

## RHACHIDOSORACEAE

轴果蕨科 *zhou guo jue ke*

He Zhaorong (和兆荣)<sup>1</sup>; Masahiro Kato<sup>2</sup>

Plants terrestrial or epilithic, evergreen, medium-sized. Rhizome erect or creeping, apex and base of stipes scaly; scales brown, lanceolate, entire, long; fronds caespitose, rarely distant or approximate. Fertile fronds up to 2 m; stipe pale stramineous, rarely red-brown, usually as long as lamina, base not thickened, with sparse scales, upward glabrous throughout. Lamina deltoid or ovate-deltoid, herbaceous, glabrous, pinnate lobes 2- or 3-pinnate or ultimate pinnules pinnate, acuminate at apex. Pinnae alternate, ascending, stipitate, pinnules anadromous, acuminate at apex, base asymmetrical or  $\pm$  symmetrical. Lobes anadromous, obtuse, usually asymmetrical at base, ultimate pinnules serrate or crenate at margin, sometimes entire. Veins free, prominently, lateral veins mostly forked or pinnate on ultimate pinnules, rarely simple. Costae slightly shallowly grooved adaxially, bilateral margin with slight protuberance. Sori shortly linear, or slightly lunate, solitary on acroscopic veinlets of ultimate pinnule base, usually in 1 line per lobe, 1 or 2 pairs per lobe with pinnate veins, close to ultimate pinnules or midrib of lobes, in parallel lines with each other. Sori and indusia similar, solitary, thickly membranous, slightly swollen, pale gray or gray-green at first, then mostly becoming pale brown, entire, persistent. Spores 2-sided, semicircular in equatorial plane. Spores perispore prominent, slightly hyaline, rough, with regular or irregular filiform ornamentation, circular projection, or rarely broad flakelike folds.  $x = 40$ .

One genus and seven species: mainly distributed in subtropical and tropical areas of China, east to Japan, the Philippines, south to Vietnam and Indonesia (Sumatra); five species (three endemic) in China.

Based on molecular evidence that *Rhachidosorus* does not form a monophyletic group with Athyriaceae (cf. R. Sano et al., *Molec. Phylogen. Evol.* 15: 403–413. 2000), X. C. Zhang proposed the family Rhachidosoraceae (*Phytotaxa* 19: 16. 2011).

Chu Wei-ming & He Zhao-rong. 1999. *Rhachidosorus*. In: Chu Wei-ming, ed., *Fl. Reipubl. Popularis Sin.* 3(2): 267–275.

### 1. RHACHIDOSORUS Ching, *Acta Phytotax. Sin.* 9: 73. 1964.

轴果蕨属 *zhou guo jue shu*

Morphological characters and geographic distribution are the same as those of the family.

- 1a. Stipe and rachis red-brown; pinnules asymmetrical ..... 1. *R. mesosorus*
- 1b. Upper part of stipe and rachis stramineous; pinnules symmetrical or  $\pm$  symmetrical.
  - 2a. Pinnules and pinnule lobes contiguous or approximate, lobes truncate, entire or shallowly crenate ..... 2. *R. truncatus*
  - 2b. Pinnules and pinnule lobes (particularly basal ones) apart, lobes orbicular, crenate.
    - 3a. Pinnule lobes and secondary pinnules usually oblong, rarely ovate ..... 3. *R. consimilis*
    - 3b. Pinnule lobes and secondary pinnules ovate.
      - 4a. Basal pinnae wider than upper ones, narrowly ovate, relative length to width ca. 2:1, surface of spores with few irregular, broadly flakelike folds ..... 4. *R. blotianus*
      - 4b. Basal pinnae similar to upper ones, broadly lanceolate, relative length to width ca. 3:1, surface of spores with sparse irregular flakelike and filiform protuberances ..... 5. *R. pulcher*

1. *Rhachidosorus mesosorus* (Makino) Ching, *Acta Phytotax. Sin.* 9: 74. 1964.

轴果蕨 *zhou guo jue*

*Asplenium mesosorum* Makino, *Bot. Mag. (Tokyo)* 12: 120. 1898; *Athyrium mesosorum* (Makino) Makino; *Diplazium mesosorum* (Makino) Koidzumi.

Rhizome long or shortly creeping, apex and stipe base densely scaly; scales brown, lanceolate, clathrate, membranous, hyaline, with long multicellular marginal hairs; fronds approximate. Fertile fronds 50–60 cm; stipe pale castaneous or red-brown, shiny, 20–40 cm, 2–3 mm in diam., upward glabrous; laminae 2- or 3-pinnate with pinnules or ultimate pinnules pinnatifid, broadly ovate to deltoid, 30–40 × 15–25 cm at base,

apex abruptly narrowed, acuminate; pinnae ascending, narrowly ovate to broadly lanceolate, apex long acuminate; basal pair largest, 15–20 × 4.5–10 cm, with stalk 2–4 cm; pinnules 8–15 pairs, alternate, subspreading, ovate-deltoid, base asymmetrical (acroscopic base subtruncate, basicopic base broadly cuneate), lower pinnules stalked, usually basicopic pinnules longer than acroscopic pinnules, ca. 8 × 3 cm, pinnatifid or nearly pinnate; pinnule lobes slightly oblique, ovate-deltoid or oblong, connate to each other with narrow wings, pinnatifid to pinnatifid or nearly pinnate, apex rounded-obtuse; ultimate pinnules obtuse at apex, shallowly toothed at margin. Veins prominent on both sides, pinnate, veinlets simple or forked; lamina green or brown-green, thinly herbaceous or submembranous, glabrous on both surfaces; lower part of rachis and costae pale castaneous or red-brown, upper part stramineous, shiny. Sori

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lunate, narrowly elliptic, single and costular on basal acroscopic veinlets; indusia pale green when young, becoming pale brown when mature; perispore with irregularly warty ornamentation.

Wetlands in forests; 100–1000 m. Hubei (Badong), Jiangsu (Yixing), Zhejiang (Lin'an) [Japan, Korea].

**2. *Rhachidosorus truncatus*** Ching, Acta Phytotax. Sin. 9: 75. 1964.

云贵轴果蕨 yun gui zhou guo jue

*Rhachidosorus subfragilis* Ching.

Rhizome erect; fronds caespitose. Fertile frond up to 1.6 m; stipe castaneous-brown at base, upward stramineous, shiny, up to 70 cm, base with dense brown lanceolate scales, upward glabrous; lamina 2- or 3-pinnate with pinnules or secondary pinnules pinnatifid, deltoid, up to 1 m × 80 cm, glabrous, acuminate at apex; pinnae up to 20 pairs, all stalked, stalk of lower pinnae ca. 2 cm, slightly ascending, basal 2 pairs of pinnae largest, broadly lanceolate or narrowly elliptic-lanceolate, up to 40 × 14 cm, base ± symmetrical, apex acuminate, shortly caudate; upper pinnae lanceolate; pinnules up to 15 pairs, alternate, spreading, up to 10 × 3 cm, with stalk ca. 4 mm, narrowly winged, pinnules on basisopic side longer than acroscopic, apex shortly acuminate to rounded; pinnule lobes up to ca. 10 pairs, oblong or ovate, up to 15 × 8 mm, pinnatifid to pinnatifid with 4 or fewer lobes, apex rounded or truncate and entire or slightly repand. Veins prominent on abaxial side, pinnate, veinlets 1 or 2 pairs in ultimate lobes, mostly simple, occasionally forked. Lamina green abaxially, usually brown adaxially, herbaceous when dry, rachis and costae pale stramineous, shiny. Sori and indusia lunate, usually 1 per lobe, costular. Perispore with dense irregular warty ornamentation.

• Under bushes, calcareous rock crevices; 600–1500 m. Guangxi (Napo), Guizhou (Anlong, Ceheng, Libo), Yunnan (Maguan, Malipo, Xichou).

**3. *Rhachidosorus consimilis*** Ching, Acta Phytotax. Sin. 9: 75. 1964.

喜钙轴果蕨 xi gai zhou guo jue

*Rhachidosorus blotianus* Ching (1976), not Ching (1964).

Rhizome erect, up to 4 cm (including remaining stipe bases); fronds caespitose. Fertile frond up to 2 m; stipe yellow-brown at base, upward stramineous, up to 1 m, up to 1 cm in diam. at base, base with dense yellow-brown lanceolate scales, upward glabrous; lamina 2- or 3-pinnate, deltoid, as long as stipe, apex long acuminate; pinnae up to 25 pairs, basal 2 pairs largest, up to 50 × 15 cm, broadly lanceolate, pinnatifid and caudate, with stalk up to 3 cm, apex long acuminate; pinnules up to 20 pairs, alternate, spreading, anadromous, up to 8 × 2.5 cm, broadly lanceolate, symmetrical or base slightly asymmetrical, with stalk up to 5 mm, apex acuminate, long caudate; pinnule lobes up to 8 pairs, ovate or oblong, ca. 1 cm × 7 mm, base asymmetrical, wider acroscopically, cuneate at basisopic base, shallowly lobed, apex rounded; secondary lobes of pinnule lobes less than 5 pairs, contiguous, oblique, truncate to rounded. Veins pinnate, veinlets less than 5 pairs per pinnule lobe, 2 pairs in secondary lobe, others forked or simple. Lamina green, paler

abaxially, herbaceous when dry, rachis stramineous, glabrous. Sori slightly lunate, oblique, costular to 5 pairs in pinnule lobe; indusia pale brown when dry. Perispore surface with irregular warty ornamentation.

• Under bushes in calcareous areas; 600–1800 m. Guizhou (Anshun, Libo), Sichuan (Emei Shan), Yunnan.

**4. *Rhachidosorus blotianus*** Ching, Acta Phytotax. Sin. 9: 74. 1964.

脆叶轴果蕨 cui ye zhou guo jue

*Athyrium fragile* Tardieu (1932), not (Linnaeus) Sprengel (1804).

Rhizome robust, erect, brown, up to 3 cm in diam. (including remaining stipe bases), woody, apex scaly, scales brown, lanceolate. Fertile fronds up to 2.2 m; stipe brown or castaneous-brown at base, upward gradually pale stramineous, up to 1.1 m, up to 7 mm in diam. at base; lamina 3-pinnate with secondary pinnules lobed, deltoid, up to 1.25 × 1 m at base, apex long acuminate; pinnae 9 or 10 pairs, ascending, mostly alternate, with stalk up to 3.5 cm; basal 1 or 2 pairs of pinnae narrowly deltoid or narrowly ovate-lanceolate, up to 70 × 30 cm, apex caudate, long acuminate; pinnules up to 19 pairs, alternate, stalked (stalk up to 1 cm), ascending, lanceolate, lower pinnules up to 16 × 5 cm, pinnatisect, apex caudate, long acuminate and roughly serrate; pinnule lobes up to 10 pairs, ovate, pinnatifid to pinnatifid, connate to each other with narrow wings, spreading, base asymmetrical, broadly cuneate, acroscopic secondary lobes larger, roughly crenate at apex; secondary pinnule lobes less than 5 pairs, shallowly crenate. Veins visible abaxially, pinnate in pinnule lobe, veinlets forked or simple. Lamina mostly brown, paler abaxially, herbaceous or thinly herbaceous when dry, rachis stramineous, shiny. Sori shortly linear or slightly lunate, single in secondary lobes or 1 or 2 pairs in basal ones, costular; indusia light gray when young, pale brown when mature, shortly linear or lunate. Perispore with mostly broad flakelike folds.

Evergreen broad-leaved forests; 700–1400 m. Guangxi (Baise), Guizhou (Guiding), Yunnan [Vietnam].

**5. *Rhachidosorus pulcher*** (Tagawa) Ching, Acta Phytotax. Sin. 9: 74. 1964.

台湾轴果蕨 tai wan zhou guo jue

*Diplazium pulchrum* Tagawa, Acta Phytotax. Geobot. 4: 144. 1935.

Rhizome erect, up to 4 cm in diam. (including remaining stipe bases), apex densely scaly; scales yellow, lanceolate or linear, up to 1 cm, membranous, entire. Fertile frond up to 2 m; stipe brown at base, upward stramineous, up to 1 m, up to 5 mm in diam. at base, sparsely scaly, scales similar to those on rhizome, upward subglabrous; lamina pinnate to nearly 3-pinnate, deltoid, up to 1 m × 80 cm, apex acuminate; pinnae ca. 15 pairs, alternate, ascending, usually narrowly ovate-lanceolate, base slightly asymmetrical with anadromous pinnules shorter, apex shortly caudate; basal 1 or 2 pairs of pinnae largest, up to 50 × 20 cm, stalked (stalk 2–3 cm), nearly 2-pinnate; pinnules spreading, separate, deltoid-lanceolate, up to 11 × 4 cm, asym-

metrical, acroscopic lobes larger, lower pinnules stalked, stalk short, narrowly winged, pinnatifid to pinnatisect, or nearly pinnatisect, apex caudate, long acuminate; pinnule lobes up to 10 pairs or more, basal lobes mostly ovate, other lobes elliptic or oblong, base slightly asymmetrical, acroscopic base larger, pinnatifid to pinnatisect, or only sparsely crenate, apex obtuse. Laminae green or pale green, slightly deeper colored adaxially, thinly membranous when dry, rachis and costae stramineous. Sori mostly narrowly elliptic, rarely lunate, costular, oblique; in-

usia pale green when young, pale brown. Perispore with flattened tuberculate ornamentation.

- Valleys, evergreen broad-leaved forests, among shrubs; 500–1400 m. Taiwan, Yunnan (Fugong, Yinjiang).

*Rhachidosorus pulcher* is very similar to *R. blotianus* in the morphology of lamina, pinnules, and pinnule lobes, so the two species have usually been considered conspecific; however, they differ in spore ornamentation.