or on solitary trees, epilithic on granite, limestone, or sandstone, terrestrial on different kinds of soil; sea level to 2200 m. Hainan [Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vietnam; Africa, Australia, Indian Ocean islands, Pacific islands].

Only the typical variety (*Davallia denticulata* var. *denticulata*) occurs in China.

*Davallia brevisora* is a form with the false veins absent or inconspicuous.

**2. *Davallia divaricata*** Blume, Enum. Pl. Javae 2: 237. 1828.

大叶骨碎补 da ye gu sui bu

*Araiostegia divaricata* (Blume) M. Kato; *A. divaricata* var. *formosana* (Hayata) M. Kato; *Davallia amabilis* Ching; *D. austrosinica* Ching; *D. divaricata* var. *orientale* (C. Christensen ex Y. C. Wu, K. K. Wong & Pong) Tardieu & C. Christensen; *D. formosana* Hayata; *D. orientalis* C. Christensen ex Y. C. Wu, K. K. Wong & Pong; *Wibelia divaricata* (Blume) M. Kato & Tsutsumi; *W. formosana* (Hayata) M. Kato & Tsutsumi.

Rhizome 10–15 mm in diam. (without scales), not white waxy. Scales brown or red-brown without pale border, nar-

rowed evenly toward apex, curling backward or not, basifixed with cordate base and much overlapping lobes, 5–20 × 2–4 mm, without multiseptate hairs, toothed. Stipe pale, adaxially grooved, 15–60 cm, glabrous or with few scales; lamina compound, tripinnate toward base and in middle part, deltoid and broadest toward base, 55–100 × 40–90 cm, glabrous, not or slightly dimorphic. Longest petiolules 4–35 mm; pinnae deltoid; longest pinnae 8–45 × 5–30 cm; pinnules of at least larger pinnae anadromous, deltoid; longest pinnules 70–200 × 40–110 mm; ultimate pinnae linear-oblong or narrowly ovate, lobed halfway toward midrib or only shallowly lobed; ultimate segments 5–27 × 2–6 mm. Rachis adaxially distinctly grooved (often with a groove at either side). Rachises and costae glabrous. Margins of each pinna not thickened. Veins in sterile ultimate lobes pinnate (or forked in very narrow lobes), reaching margin; false veins absent. Sori separate, borne several on a segment, at forking point of veins; indusium also attached along sides, pouch-shaped, oblong, ± as wide as long, ca. 1 × 1 mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina generally extending into a tooth at both sides of a sorus.

Generally epiphytic, sometimes epilithic on limestone, rarely terrestrial, mostly in dense forests, sometimes on dry places; sea level to 1900 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vietnam; Pacific islands (Solomon Islands)].

Although FRPS (6(1): 183. 1999) and Fl. Taiwan (ed. 2, 1: 188. 1994) recognized *Davallia formosana* as a separate species, the type of *D. formosana* fits well within the variability of *D. divaricata*.

**3. *Davallia trichomanoides*** Blume, Enum. Pl. Javae 2: 238. 1828.

骨碎补 gu sui bu

*Davallia bullata* Wallich ex Hooker; *D. cylindrica* Ching; *D. mariesii* T. Moore ex Baker (1891), not H. J. Veitch (1880); *D. mariesii* var. *stenolepis* (Hayata) Hoshizaki; *D. petelotii* Tardieu & C. Christensen; *D. stenolepis* Hayata; *D. trichomanoides* var. *bullata* (Wallich ex Hooker) Sarn. Singh & Panigrahi; *Trogostolon yunnanensis* Ching.

Rhizome 3–8 mm in diam. (without scales), not white waxy. Scales brown or red-brown, with pale border from base to apex or not, flat and nearly acicular, narrowed abruptly from a broad base or above much broader base evenly narrowed toward apex, often curling backward or appressed to rhizome, usually crisped, margins recurved, peltate, 4–8 × 1–1.5 mm, without multiseptate hairs, with marginal setae at least in distal part or toothed. Stipe pale, adaxially grooved, 4.5–20 cm, glabrous or with few scales; lamina compound, tripinnate or quadripinnate toward base and in middle part, deltoid and broadest toward base, 10–35 × 9–25 cm, glabrous, not or slightly dimorphic. Longest petiolules 1–6 mm; pinnae deltoid, longest 5–19 × 3–12 cm; pinnules of at least larger pinnae anadromous, narrowly ovate, longest 20–70 × 10–30 mm; ultimate pinnae linear-oblong or narrowly ovate, lobed almost to midrib; ultimate segments 5–27 × 2–6 mm. Rachises and costae glabrous. Margins of each pinna not thickened. Veins in sterile ultimate lobes simple or forked, not reaching margin; false veins present,

rarely absent. Sori separate, frequently single on a segment, at forking point of veins; indusium also attached along sides, pouch-shaped, oblong, longer than wide, 1.2–2 × 0.5–1 mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina generally extending into a tooth at both sides of a sorus or only at outside of a sorus.

Epiphytic and epilithic on different kinds of rocks, mostly in wet places, sometimes on dry, exposed places; 100–3500 m. Fujian, Jiangsu, Liaoning, Shandong, Taiwan, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan (including Ryukyu Islands), Korea, Malaysia, Myanmar, Nepal, Papua New Guinea, Thailand, Vietnam].

One of us (Nooteboom) notes that, according to B. J. Hoshizaki (pers. comm.) and personal observations, several of the species treated here as synonyms behave as good species in cultivation. However, after studying over 400 different collections of the entire area, it is clear that they all belong to one species. That does not exclude that different forms from different localities intergrade in nature but behave differently in cultivation. It would be best to give these forms cultivar names ('*Mariesii*' and '*Stenolepis*'). As soon as a plant is cultivated and vegetatively propagated it forms a clone of similar plants that can be recognized from other clones of the same species. Formally naming the forms according to the rules of nomenclature means that quite a lot of collections cannot be named. As the spores of all the forms are also extremely similar, there is no doubt as to their conspecificity.

**4. *Davallia sinensis*** (Christ) Ching, Bull. Fan Mem. Inst. Biol. 2: 202. 1931, nom. cons., not *D. chinensis* (Linnaeus) Smith (1793).

中国骨碎补 zhong gu sui bu

*Davallia solida* (G. Forster) Swartz var. *sinensis* Christ, Bull. Herb. Boissier 7: 18. 1899.

Rhizome long creeping, robust, 6–8 mm in diam., densely covered with scales. Scales dark brown, ovate, long subulate upward, ca. 7 mm, margin ciliate. Fronds remote, 2–3 cm apart; stipe brownish stramineous, adaxially grooved, 12–15 cm, 2–2.5 mm in diam., base densely covered with brown scales; lamina dark brown when dry, tripinnate or base 4-pinnate-pinnatifid, pentagonal, 18–22 × 18–22 cm, thickly papery, base cordate, apex acuminate, shallowly dentate. Petiolules 4–6 mm; pinnae ca. 10 pairs, basal 2 pairs subopposite, alternate upward, apex obtuse or acute, largest pinnae triangular, 10–12 × 8–10 cm; upper pinnae shortened to oblong-lanceolate, base oblique, apex shortly acuminate; pinnules 8–10 pairs, shortly stalked, alternate, with first basispic pinnule enlarged, oblong-lanceolate, 5–6 × 2.5–3 cm, base cuneate, pinnatifid to rachillae with narrow wing, apex acute; ultimate pinnae ca. 6 pairs, sessile, basal pairs larger, oblong, 10–12 × 4–5 mm, base cuneate, decurrent, apex rounded-obtuse. Veins brown, palmately forked, distinct abaxially. Sori separate, borne several on a segment, each at forking point of veins; indusium rufous, attached along sides, submarginal to lamina, tubular, ca. 1.5 × 1 mm, thickly membranous, apex truncate.

Wet forests, near streams, epilithic on rocks or epiphytic on tree trunks; 500–1400 m. Guangxi, Yunnan [Vietnam].

One of us (Nooteboom) considers *Davallia sinensis* to be a synonym of *D. solida* and notes that, having seen the type of *D. solida* var.

*sinensis*, it falls well in the variability of *D. solida*. However, two of us (Xing and Wang) prefer to recognize two species on account of differences in the texture of the scales and in the apices of the pinnae, according to field observations and specimens.

**5. *Davallia solida*** (G. Forster) Swartz, *J. Bot.* (Schrader) 1800(2): 87. 1801.

阔叶骨碎补 *kuo ye gu sui bu*

*Trichomanes solidum* G. Forster, *Fl. Ins. Austr.* 86. 1786; *Davallia solida* var. *latifolia* Hooker; *D. solida* var. *ornata* Mettenius ex Kuhn; *D. subsolida* Ching; *Humata solida* (G. Forster) Desvaux; *Stenolobus solidus* (G. Forster) C. Presl.

Rhizome 4–14 mm in diam., densely covered with scales, generally not white waxy. Scales red-brown, with pale border from base to apex, narrowed evenly toward apex or above much broader base evenly narrowed toward apex, not or seldom curling backward, peltate, 5–10 × 1–1.2 mm, with multiseptate hairs at least when young (hairs at least at apex of young scales, ca. 1 mm, woolly). Stipe pale, adaxially grooved, 9–35 cm, glabrous or with few scales; lamina compound, bipinnate or tripinnate toward base and in middle part, deltoid and broadest toward base, 15–90 × 21–40 cm, glabrous (sometimes with hairs at junction of rachis and petiolule), not or slightly dimorphic. Longest petiolules 5–25 mm; pinnae linear-triangular or narrowly ovate, apex acuminate; longest pinnae 11–28 × 6–15 cm; pinnules of at least larger pinnae anadromous, deltoid or rhombic; longest pinnules 40–100 × 15–80 mm; ultimate pinnae linear-oblong or rhombic, lobed almost to midrib, or only shallowly lobed (in bipinnate fronds: ultimate segments shallowly lobed); ultimate segments 10–40 × 3–17 mm. Rachises and costae glabrous (often hairs at junction of petiolules). Margins of each pinna not thickened. Veins in sterile ultimate lobes pinnate, reaching margin or not; false veins not present. Sori separate, borne several on a segment, at forking point of veins; indusium also attached along sides, pouch-shaped, oblong, longer than wide, 1.2–2 × 0.5–1 mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina not extending into teeth beyond a sorus.

Epiphytic, epilithic on different kinds of rocks, or terrestrial on different kinds of soils, in exposed places or in deep shade, from open

rocky places and savannas to primary rain forests; sea level to 1500 m. Guangdong, Guangxi, Taiwan, Yunnan [Cambodia, India, Indonesia, Malaysia, Myanmar, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam (Tonkin); Pacific islands].

Sometimes the segments in *Davallia solida* are very narrow and the plant resembles *D. solida* var. *fejeensis* (Hooker) Nootboom. *Davallia solida* is a widespread species and generally is easily recognizable by the black rhizome, which bears hairy scales that soon fall off leaving only the bases.

**6. *Davallia napoensis*** F. G. Wang & F. W. Xing, *Novon* 21: 380. 2011.

那坡骨碎补 *na po gu sui bu*

Rhizome robust, 4–5 mm in diam., densely covered with scales, woody. Scales rufous, triangular, peltate, 4–5 × ca. 2 mm, overlapping, base truncate, margin glabrous, apex attenuate to obtuse. Stipe brown, 20–24 cm, ca. 2 mm thick, finely grooved adaxially, base densely covered with scales similar to those on rhizome, sparser apically; lamina tripinnate or basally 4-pinnate pinnatifid, broadly triangular-ovate, 25–28 × 18–22 cm, base nearly rounded, apex acuminate. Longest petiolules 3–20 mm; pinnae in 11–13 pairs, alternate or basal 1 or 2 pairs subopposite, basal pair of pinnae largest, narrowly triangular-lanceolate, 15–16 × 4.5–5.5 cm, base broadly cuneate, apex long acuminate, with basal stalk ca. 2 cm, bipinnate; pinnules in 10–12 pairs, alternate, anadromous, with a shortened petiolule 5–6 mm, basal pinnule largest, 1.8–2.1 × 0.7–0.9 cm, asymmetrically cuneate; ultimate pinnae in 6–8 pairs, alternate, shortly stalked or sessile, basal pinna larger, ovate-triangular, 0.9–1.6 × 0.5–1 cm, base obliquely cuneate and decurrent, apex acute; lobes entire, apex obtuse or with sinus, 3–4 × ca. 1 mm; upper pinnae gradually shortened, lanceolate, 3-pinnate and shallowly pinnatifid, lobes entire, terminal pinnae shortened to ovate-triangular, close together. Veins inconspicuous, veinlets simple or forked; false veins absent. Sori separate, borne always single on middle of pinnae segment; indusium brown, broadly crateriform, ca. 0.4 × 0.6 mm, entire, membranous, basifixed, both sides free.

• Epiphytic on limestone substrate in humid places, near mountain summits; ca. 1200 m. Guangxi (Napo).

#### 4. HUMATA Cavanilles, *Descr. Pl.* 272. 1802.

阴石蕨属 *yin shi jue shu*

*Davallia* [unranked] *Pachypleuria* C. Presl; *Pachypleuria* (C. Presl) C. Presl.

Plants small, epiphytic. Rhizome long creeping, dictyostelic, densely scaly; scales peltate, broad at base, acuminate toward apex, margin often minutely ciliate or denticulate. Fronds remote; stipe slender, adaxially grooved, articulate to rhizome, scaly near base; lamina tripinnatifid, rarely simple or pinnatifid, usually deltoid, leathery; fertile lamina usually more dissected than sterile one. Veins free. Sori submarginal, terminal on acroscopic veinlet; indusium orbicular or semicircular-reniform, attached at base only, or by sides slightly above base, long stalked; annulus longitudinal, consisting of 12 thickened cells; spores elliptic, densely tuberculate; perispore absent.  $n = 10$ , (40).

About 50 species: mostly in SE Asia to Polynesia; four species in China.

1a. Lamina elongate and narrowly ovate; lowest pinna similar to upper one.

2a. Lamina simple, with pectinate or pinnatifid margin ..... 1. *H. pectinata*

2b. Lamina pinnate with pinnatifid to pinnatifid pinnae toward base and in middle part, or sometimes bipinnate ..... 2. *H. assamica*

1b. Lamina ovate or triangular-ovate; lowest pinna larger than upper one.

- 3a. Lamina 0.6–24 × 0.5–14 cm; rhizome 0.5–3 mm in diam. (without scales), white waxy under scales ..... 3. *H. repens*  
 3b. Lamina 10–32 × 8–27 cm; rhizome 3–6 mm in diam. (without scales), not white waxy ..... 4. *H. griffithiana*

**1. *Humata pectinata*** (Smith) Desvaux, Mém. Soc. Linn. Paris 6: 323. 1827.

马来阴石蕨 *ma lai yin shi jue*

*Davallia pectinata* Smith, Mém. Acad. Roy. Sci. (Turin) 5: 415. 1793; *Davallia gaimardiana* (Gaudichaud) C. Presl; *D. parallela* Wallich ex Hooker; *Humata gaimardiana* (Gaudichaud) J. Smith; *H. parallela* (Wallich ex Hooker) Brackenridge; *Nephrodium gaimardianum* Gaudichaud; *Pachypleuria pectinata* (Smith) C. Presl.

Rhizome 1.4–2.6 mm in diam. (without scales), white waxy under scales. Scales red-brown, with pale border from base to apex, narrowed evenly toward apex, not or seldom curling backward, peltate, ca. 5 × 1.1–1.5 mm, with multiseptate hairs at least when young. Stipe pale or dark brown, adaxially grooved, 5–18 cm, glabrous or with few scales; lamina simple, with pectinate or pinnatifid margin, narrowly ovate, elongate, often narrowing toward base, 4–21 × 2.5–8 cm, with multicellular hairs or glabrous, not or slightly dimorphic. Longest pinnae 1.5–3.2 × 0.3–0.5 cm. False veins not present. Sori separate, at forking point of veins or at bending point of a vein; indusium attached at broad base and hardly or not at sides, semicircular, wider than long or ± as wide as long, 0.6–0.8 × 0.6–1 mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin.

Wet forests, epiphytic, epilithic, or sometimes terrestrial, on sand, old lava flows, or limestone; 300–400 m. Taiwan (Lan Yu) [Cambodia, India (S Andaman Islands, Nicobar Islands), Indonesia, Malaysia, Papua New Guinea, Philippines, Thailand; Australia, Pacific islands].

**2. *Humata assamica*** (Beddome) C. Christensen, Contr. U.S. Natl. Herb. 26: 293. 1931.

长叶阴石蕨 *chang ye yin shi jue*

*Acrophorus assamicus* Beddome, Ferns Brit. India 1: t. 94. 1865; *Davallia assamica* (Beddome) Baker; *D. micans* Mettenius ex Baker; *Humata micans* (Mettinius ex Baker) Diels; *Leucostegia assamica* (Beddome) J. Smith.

Rhizome 3–5.3 mm in diam. (without scales), not white waxy. Scales whitish or red-brown, without pale border, narrowed evenly toward apex, not or seldom curling backward, peltate, 8–10 × 1.8–2.5 mm, without multiseptate hairs, toothed. Stipe adaxially grooved, 4–7 cm, glabrous or with few scales; lamina pinnate with pinnatifid to pinnatifid pinnae toward base and in middle part, or sometimes bipinnate, narrowly ovate, elongate, 10–27 × 3.5–12 cm, glabrous, not or slightly dimorphic. Longest petiolules ca. 1 mm; pinnae narrowly ovate; longest pinnae 3.5–6 × 1–2 cm; pinna lobes of at least larger pinnae anadromous, linear-oblong, longest 7–15 × 3–4 mm. Rachises and costae glabrous. Margins of each pinna in fertile fronds thickened and recurved on edge of grooved rachis. Veins in sterile ultimate lobes pinnate, not reaching margin; false veins not present. Sori separate, borne several or frequently single on a segment, at forking point of veins; indusium attached at broad base and hardly or not at sides, semicircular, wider than long or

± as wide as long, 0.7–1 × 0.8–1.2 mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina generally extending into a tooth at both sides or only at outside of a sorus.

Wet forests, climbing on rocks or tree trunks; 900–2300 m. Xizang, Yunnan [Bhutan, India, Myanmar].

**3. *Humata repens*** (Linnaeus f.) Small ex Diels in Engler & Prantl, Nat. Pflanzenfam. 1(4): 209. 1899.

阴石蕨 *yin shi jue*

*Adiantum repens* Linnaeus f., Suppl. Pl. 446. 1782; *Davallia chrysanthemifolia* Hayata; *D. cumingii* Hooker; *D. lepida* C. Presl ex Goldmann; *D. pedata* Smith; *D. repens* (Linnaeus f.) Kuhn (1868), nom. cons., not (Bory) Desvaux (1827); *D. subalpina* Hayata; *D. vestita* Blume; *Humata chrysanthemifolia* (Hayata) C. Christensen; *H. cumingii* (Hooker) Brackenridge; *H. kinabaluensis* Copeland; *H. lepida* (C. Presl ex Goldmann) T. Moore; *H. macrostegia* Tagawa; *H. pedata* (Smith) J. Smith; *H. trifoliata* Cavanilles; *H. vestita* (Blume) T. Moore; *Pachypleuria lepida* (C. Presl ex Goldmann) C. Presl; *P. macrostegia* (Tagawa) M. Kato; *P. pedata* (Smith) C. Presl; *P. repens* (Linnaeus f.) M. Kato; *P. trifoliata* (Cavanilles) C. Presl.

Rhizome 0.5–3 mm in diam. (without scales), white waxy under scales. Scales brown or red-brown, with pale border from base to apex or not, narrowed evenly toward apex, not or seldom curling backward, peltate, 2.5–7 × 0.3–1.5 mm, with multiseptate hairs at least when young, or with marginal setae at least in distal part. Stipe adaxially grooved, 0.1–18 cm, glabrous or with few scales; lamina compound (pinnate with pinnatifid to pinnatifid pinnae, or bipinnate to quadripinnate toward base and in middle part), simple (margin pectinate or pinnatifid), trifoliolate (pinnae ± divided), or pinnate toward base, ovate, deltoid and broadest toward base, 0.6–24 × 0.5–14 cm, glabrous, strongly dimorphic or not or slightly dimorphic. Longest petiolules 0–4 mm; pinnae linear-triangular, narrowly ovate, linear, or ovate to deltoid; longest pinnae 1–10 × 0.6–7 cm; pinnules (if present) of at least larger pinnae anadromous, linear-oblong or narrowly ovate; longest pinnules 5–55 × 5–20 mm; ultimate pinnae (if present) lobed almost to midrib or only shallowly lobed; ultimate segments or lobes obtuse or acute without a tooth. Dimorphic plants: lamina of fertile fronds pinnate with strongly dissected pinnae, bipinnate, or tripinnate toward base and in middle part; longest petiolules of fertile fronds 1–7 mm; pinnae deltoid, linear-triangular, or narrowly ovate, 1–8 × 0.3–2.5 cm; pinnules or pinna lobes deltoid or linear-oblong, 2–35 × 1.5–15 mm; ultimate pinnae linear-oblong; ultimate segments of fertile fronds 1–15 × 0.5–2 mm. Rachises and costae glabrous. Veins in sterile ultimate lobes simple, forked, or pinnate, reaching margin; false veins not present. Sori separate, borne several on a segment, or in much-divided fronds frequently single on a segment, at forking point of veins; indusium attached at broad base and hardly or not at sides, semicircular or ± triangular to rhomboid, wider than long, ± as

wide as long,  $0.3\text{--}1 \times 0.3\text{--}1.3$  mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina generally extending into a tooth at both sides or only at outside of a sorus, or not extending into teeth beyond a sorus.

Low or high epiphytic, epilithic on various kinds of rocks, sometimes terrestrial, in very wet to dry sunny places; sea level to 3400 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Cambodia, India, Indonesia, Japan, Malaysia, S Myanmar, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Africa, Australia, Indian Ocean islands, Pacific islands].

*Humata repens* is a very variable species. All the forms have in common the same spores, which vary in size because of polyploidy. The *H. repens* group, and probably the entire *Humata* clade in Tsutsumi, X. C. Zhang and Kato (Syst. Bot. 33: 44–48. 2008), is as far as we know polyploid and (?entirely) apomictic. Both *H. trifoliata* and *H. vestita* belong to this group. While *H. trifoliata* often is a young stage of *H. repens* (later in time more developed and more divided leaves may appear on the same rhizome), *H. vestita* is more recognizable when mature and is probably one of the sterile clones that so often occur within the *H. repens* group. In Peninsular Malaysia, *H. vestita* grows at higher elevations than other *H. repens*, but this has not been observed in China. It seems acceptable to distinguish *H. vestita* as merely a form of *H. repens*.

**4. *Humata griffithiana*** (Hooker) C. Christensen, Contr. U.S. Natl. Herb. 26: 293. 1931.

杯盖阴石蕨 bei gai yin shi jue

*Davallia griffithiana* Hooker, Sp. Fil. 1: 168. 1845; *Davallia henryana* Baker; *D. platylepis* Baker; *D. tyermanii* (T. Moore) Baker; *Humata griffithiana* var. *tyermanii* (T. Moore) Tagawa; *H. henryana* (Baker) Ching; *H. platylepis* (Baker) Ching; *H. tyermanii* T. Moore; *Leucostegia griffithiana* (Hooker) J. Smith.

Rhizome 3–6 mm in diam. (without scales), not white waxy. Scales whitish, brown, or red-brown, without pale border, narrowed evenly toward apex, curling backward or not, peltate,  $6\text{--}9 \times 1\text{--}1.5$  mm, without multiseptate hairs, with marginal setae at least in distal part. Stipe adaxially grooved, 6–24 cm, glabrous or with few scales; lamina compound, bipinnate or tripinnate toward base and in middle part, deltoid and broadest toward base,  $10\text{--}32 \times 8\text{--}27$  cm, glabrous, not or slightly dimorphic. Longest petiolules 2–10 mm; pinnae deltoid or linear; longest pinnae  $6\text{--}16 \times 4\text{--}8$  cm; pinnules of at least larger pinnae anadromous, linear-oblong or narrowly ovate; longest pinnules  $25\text{--}100 \times 7\text{--}60$  mm; ultimate pinnae narrowly ovate, lobed almost to midrib or only halfway toward midrib; ultimate segments or lobes obtuse or acute without a tooth,  $2\text{--}5 \times 2\text{--}3$  mm. Rachises and costae glabrous. Margins of each pinna not thickened. Veins in sterile ultimate lobes simple, forked or pinnate, not reaching margin; false veins not present. Sori separate, borne several or single on a segment, at forking point of veins; indusium attached at base and only part of sides, semicircular,  $\pm$  as wide as long, ca.  $1 \times 1\text{--}2$  mm, upper margin not elongated, truncate or slightly rounded, separated from or even with lamina margin; lamina generally extending into a tooth at both sides or only at outside of a sorus, or not extending into teeth beyond a sorus.

Wet forests, climbing on tree trunks or rocks; near sea level to 2200 m. Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India (Assam, Manipur), Japan (Okinawa), Laos, Myanmar (Kengtung), Vietnam (Tonkin)].

*Humata henryana*, *H. platylepis*, and *H. tyermanii* were treated as separate species in FRPS (6(1): 194–197. 1999), but comparisons of the types of *Davallia henryana*, *D. platylepis*, and *H. tyermanii* suggest that they all belong to the same species, *H. griffithiana*.