

LINDSAEACEAE

鳞始蕨科 lin shi jue ke

Dong Shiyong (董仕勇)¹; Lin Sujuan (林苏娟)², Maarten J. M. Christenhusz³, Julie Barcelona⁴

Plants terrestrial, rarely climbing or epiphytic. Rhizomes creeping, sometimes scandent, protostelic or solenostelic, covered with narrow scales and/or hairs; scales basifixed, glabrous, 2–6(–12) cells wide at base, cells thick-walled, scale margin entire, apex bristlelike, ca. 1 cell wide. Fronds approximate or distant, vernation circinate; stipe not articulate to rhizome, with a single vascular bundle; lamina 1–4-pinnate, rarely simple, imparipinnate or not, herbaceous, papery, or thinly leathery, glabrous or with scattered very minute (microscopic) 2-celled hairs; pinnae or pinnules symmetrical or dimidiate, anadromous, rarely catadromous; veins free or anastomosing without included veinlets. Sori marginal or submarginal, terminal on a single veinlet or on 2 to several uniting veinlets, linear or oblong, indusiate; indusia basally adnate, laterally free or adnate, opening toward margin. Spores 32 per sporangium, tetrahedral-globose, globose, or ellipsoid, trilete or monolete.

Six to nine genera and ca. 200 species: pantropical; four genera and 18 species (one endemic) in China.

Ching Ren-chang, Fu Shu-hsia, Wang Chu-hao & Shing Gung-hsia. 1959. Lindsaeaceae (excluding *Taenitis*). In: Ching Ren-chang, ed., *Fl. Reipubl. Popularis Sin.* 2: 256–279, 371–374.

- 1a. Sori terminal on a single vein or no more than 3 veins; indusia cup-shaped, basally and partially or entirely adnate laterally.
- 2a. Lamina 3- or 4-pinnate; sori terminal on 1–3 veins 1. *Odontosoria*
- 2b. Lamina usually 1- or 2-pinnate; sori terminal on a single vein 3. *Tapeinidium*
- 1b. Sori terminal on 3 or more veins, rarely on a single vein; indusia linear or oblong, basally adnate, laterally free.
- 3a. Spores monolete; rhizomes solenostelic with sclerified pith; fronds fragrant, smelling of coumarin 2. *Osmolindsaea*
- 3b. Spores trilete; rhizomes protostelic; fronds not fragrant 4. *Lindsaea*

1. ODONTOSORIA Fée, Mém. Foug. 5: 325. 1852.

乌蕨属 wu jue shu

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Lindsayopsis Kuhn.

Plants terrestrial. Rhizomes shortly creeping, protostelic or solenostelic, covered with dark brown hairs or subulate scales. Fronds approximate; stipe stramineous or dark stramineous, shallowly sulcate adaxially, glabrous; lamina 3- or 4-pinnate, pinnatifid and gradually narrowed toward apex; ultimate pinnules or segments usually cuneate or linear; veins free, simple or once or twice forked on ultimate pinnules, papery to slightly leathery. Sori usually submarginal, ovate, terminal on a single vein, or on 2 or 3 veins; annulus consisting of 12–24 thickened cells; indusia ovate or cup-shaped, basally and partially or entirely adnate laterally. Spores ellipsoid and monolete, or globose and trilete.

About 20 species: pantropical, extending north to Korea; two species in China.

Many of the Oriental non-scandent species of *Odontosoria* were previously placed in *Sphenomeris* Maxon, nom. cons. (*Stenoloma* Fée), which is a genus now restricted to a single Caribbean species that forms an independent lineage (Lehtonen et al., *Bot. J. Linn. Soc.* 163: 305–359. 2010).

The position of *Odontosoria tsoongii* Ching (*Bull. Fan Mem. Inst. Biol.* 1: 149. 1930) is uncertain. It was treated as a synonym of *Stenoloma biflorum* (Kaulfuss) Ching (= *O. biflora*) in *FRPS* (2: 277. 1959).

- 1a. Rhizome scales 1 or 2 cells wide at base; lamina ovate to lanceolate, papery; pinnae patent to slightly ascending; veins slightly raised adaxially or on both surfaces, rarely immersed, slightly darker than laminar surface; indusia entire or repand, coterminous with or rarely shorter than adaxial lamina, entirely adnate laterally 1. *O. chinensis*
- 1b. Rhizome scales 3–6 cells wide at base; lamina triangular-ovate, thickly papery to leathery; pinnae slightly to distinctly ascending; veins slightly raised abaxially; indusia denticulate to erose, rarely repand, distinctly shorter than or rarely coterminous with adaxial lamina, partially adnate laterally 2. *O. biflora*

1. *Odontosoria chinensis* (Linnaeus) J. Smith, *Bot. Voy. Herald* 10: 430. 1857.

Trichomanes chinense Linnaeus, *Sp. Pl.* 2: 1099. 1753 [“*chinensis*”]; *Adiantum chusanum* Linnaeus; *Davallia chinensis* (Linnaeus) Smith (1793), not *D. sinensis* (Christ) Ching (1931, nom. cons.); *D. chusana* (Linnaeus) Willdenow; *Lind-*

乌蕨 wu jue

¹ South China Botanical Garden, Chinese Academy of Sciences, 723 Xingke Road, Tianhe District, Guangzhou, Guangdong 510650, People’s Republic of China.

² Department of Biological Science, Faculty of Life and Environmental Science, Shimane University, 1060 Nishikawatsu, Matsue 690-8504, Japan.

³ Jodrell Laboratory, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3SD, United Kingdom.

⁴ School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand.

saea chinensis (Linnaeus) A. Braun & C. D. Bouché; *Microlepia chinensis* (Linnaeus) Mettenius; *Odontosoria chusana* (Linnaeus) Masamune; *O. gracilis* (Tagawa) Ralf Knapp; *Sphenomeris chinensis* (Linnaeus) Maxon; *S. chusana* (Linnaeus) Copeland; *Stenoloma chinensis* (Linnaeus) Beddome; *S. chusanum* (Linnaeus) Ching; *S. gracile* Tagawa.

Rhizomes shortly creeping, densely scaly; scales dark brown, ca. 2 mm, narrow, 1 or 2 cells wide at base, acicular at apex, stiff. Stipe stramineous to dark stramineous, 20–30 cm, abaxially sulcate except at base; lamina ovate-oblong to lanceolate, 20–50 × 5–15 cm, firmly herbaceous to papery, 3- or 4-pinnate, widest at middle, base broadly cuneate, apex acuminate; pinnae 15–20 pairs, alternate, patent to slightly ascending, ovate-lanceolate, 3-pinnate at base, base cuneate and shortly stalked, margin denticulate to erose, apex acuminate; ultimate pinnules or segments cuneate, to 4 mm wide, apex broadly rounded to truncate or shallowly lobed; veins visible on abaxial surface, forked in ultimate lobes. Sori terminal on 1 or uniting 2 or 3 vein ends; indusia basally and partially adnate laterally, denticulate to erose, rarely repand, distinctly shorter than or rarely coterminous with adaxial lamina. Spores ellipsoid, monolet. $2n = 96, 192$.

Terrestrial, along roadsides, forest margins; 300–1700 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Japan, Korea, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Madagascar, Pacific islands (including Polynesia)].

Knapp differentiated *Odontosoria gracilis* from *O. chinensis* by its rheophytic habit, creeping rhizome, narrowly triangular scales, and thinly herbaceous narrowly ovate lamina and indicated that the two taxa

hybridize. One of us (Barcelona) reviewed the type of *O. gracilis* and considers it to be a synonym of the very variable *O. chinensis*.

2. *Odontosoria biflora* (Kaulfuss) C. Christensen, Index Filic. 207. 1905.

阔片乌蕨 kuo pian wu jue

Davallia biflora Kaulfuss, Enum. Filic. 221. 1824; *Microlepia biflora* (Kaulfuss) Mettenius; *Sphenomeris biflora* (Kaulfuss) Tagawa; *Stenoloma biflorum* (Kaulfuss) Ching.

Rhizomes shortly creeping, densely scaly; scales dark brown, stiff, 2–3 mm, 3–6 cells wide at base, acicular at apex. Stipe stramineous or castaneous, 15–30 cm, abaxially sulcate except toward base; lamina triangular-ovate, 10–20 × 10–15 cm, thickly papery to leathery, 3- or 4-pinnate, base broadly cuneate to rounded, apex acuminate; pinnae 8–10 pairs, alternate, slightly to distinctly ascending, lanceolate or narrowly triangular, 2- or 3-pinnate at base, base broadly cuneate and stalked, apex ± abruptly acuminate, gradually becoming smaller upward; ultimate pinnules or segments cuneate, to 7 mm wide, apex broadly rounded to truncate, its margin entire to irregularly crenulate when fertile, erose when sterile, revolute in thicker segments; veins immersed or slightly raised adaxially, complanate to slightly raised on both surfaces in thinner laminae, concolorous with laminar surface. Sori terminal on 2–4 vein ends; indusia basally and entirely adnate laterally, denticulate to erose, rarely repand, distinctly shorter than or rarely coterminous with adaxial lamina. Spores ellipsoid, monolet. $2n = 96$.

On rocks along seashore. Fujian, Guangdong, Hainan, Taiwan, Zhejiang [Japan, Philippines; Pacific islands].

2. OSMOLINDSAEA (K. U. Kramer) Lehtonen & Christenhusz, Bot. J. Linn. Soc. 163: 335. 2010.

香鳞始蕨属 xiang lin shi jue shu

Dong Shiyong (董仕勇); Lin Sujuan (林苏娟), Maarten J. M. Christenhusz, Julie Barcelona

Lindsaea sect. *Osmolindsaea* K. U. Kramer, Blumea 15: 560. 1967.

Plants terrestrial or epilithic, evergreen. Rhizomes shortly to long creeping, solenostelic with an internal sclerified pith, densely scaly; scales appressed or spreading, reddish brown, 1–15 cells wide, nearly acicular. Fronds approximate or distant, 0.5–1 cm apart; stipe stramineous or castaneous to black, adaxially sulcate, with a single vascular bundle, glabrous; lamina once pinnate, lanceolate, gradually narrowed toward apex or terminated by a pinna similar in size to lateral ones, herbaceous, strongly scented of coumarin; pinnae sessile, dimidiate, rhomboid or cuneate, upper margin shallowly lobed-incised or entire, incisions reaching to or slightly beyond level of sori, apices obtuse-acute, straight on upper margin; veins free, evident, not reaching margin. Sori marginal, terminal on several veinlet ends; indusia oblong, continuous or interrupted by incisions, attached at base. Spores ellipsoid, monolet.

Two (to six) species: from E Africa and Madagascar through India to Peninsular Malaysia, northeast to Japan and Korea and southeast to the Solomon Islands; two species in China.

First recognized by Kramer (Blumea 15: 560. 1967) as a section within *Lindsaea*, *Osmolindsaea* was recently elevated to a separate genus based on molecular data by Lehtonen et al. (Bot. J. Linn. Soc. 163: 305–359. 2010). *Osmolindsaea*, together with *Nesolindsaea* and *Tapeinidium*, was resolved to be sister to *Lindsaea* s.s. (Lehtonen et al., loc. cit.). The number of species that should be accepted in this genus worldwide is still uncertain, but there are two taxa in China.

- 1a. Pinnae 15–30 pairs, incised; sori interrupted; rhizome scales 2–3 mm 1. *O. odorata*
 1b. Pinnae 3–10 pairs, mostly entire or with few incisions; sori continuous or nearly so; rhizome scales less than 1 mm 2. *O. japonica*

1. *Osmolindsaea odorata* (Roxburgh) Lehtonen & Christenhusz, Bot. J. Linn. Soc. 163: 335. 2010.

香鳞始蕨 *xiang lin shi jue*

Lindsaea odorata Roxburgh, Calcutta J. Nat. Hist. 4: 511. 1844; *L. bullata* Alderwerelt; *L. calomelanos* Kunze; *L. crasipes* Rosenstock; *L. cultrata* (Willdenow) Swartz var. *attenuata* Hooker; *L. cultrata* var. *pallens* Hooker; *L. cultrata* var. *parvula* Holttum; *L. cultrata* var. *plumula* (Ridley) Holttum; *L. cultrata* var. *varia* Copeland; *L. loheriana* Christ; *L. neocultrata* Ching & Chu H. Wang; *L. odorata* var. *darjeelingensis* T. Sen & U. Sen; *L. plumula* Ridley.

Rhizomes shortly to long creeping, densely scaly; scales dark, 2–3 mm, 1–4 cells wide at base. Stipe stramineous to greenish with a darker base, rarely dark red-brown, 2–13 cm, abaxially rounded, adaxially grooved; lamina ovate-lanceolate to linear-lanceolate, 7–40 × 1–4 cm, herbaceous, 1-pinnate; rachis abaxially rounded, adaxially grooved, stramineous or dark at base; pinnae 15–30 pairs, alternate except basal ones, shortly stalked, dimidiate, spreading, less than their width apart, lower ones more remote, larger ones 6–20 mm, 3–8 mm wide, twice as long as wide, rhombic-trapeziform to triangular, unequal and attenuate at base, margins incised acroscopically, incisions (0.1–)1–3 mm deep, apex rounded to acuminate; upper pinnules gradually and strongly reduced; veins immersed, simple to twice forked, 0.5–1 mm apart. Sori interrupted, forming 2–6 per pinnule on 2–6 vein ends; indusia sinuate, 1–4 × 0.5–0.7 mm, reaching margin; annulus with 20–24 hardened cells. Spores monolet, smooth. $2n = ca. 300$.

Terrestrial or on rocks beside streams, forests, roadsides on slopes, manmade walls; 400–1100 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang

[Bangladesh, Bhutan, India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Pacific islands (Solomon Islands)].

Osmolindsaea odorata is also reported from Africa and Madagascar, but these probably represent a different species of *Osmolindsaea*.

2. *Osmolindsaea japonica* (Baker) Lehtonen & Christenhusz, Bot. J. Linn. Soc. 163: 336. 2010.

日本鳞始蕨 *ri ben lin shi jue*

Lindsaea cultrata (Willdenow) Swartz var. *japonica* Baker in Hooker & Baker, Syn. Fil. 105. 1867; *L. japonica* (Baker) Diels; *L. odorata* Roxburgh var. *japonica* (Baker) K. U. Kramer.

Rhizomes shortly creeping, sparsely scaly; scales reddish brown, ca. 0.5 mm, 1–3 cells wide at base. Stipe stramineous, dark purple throughout, 0.5–5 cm, abaxially rounded, adaxially grooved; lamina lanceolate, 2–7(–10) × 1–2.5 cm, herbaceous, 1-pinnate; rachis abaxially rounded, adaxially grooved, stramineous or dark at base; pinnae 3–10 pairs, alternate, shortly stalked, asymmetrically triangular-dimidiate, less than their width apart, larger ones 7–12 × 3–8 mm, twice as wide as long, unequal, attenuate at base, obtuse to subacute at apex; margins of fertile pinnules entire, margins of sterile ones slightly crenate; basal pinnules often sterile and slightly reduced, upper pinnules slightly reduced, terminal segment free, flabellate; veins immersed, simple to twice forked, ca. 1 mm apart. Sori marginal, continuous; indusia adnate laterally, 0.5–0.7 mm wide, entire, reaching margin; annulus with ca. 15 hardened cells. Spores monolet, smooth. $2n = 150$.

Terrestrial or on wet rocks beside streams, forest ravines; 200–500 m. Guangdong, Guizhou (Chishui), Hainan, Jiangxi, Sichuan, Taiwan [Japan, Korea].

3. *TAPEINIDIUM* (C. Presl) C. Christensen, Index Filic. 631. 1906.

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Dong Shiyong (董仕勇); Lin Sujuan (林苏娟), Julie Barcelona

Microlepia subg. *Tapeinidium* C. Presl, Epimel. Bot. 96. 1851; *Protolindsaya* Copeland.

Plants terrestrial. Rhizomes shortly to long creeping, protostelic or rarely solenostelic, covered with brown narrow scales. Fronds approximate or distant; stipe dark stramineous, shallowly sulcate on adaxial surface, glabrous; lamina 1- or 2-pinnate, slightly leathery; upper pinnae gradually becoming smaller into a coadunate apex, sometimes a terminal pinna present; pinnae or ultimate pinnules or segments linear; veins free, once or twice forked on ultimate segments. Sori submarginal, terminal on a single vein; annulus consisting of 13–16 thickened cells; indusia cup-shaped, basally and partially adnate laterally. Spores ellipsoid to subglobose, monolet.

Seventeen species: Asia and the W Pacific; one species in China.

1. *Tapeinidium pinnatum* (Cavanilles) C. Christensen, Index Filic. 631. 1906.

达边蕨 *da bian jue*

Rhizomes shortly creeping; scales castaneous, linear or narrowly lanceolate, 3–8 cells wide at base, acicular at apex. Fronds clustered or approximate; stipe dark stramineous, 10–35 cm, glabrescent except near base, narrowly sulcate adaxially, 2-angular abaxially except at base; lamina oblong, 15–60 × 9–30 cm, papery to subleathery, simply pinnate, with 15–20 pinnae

per side, base slightly narrowed, apex acuminate; pinnae linear, 7–20 × 0.3–1 cm, sessile or subsessile, base cuneate, margin shallowly serrate or crenate, or sometimes deeply lobed, apex acuminate; rachis stramineous, glabrescent, narrowly sulcate adaxially; veins distinct on both surfaces, once or twice forked, oblique. Sori submarginal, terminal on veins; indusia half cup-shaped. $2n = ca. 300$.

Terrestrial in forests; near sea level to 500[–2000] m. Taiwan [India, Indonesia, Japan (Ryukyu Islands), Malaysia, New Guinea, Philippines, Thailand; Pacific islands].

Two varieties are tentatively accepted.

- 1a. Pinnae 3–5 mm wide, crenate or shallowly lobed 1a. var. *pinnatum*
 1b. Pinnae 6–10 mm wide, deeply lobed ... 1b. var. *biserratum*

1a. *Tapeinidium pinnatum* var. *pinnatum*

达边蕨(原变种) da bian jue (yuan bian zhong)

Davallia pinnata Cavanilles, Descr. Pl. 277. 1802; *Microlepia pinnata* (Cavanilles) Beddome (1883), not J. Smith (1841).

Pinnae usually 3–5 mm wide, crenate or shallowly lobed.

Terrestrial in forests; near sea level to 500[–2000] m. Taiwan [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Philippines, Thailand; Pacific islands].

Microlepia pinnata var. *gracilis* Tak. Itô (Illus. Form. Pl. Suppl. t. 178. 1928) was described from Taiwan.

1b. *Tapeinidium pinnatum* var. *biserratum* (Blume) W. C. Shieh, Quart. J. Chin. Forest. 6(4): 105. 1973.

二羽达边蕨 er yu da bian jue

Davallia biserrata Blume, Enum. Pl. Javae 2: 232. 1828; *Tapeinidium biserratum* (Blume) Alderwerelt.

Pinnae usually 6–10 mm wide, deeply lobed.

Terrestrial in forests; near sea level to 500 m. Taiwan [Indonesia, Malaysia, New Guinea, Philippines].

Kramer (Fl. Males., Ser. 2, 1: 194. 1971) pointed out that this variety is intermediate between *Tapeinidium pinnatum* var. *pinnatum* and *T. luzonicum* (Hooker) K. U. Kramer. The true identity of this variety remains unclear.

4. *LINDSAEA* Dryander ex Smith, Mém. Acad. Roy. Sci. (Turin) 5: 413. 1793.

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Dong Shiyong (董仕勇); Lin Sujuan (林苏娟), Julie Barcelona

Lindsaea Kaulfuss; *Schizolegnia* Alston; *Schizoloma* Gaudichaud; *Synaphlebium* J. Smith.

Plants terrestrial, climbing or epiphytic. Rhizomes creeping with a *Lindsaea*-type protostele (differs from a true protostele by presence of a central core of phloem within xylem mass usually concentrated on dorsal side of rhizome), covered with subulate scales or acicular hairs or both. Fronds approximate or distant; stipe short, stramineous or castaneous, shallowly sulcate adaxially, glabrous; lamina 1- or 2-pinnate or pinnatifid, gradually narrowed toward apex, rarely with a terminal pinna, herbaceous to papery; rachis widely sulcate, abaxially keeled; ultimate pinnules or segments usually dimidiate or flabellate; veins free or anastomosing in a few species. Sori marginal or submarginal, linear, terminal on 2 to many uniting veins, or rarely orbicular and terminal on a single vein; annulus consisting of 9–17 thickened cells; indusia linear or oblong, usually attached only at base. Spores usually tetrahedral-globose and trilete.

About 200 species: tropical and subtropical areas, extending north to Japan and south to S Brazil, Australia, and New Zealand; 13 species (one endemic) in China.

Lindsaea kawabatae Kurata (J. Geobot. 13: 100. 1965), recorded from Taiwan, could not be treated here because no material was seen by the present authors. For more details, see Knapp (Ferns Fern Allies Taiwan, 93–95. 2011), who distinguished it from other Taiwanese species by the very small narrowly cuneate pinnules.

- 1a. Plants epiphytic; rhizomes long creeping, scandent; scales on rachis lanceolate, with 6–12 rows of cells at base 1. *L. merrillii*
 1b. Plants terrestrial; rhizomes shortly creeping, rarely long creeping, not scandent; scales on rachis very narrow, with 1–6(–8) rows of cells at base.
 2a. Lamina 1- or 2-pinnate, if 2-pinnate then only 1–3(–5) pairs of lower pinnae pinnate, middle and upper pinnae not lobed.
 3a. Veins free; lamina deltoid-lanceolate 2. *L. javanensis*
 3b. Veins anastomosing; lamina oblong.
 4a. Lamina 1-pinnate, terminal pinna similar to lateral ones 3. *L. ensifolia*
 4b. Lamina 1- or 2-pinnate, without a terminal pinna, upper pinnae gradually becoming smaller into a coadunate apex 4. *L. heterophylla*
 2b. Lamina 1–3(or 4)-pinnate, if decompose then all lateral pinnae 1- or 2-pinnate.
 5a. Veins anastomosing.
 6a. Rhizome scales very narrow, 1 or 2 cells wide at base; pinnules lobed on upper margin, reaching to 1/3–1/2 pinnule width, incisions 1–1.5 mm deep; lobes rounded at apex 5. *L. hainaniana*
 6b. Rhizome scales lanceolate or triangular, 4–8 cells wide at base; pinnules shallowly lobed on upper margin, incisions usually less than 1 mm deep; lobes or pinnules straight or nearly so on upper margin.
 7a. Pinnules obtuse-acuminate at apex, upper margin of fertile lobes entire; sori continuous or nearly so 6. *L. cultrata*
 7b. Pinnules rounded or subtruncate at apex, upper margin of fertile lobes erose; sori distinctly interrupted by incisions 7. *L. obtusa*

5b. Veins free.

8a. Lamina 1-pinnate, linear, less than 3 cm wide.

9a. Stipes usually stramineous; pinnae rhomboid or semi-ovate; sori interrupted 8. *L. lucida*9b. Stipes usually castaneous; pinnae flabellate or semi-orbicular; sori continuous 9. *L. orbiculata*

8b. Lamina 2- or 3-pinnate, ovate, ovate-lanceolate, or deltoid-lanceolate, over 10 cm wide.

10a. Sori usually terminal on a single vein, subrounded (orbicular?), two sori rarely closed or connected.

11a. Lamina 1- or 2-pinnate with a large terminal pinna; ultimate pinnules rhomboid or cuneate 10. *L. chingii*11b. Lamina 3- or 4-pinnate, pinnatifid and gradually narrowed toward apex; ultimate pinnules linear 11. *L. eberhardtii*

10b. Sori terminal on 2 or more veins.

12a. Terminal pinnae similar to lateral pinnae; lateral pinnae clearly stalked, stalks 5–15 mm; pinnules all or partly catadromous 12. *L. austrosinica*

12b. Terminal pinnae absent or present, if present then much larger than lateral ones; lateral pinnae sessile or shortly stalked (less than 2 mm); pinnules usually anadromous.

13a. Distal part of lamina abruptly narrowed and caudate, or lamina with a large terminal pinna; terminal pinnules usually entire; sori continuous or nearly so 9. *L. orbiculata*13b. Distal part of lamina gradually narrowed and acuminate, terminal pinnae absent; terminal pinnules distinctly lobed; sori interrupted 13. *L. chienii***1. *Lindsaea merrillii* Copeland subsp. *yaeyamensis* (Tagawa) K. U. Kramer, Gard. Bull. Singapore 26(1): 46. 1972.**攀缘鳞始蕨 *pan yuan lin shi jue**Lindsaea yaeyamensis* Tagawa, Acta Phytotax. Geobot. 6: 31. 1937; *L. merrillii* var. *yaeyamensis* (Tagawa) W. C. Shieh.

Rhizomes long creeping, scandent, castaneous, sparsely scaly; scales spreading, reddish brown, lanceolate, 6–12 cells wide at base, entire. Fronds distant, 2–3 cm apart; stipe castaneous at base and stramineous upward, 1–8 cm, quadrangular except for cylindrical basal part; lamina linear, 20–40 × 2–3 cm, once pinnate, membranous, apex acuminate to caudate; pinnae 35–50 pairs, dimidiate, alternate, narrowly triangular or oblong, cuneate at base, crenate or shallowly lobed at upper and outer margins, obtuse at apex; veins free, forked, distinct on both surfaces. Sori submarginal, 1 in each lobe, terminal on a single vein, sometimes on uniting 2 veins; indusia oblong, 1 in each lobe. $2n = 94$.

Epiphytic on tree trunks in forests, sometimes terrestrial; near sea level to 500 m. Taiwan [Japan (Ryukyu Islands)].

Lindsaea merrillii subsp. *merrillii* was described from the Philippines.

Lindsaea merrillii Copeland (Perkin's Fragm. 181. 1905) was included in FRPS (2: 265. 1959) as a species distinct from *L. yaeyamensis*, which was included under *L. macraeana* (Hooker & Arnott) Copeland (loc. cit.: 266).

2. *Lindsaea javanensis* Blume, Enum. Pl. Javae 2: 219. 1828.爪哇鳞始蕨 *zhao wa lin shi jue*

Lindsaea chienii Ching var. *deltoides* (Y. C. Wu) Tagawa; *L. liangkwanensis* Ching; *L. longipetiolata* Ching; *L. orbiculata* (Lamarck) Mettenius ex Kuhn var. *deltoides* Y. C. Wu; *L. yunnanensis* Ching.

Rhizomes shortly creeping, sparsely scaly; scales appressed or slightly spreading, castaneous, (2 or)3–5 cells wide

at base, acicular at apex. Fronds approximate; stipe castaneous, 10–30 cm, quadrangular; lamina deltoid-lanceolate, 7–20 × 6–15 cm, firmly herbaceous to papery, 2-pinnate at base and 1-pinnate apically, pinnatifid and gradually reduced toward apex; pinnae morphologically variable, larger pinnae on middle and lower part lanceolate, upper smaller pinnae rhombic, narrowly triangular, or oblong, pinnae 5–12 pairs, alternate, very unequal at base, basiscopically concave, acuminate at apex, 1–3 basal pinnae 1-pinnate with pinnules rhombic; veins free, mostly twice forked, immersed but ± evident. Sori submarginal, terminal on 2 to many veins; indusia linear, continuous or interrupted. $2n = ca. 130^*$.

Terrestrial, in forests; 400–1300 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Taiwan, Yunnan [India, Japan, Malaysia, Myanmar, Thailand, Vietnam].

3. *Lindsaea ensifolia* Swartz, J. Bot. (Schrader) 1800(2): 77. 1801.剑叶鳞始蕨 *jian ye lin shi jue*

Adiantum ensifolium (Swartz) Poirlet; *Lindsaea erecta* Mirbel; *L. griffithiana* Hooker; *L. lanceolata* Labillardière; *L. membranacea* Kunze; *Schizolegnia ensifolia* (Swartz) Alston; *Schizoloma ensifolium* (Swartz) J. Smith; *S. griffithiana* (Hooker) Fée.

Rhizomes long creeping, densely scaly; scales appressed, reddish brown, 2–6 cells wide at base and acicular at apex. Fronds approximate or distant, 0.5–1 cm apart; stipe castaneous, 10–30 cm, quadrangular; lamina oblong, 15–40 × 10–25 cm, herbaceous to papery, 1-pinnate; pinnae 1–8 pairs, subopposite at base, alternate apically, narrowly lanceolate, shortly stalked or sessile, base broadly cuneate, margin entire or serrate in sterile pinnae, apex acuminate; terminal pinnae similar to lateral ones; veins anastomosing, veins uniting to 2 rows of areoles along each side of costae, other veins free, visible on both surfaces. Sori marginal, terminal on veinlets; indusia linear, continuous. $2n = ca. 176^*$.

Terrestrial, roadsides, forests; 100–700 m. Fujian, Guangdong, Guangxi, Guizhou (Wangmo), Hainan, Taiwan, Yunnan [Bangladesh, India, Japan, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Africa, SW Asia, Australia, Pacific islands].

For a complete synonymy, see Kramer (Fl. Males., Ser. 2, 1: 211. 1971).

4. *Lindsaea heterophylla* Dryander, Trans. Linn. Soc. London 3: 41. 1797.

异叶鳞始蕨 yi ye lin shi jue

Adiantum heterophyllum (Dryander) Poiret; *Lindsaea variabilis* Hooker & Arnott; *Schizoloma heterophyllum* (Dryander) J. Smith.

Rhizomes shortly creeping, densely scaly; scales appressed or spreading, brown to castaneous, 2–6 cells wide at base, acicular at apex. Fronds approximate; stipe castaneous, 15–25 cm, subterete at base and quadrangular upward; lamina lanceolate to ovate-triangular, 15–30 × 6–20 cm, herbaceous, 1-pinnate or sometimes 2-pinnate at base, upper pinnae gradually becoming smaller toward apex, without terminal pinnae; pinnae 10–25 pairs, subopposite at base, alternate apically, morphologically variable, ovate, rhomboid, flabellate, or deltoid-lanceolate, usually sessile, broadly cuneate at base, margin subentire or erose, apex obtuse or acuminate; veins irregularly anastomosing or most often free on upper pinnae, one irregular areole present on either side of costa, other veins free, visible on both surfaces. Sori marginal, terminal on veins; indusia linear, continuous or rarely interrupted. $2n = \text{ca. } 130^*$, ca. 216, ca. 220.

Terrestrial, roadsides, on rocks along stream banks or in forests; 300–900 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [India, Japan, Malaysia, Sri Lanka, Thailand, Vietnam; Africa].

5. *Lindsaea hainaniana* (K. U. Kramer) Lehtonen & Tuomisto, Bot. J. Linn. Soc. 163: 339. 2010, not *L. hainanensis* Ching (1949).

向日鳞始蕨 xiang ri lin shi jue

Lindsaea lobata Poiret var. *hainaniana* K. U. Kramer, Gard. Bull. Singapore 26(1): 37. 1972.

Rhizomes shortly creeping, sparsely scaly; scales slightly spreading, brown, 2 or 3 cells wide at base and acicular at apex. Fronds approximate; stipe stramineous or sometimes brown, 10–25 cm, quadrangular; lamina 20–30 × 10–15 cm, herbaceous, 2-pinnate, consisting of a long terminal pinna and 1 or 2(or 3) pairs of short lateral pinnae, or sometimes without lateral pinnae, linear when 1-pinnate or trifurcate to ovate when 2-pinnate; pinnae linear, lateral pinnae 0–2(or 3) pairs, with 35–40 pairs of pinnules on terminal or central pinnae, 15–25(–35) pairs on lateral pinnae, pinnules not reduced toward base but gradually becoming smaller toward apex, dimidiate and oblong, lobed on upper margin, incisions reaching to 1/3–1/2 pinnule width, apex rounded, ultimate lobes convex at apex; veins anastomosing, evident on both surfaces. Sori marginal, terminal on 2 to many united veins; indusia linear, interrupted. $2n = 94^*$.

- Terrestrial, forests; 700–1200 m. Hainan.

Lindsaea hainaniana is morphologically very similar to *L. lobata*

var. *lobata*, differing only in the upper pinnules being gradually reduced in *L. lobata* var. *lobata* but ± suddenly reduced in *L. hainaniana*. A recent molecular analysis (Lehtonen et al., Bot. J. Linn. Soc. 163: 305–359. 2010) found, however, that *L. lobata* in the traditional sense was polyphyletic and this resulted in the recognition of the variety at the species level. *Lindsaea hainaniana* also resembles *L. cultrata*, from which it mainly differs in having wider rhizome scales and upper margins of the pinnae more deeply lobed.

6. *Lindsaea cultrata* (Willdenow) Swartz, Syn. Fil. 119. 1806.

网脉鳞始蕨 wang mai lin shi jue

Adiantum cultratum Willdenow, Phytographia, 14. 1794; *Lindsaea decomposita* Willdenow; *L. nitens* Blume; *L. nitida* Copeland; *L. recurvata* Wallich ex Hooker; *L. sarasinorum* Christ; *L. trapezoidea* Copeland; *Synaphlebium nitens* (Blume) J. Smith; *S. recurvatum* (Wallich ex Hooker) J. Smith.

Rhizomes shortly creeping, sparsely scaly; scales appressed, reddish brown, narrowly triangular, ca. 8 cells wide at base, acicular at apex. Fronds approximate; stipe stramineous, 10–30 cm, quadrangular at least on upper part; lamina 10–30 × 2–4 cm, or much wider when lateral pinnae are present, herbaceous, 1- or 2-pinnate with 1 or 2 pairs of lateral pinnae, terminal pinnae similar to lateral pinnae; pinnae linear, lateral pinnae 0–2 pairs, not or slightly narrowed toward base, apex ± abruptly narrowed; pinnules 12–25 pairs, dimidiate, rhomboid, upper margin with 1–3 narrow incisions to 1 mm deep, upper margin or lobes apically straight or slightly convex; veins anastomosing, evident or not. Sori marginal or submarginal, terminal on 2–5 veins; indusia linear, interrupted. $2n = \text{ca. } 300$.

Terrestrial, forests; 200–600 m. Taiwan (Taidong) [India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand; Pacific islands].

Once-pinnate specimens of this species have often been confused with *Osmolindsaea odorata*, which explains the observations of solenostelic rhizomes in *Lindsaea cultrata*. Like other species of *Lindsaea*, *L. cultrata* has a protostele and lacks the strong fragrance of *Osmolindsaea*.

7. *Lindsaea obtusa* J. Smith, Sp. Fil. 1: 224. 1846.

钝齿鳞始蕨 dun chi lin shi jue

Lindsaea decomposita Willdenow f. *longipinnula* Alderwerelt; *L. decomposita* f. *minor* Alderwerelt; *L. furcata* Copeland.

Rhizomes shortly creeping, covered with scales; scales appressed, brown, narrowly triangular, ca. 4 cells wide at base, acicular at apex. Fronds approximate; stipe castaneous, 10–30 cm, quadrangular; lamina 10–30 × 10–20 cm, herbaceous to papery, 2-pinnate with 1 or 2 lateral pinnae or 1-pinnate; pinnae linear, lateral pinnae 0–2(or 3) pairs, not narrowed toward base, distal part gradually narrowed, apex acuminate; pinnules 20–25 pairs, dimidiate, rhomboid, lobed on upper margin, incisions reaching at most to 1/3 pinnule width, apex rounded or truncate, ultimate lobes straight or ± convex at apex; veins anastomosing, evident or not. Sori marginal or submarginal, terminal on 2–5 veins; indusia linear, interrupted.

Terrestrial, forests; 300–400 m. Taiwan (Pingdong, Taibei, Yilan) [Malaysia, Thailand; Australia, Pacific islands].

For a complete synonymy, see Kramer (Fl. Males., Ser. 2, 1: 218. 1971).

8. *Lindsaea lucida* Blume, Enum. Pl. Javae 2: 216. 1828.

亮叶鳞始蕨 liang ye lin shi jue

Lindsaea changii C. Christensen; *L. concinna* J. Smith; *L. concinna* var. *kusukusensis* (Hayata) Tagawa; *L. kusukusensis* Hayata; *L. minima* Ching (1930), not Copeland (1929); *L. securifolia* C. Presl ex Goldmann; *L. securifolia* var. *kusukusensis* (Hayata) Shieh.

Rhizomes shortly creeping, densely scaly; scales \pm spreading, castaneous, 2 or 3 (or 4) cells wide at base, acicular at apex. Fronds approximate; stipe stramineous, 5–10 cm, quadrangular; lamina linear, 20–30 \times (0.7–)1.5–2 cm, herbaceous, 1-pinnate; pinnae 40–50 pairs, dimidiate, rhomboid or cuneate toward apex, crenate or shallowly lobed on upper margin, incisions reaching just beyond level of receptacle, apex rounded or obtuse-acute, straight on upper margin; veins free, evident. Sori marginal, terminal on 2–4 veins; indusia linear, interrupted. $2n = 94^*$.

On rocks beside streams in forests; 200–600 m. Guangdong, Hainan, Jiangxi, S Taiwan (Pingdong, Taidong) [Bangladesh, Bhutan, India, Japan, Malaysia, Myanmar, Thailand, Vietnam; Pacific islands].

Ching (Icon. Filic. Sin. 4: t. 156. 1937) misidentified this species as *Lindsaea lobbiana* Hooker (Sp. Fil. 1: 205. 1846), a species described from Java, Indonesia.

9. *Lindsaea orbiculata* (Lamarck) Mettenius ex Kuhn, Ann. Mus. Bot. Lugduno-Batavi 4: 279. 1869.

团叶鳞始蕨 tuan ye lin shi jue

Adiantum orbiculatum Lamarck, Encycl. 1: 41. 1783; *Lindsaea commixta* Tagawa; *L. hainanensis* Ching (1949), not *L. hainaniana* (K. U. Kramer) Lehtonen & Tuomisto (2010); *L. orbiculata* var. *commixta* (Tagawa) K. U. Kramer; *L. simulans* Ching; *L. taiwaniana* Ching; *L. tenera* Dryander var. *commixta* (Tagawa) K. Iwatsuki; *Schizoloma intertextum* Ching.

Rhizomes shortly creeping, sparsely scaly; scales appressed or spreading, castaneous, 2–4 cells wide at base, acicular at apex. Fronds approximate; stipe castaneous, 4–35 cm, quadrangular; lamina 9–25 \times 1.5–15 cm, herbaceous to papery, 1- or 2-pinnate; if 1-pinnate then lamina linear, pinnae 10–22 pairs, dimidiate, rhomboid, flabellate, or orbicular, upper margin entire or erose in fertile pinnae or dentate in sterile pinnae, upper pinnae hardly or gradually reduced toward apex; if 2-pinnate then lamina with 1–5 pairs lateral pinnae, terminal pinna similar to or usually much larger than lateral ones, basal pinnae very small or fully developed; in 2-pinnate laminae, pinnules similar to those pinnae in 1-pinnate lamina but fewer, usually with 1–9 on each side of costa; veins free, evident. Sori marginal or submarginal, terminal on all veins; indusia linear, continuous, or rarely interrupted by incisions. $2n = 88^*$, ca. 300.

Terrestrial, forests; near sea level to 1200 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Thailand, Vietnam].

Lindsaea orbiculata is very variable, and it is possibly a complex. The typical form (stipes 5–10 cm, lamina 1-pinnate, pinnae orbicular or flabellate, and sori marginal, continuous) is found on the one hand, and on the other is the form known as *L. hainanensis* (stipes up to 28 cm, fully 2-pinnate, and pinnules rhomboid). The two forms appear very distinct, but there is a series of transitional specimens known. Two cytotypes, diploid and tetraploid, were reported for *L. orbiculata*. Further taxonomic studies at the population level of this taxon are needed.

Lindsaea flabellulata Dryander (Trans. Linn. Soc. London 3: 41. 1797), type from Macao, was treated as a synonym of *L. orbiculata* in FRPS (2: 264. 1959).

10. *Lindsaea chingii* C. Christensen, Index Filic., Suppl. 3: 121. 1934.

碎叶鳞始蕨 sui ye lin shi jue

Lindsaea chinensis Ching, Sinensia 1: 5. 1929, not (Linaeus) A. Braun & C. D. Bouché (1866).

Rhizomes long creeping, sparsely scaly; scales appressed, reddish brown, 2–4 cells wide at base. Fronds approximate, or distant, 0.5–1.5 cm apart; stipe castaneous, 3–13 cm, terete or slightly quadrangular; lamina 10–20 \times 1.5–10 cm, herbaceous, 1- or 2-pinnate; if 1-pinnate then lamina linear, pinnae 18–25 pairs, dimidiate, rhomboid, flabellate, or cuneate, deeply lobed to linear lobes, upper pinnae gradually reduced toward apex; if 2-pinnate then lamina triangular or deltoid-lanceolate, with 1–10 pairs of lateral pinnae, base truncate, upper part \pm abruptly narrowed to caudate; if 2-pinnate then pinnules similar to those in 1-pinnate laminae but smaller and fewer, usually 6–14 on each side of costa; veins free, visible. Sori usually terminal on 1 vein, 1 in each lobe, or sometimes 2 sori connected to form a coenosorus, or rarely terminal on 3 or 4 veins; indusia reniform or oblong, interrupted.

Terrestrial, on sandy soil beside streams in forests; ca. 500 m. Guangxi, Hainan [Vietnam].

11. *Lindsaea eberhardtii* (Christ) K. U. Kramer, Acta Bot. Neerl. 6: 135. 1957.

线片鳞始蕨 xian pian lin shi jue

Type: Vietnam. 1906, *Eberhardt 116* (**lectotype, designated here**, P! [barcode 00633692]).

Odontosoria eberhardtii Christ, J. Bot. (Morot), ser. 2, 1: 266. 1908; *Lindsaea dissectiformis* Ching; *Stenoloma eberhardtii* (Christ) Ching.

Rhizomes shortly creeping, sparsely scaly; scales appressed or nearly so, reddish brown, 2–4(–6) cells wide at base, acicular at apex. Fronds approximate; stipe castaneous, (10–) 20–30 cm, quadrangular or sometimes not distinctly so; lamina oblong-subtriangular, 10–18 \times 5–16 cm, herbaceous, 3- or 4-pinnate, finely dissected, rounded or truncate at base, confluent apically; pinnae 15–18 pairs, subopposite at base, alternate apically, deltoid-lanceolate to lanceolate, usually sessile, 2- or 3-pinnate, cuneate at basiscopic base and truncate at acroscopic base, apex acuminate; ultimate pinnules linear; veins free, 1 (or 2) in each lobe, visible. Sori marginal, terminal on 1 (or 2) veins; indusia suborbicular, reniform, or oblong. $2n = ca. 178^*$.

Terrestrial, forests; 800–1200 m. Hainan [Vietnam].

In the protologue of *Odontosoria eberhardtii*, two syntypes (*Eberhardt 115* and *116*) were cited. Two sheets of *Eberhardt 115* and one sheet of *Eberhardt 116* are in P. The sheet of *Eberhardt 116* contains three fully developed fronds and is selected as the lectotype of *L. eberhardtii*.

12. *Lindsaea austrosinica* Ching, Bull. Fan Mem. Inst. Biol., n.s., 1: 297. 1949.

华南鳞始蕨 hua nan lin shi jue

Rhizomes shortly creeping, densely scaly; scales \pm spreading, reddish brown, narrowly lanceolate, 2–6 cells wide at base, acicular at apex. Fronds distant, 1–2.5 cm apart; stipe castaneous, 30–45 cm, quadrangular; lamina ovate or oblong, 23–32 \times 10–15 cm, papery, 2-pinnate, base broadly cuneate to truncate, terminal pinnae similar to lateral ones; pinnae 3–5 pairs, linear, stalked, stalks 0.5–1.5 cm; pinnules 10–17 pairs, dimidiate, rectangular or nearly so, subentire or with 1–3 incisions on upper and outer margins, incisions reaching hardly beyond receptacle, apex rounded or rectangular, usually catadromous, upper pinnules slightly reduced toward apex, truncate at base; veins free, evident on abaxial surface and visible on adaxial surface. Sori marginal, terminal on 4 to many veins; indusia linear, continuous or interrupted.

Terrestrial, forests; 900–1000 m. Guangxi, Hainan [Cambodia, Vietnam].

Lindsaea austrosinica is easily distinguished from other species of Chinese *Lindsaea* by the obviously stalked pinnae and catadromous pinnules in all or part of the lateral pinnae.

13. *Lindsaea chienii* Ching, Sinensia 1: 4. 1929.

钱氏鳞始蕨 qian shi lin shi jue

Lindsaea annamensis K. U. Kramer; *L. conformis* Ching; *L. fengkaiensis* B. S. Wang & S. H. Shi; *L. orbiculata* (Lamarck) Mettenius ex Kuhn var. *recedens* (Ching) W. C. Shieh; *L. recedens* Ching.

Rhizomes shortly creeping, sparsely scaly; scales appressed, reddish brown, 2–4 cells wide at base, acicular at apex. Fronds approximate; stipe castaneous or at least castaneous at base and brown to stramineous apically, 15–26 cm, quadrangular or subterete at base; lamina ovate or deltoid-ovate, 10–18 \times 5–12 cm, herbaceous to papery, 2-pinnate or rarely 3-pinnate at base, base rounded or broadly cuneate, upper pinnae gradually reduced or sometimes upper part abruptly narrowed to a caudate apex; 1-pinnate pinnae 4–6 pairs, linear or lanceolate, sessile or basal pinnae shortly stalked, pinnules anadromous, base cuneate, upper pinnules gradually reduced toward apex; pinnules 6–13 pairs, dimidiate, rhomboid or cuneate, lobed on upper margin or rarely entire when pinnules small and cuneate, incisions reaching to 1/3 pinnule width, outer margin straight or nearly so; veins free, visible. Sori submarginal, terminal on 2–4 veins; indusia linear or oblong, interrupted. $2n = 188^*$.

Terrestrial, forests; 100–1300 m. Fujian, Guangdong, Guangxi, Guizhou (Chishui), Hainan, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, Thailand, Vietnam].

Lindsaea chienii is morphologically variable. Two cytotypes, diploid and tetraploid, have been reported. Further intraspecific study is needed.