

5. TETRAPHIDACEAE Schimper

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Plants minute and budlike or merely small, forming dense turfs or scattered patches; protonema producing chlorophyllose, perpendicular protonematal flaps, which are persistent or disappear after the development of the gametophores. **Stems** erect, to 1.5 cm. **Leaves** ovate or lanceolate, erect, three-ranked and appressed or spreading, costate or ecostate, cells smooth, rounded-hexagonal or oblong-rhomboid, basal cells elongate. **Sexual condition** autoicous; archegonia and antheridia on short stems at the plant base. **Seta** straight or flexuose, smooth or papillose. **Capsule** exserted, single, cylindrical, ovate or shortly oblong-cylindrical; peristome of four, single, unsegmented, narrowly triangular, multicellular teeth; annulus absent. **Calyptra** mitrate, smooth or plicate, naked. **Spores** green to yellowish, 10–16 μm , spheric, smooth or finely papillose.

Genera 2, species 4 (2 genera, 4 species in the flora): circumboreal, disjunct to the Southern Hemisphere.

1. Plants with conspicuous stems to 1.5 cm, forming dense turfs or scattered patches, leaves costate, protonematal flaps not persistent, stalked asexual structures often present 1. *Tetraphis*, p. 111
1. Plants minute, bud-like, stems less than 0.05 cm, leaves weakly costate in distal leaves or costa absent, protonematal flaps persistent and usually present, specialized asexual structures absent 2. *Tetrodontium*, p. 113

1. TETRAPHIS Hedwig, Sp. Musc. Frond., 43. 1801 • [Greek *tetra*, four, and probably Graecized Latin *-fid*, divided, alluding to peristome]

Georgia Müller Hal.

Plants small, green distally, reddish brown proximally. **Thallose protonematal flaps** not persistent. **Stems** many, 0.8–1.5 cm, rarely taller, naked proximally, densely foliate distally. **Leaves** spreading, keeled, pellucid when moist, slightly contorted when dry, variable in size and shape, 1–3 mm, proximal leaves ovate to ovate-lanceolate; costa ending well before the apex, distal leaves linear, acute to acuminate, margins entire, broadly reflexed, costa subpercurrent;

laminal cells thick-walled, irregularly rounded-hexagonal in distal leaf and becoming oblong-linear near leaf base. **Specialized asexual structures:** stalked, discoid gemmae borne in rosette of rounded bracts formed on top of vegetative stem, usually present in both sterile and fertile material. **Sexual condition** with antheridia among numerous paraphyses adjacent to the archegonia; perichaetial leaves lanceolate, long-acuminate, entire. **Seta** 6–17 mm, straight, smooth, cells spirally twisted throughout or smooth, occasionally small sections of straight cells papillose by projecting cell ends (prorulate) near the base, or geniculate, cells smooth and spirally twisted below the bend but cells straight, prorulate beyond the bend. **Capsule** narrowly cylindrical, 2–3 mm, symmetric or slightly curved, brown to reddish brown; operculum conic; peristome teeth occasionally splitting when dry and appearing to be more than four. **Calyptra**, smooth, whitish. **Spores** papillose.

Species 2 (2 in the flora): circumboreal.

- 1. Seta geniculate, outer cells smooth, and spirally twisted below the bend, cells straight and papillose by projecting cell walls above the bend 1. *Tetraphis geniculata*
- 1. Seta not geniculate, outer cells smooth, and spirally twisted throughout the entire length of the seta, not papillose, or sometimes lightly papillose near the base 2. *Tetraphis pellucida*

1. ***Tetraphis geniculata*** Milde, Bot. Zeitung (Berlin) 23: 155. 1865 [F]



Georgia geniculata (Milde) Brockmüller

Specialized asexual structures are often present. **Seta** 7–17 mm, erect, geniculate, cells smooth and spiraled below the bend, cells straight and papillose by projecting cell ends above the bend, twisted when dry. **Spores** 13–16 µm.

Capsules mature spring–early summer, rare. Well decayed wood, stumps, logs, rarely on rock; sea level to subalpine; Alta., B.C., N.B., Nfld. and Labr., N.S., P.E.I., Que., Yukon; Alaska, Idaho, Maine, N.H., N.Y., Oreg., Wash.; e Asia (Russian Far East).

2. ***Tetraphis pellucida*** Hedwig, Sp. Musc. Frond., 45, plate 7, fig. 1a–f. 1801 [F]



Georgia pellucida (Hedwig) Rabenhorst; *Tetraphis cuspidata* (Kindberg) Paris

Specialized asexual structures are usually present. **Seta** 6–14 mm, erect, straight or ± flexuose, superficial cells smooth and spirally twisted the entire length or spirally twisted and interspersed

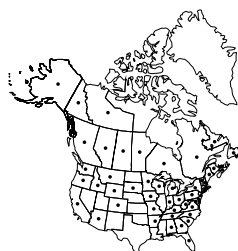
with sections of prorulate straight cells. **Spores** 10–13 µm.

Varieties 2 (2 in the flora); throughout Northern Hemisphere

Using growth studies, R. T. T. Forman (1962) suggested that leaf width and shape are influenced by temperature but could be used for species determination in some areas of North America, although it appears to be an inconsistent character and should be used with caution to determine sterile material. The varieties are distinguished by twisting of the superficial cells of the seta in both old, dry, and young, fresh material; the seta itself is twisted when dry.

- 1. Seta smooth, superficial cells spirally twisted throughout entire length 2a. *Tetraphis pellucida* var. *pellucida*
- 1. Seta usually lightly papillose near base, superficial cells spirally twisted but interspersed with sections of straight cell 2b. *Tetraphis pellucida* var. *trachypoda*

2a. ***Tetraphis pellucida*** Hedwig var. *pellucida* [F]



Seta superficial cells smooth, spirally twisted the entire length.

Capsules mature spring–early summer. Common on well-decayed wood, stumps, and logs, sometimes on sandstone or very humic soil; sea level to subalpine; Alta., B.C., Man., N.B., Nfld. and Labr., N.W.T., N.S., Ont., P.E.I., Que., Sask., Yukon; Ala., Alaska, Ariz., Ark., Calif., Colo., Conn., Del., Fla., Ga., Idaho, Ind., Iowa, Ky., Maine, Md., Mass., Mich., Minn., Mo., Mont., N.H., N.J., N.Y., N.C., Ohio, Oreg., Pa., R.I., S.C., S.Dak., Tenn., Vt., Va., Wash., W.Va., Wis., Wyo.; Europe; Asia (China, Japan, Russian Far East).

2b. *Tetraphis pellucida* var. *trachypoda* (Kindberg)

J. Harpel, Sida 22: 551. 2006 [F]

*Georgia trachypoda* Kindberg, Rev. Bryol. 20: 93. 1893

Seta superficial cells usually lightly papillose near the base, cells spirally twisted but interspersed with sections of straight, prorulate cells.

Capsules mature spring–early summer. Rare, on well-decayed wood, stumps, and logs; B.C., N.B., Nfld. and Labr. (Labr.), N.W.T.; Colo., Mont., Wyo.; e Asia (Russian Far East).

Variety *trachypoda* has been synonymized under both *Tetraphis geniculata* and *T. pellucida*. It proved, in fact, to be a form intermediate between these species. It occurs in North America and Russia, although at the present time the geographic range in Russia is little known. Based on the North American material examined it appears to be found only in areas where both *T. pellucida* and *T. geniculata* occur, suggesting that it might be found in the Russian Far East where the two species also overlap.

2. TETRODONTIUM Schwägrichen, Sp. Musc. Frond. Suppl. 2(1,2): 102. 1824

- [Greek *tetra*, four, and *odontos*, tooth, alluding to peristome]

Plants very small, budlike, dull dark-green to brownish green, in scattered, gregarious or sometimes very small clumps. **Thallose protonematal flaps** persistent and usually present. **Stems** few, very short, less than 0.05 cm; flagelliform shoots may occur at the base of the stem, 0.2–0.5 cm, with 3-ranked, tightly appressed linear to lanceolate leaves. **Leaves** of main stem few, appressed, ovate, acuminate, or obtuse, margins entire or dentate, to 1.2 mm; costa single, weak or absent; laminal cells rhombic or rectangular. **Specialized asexual structures** absent. **Sexual condition:** perichaetial and perigonial buds occurring on the same protonema; perichaetial leaves ovate to ovate-lanceolate, concave. **Seta** 3–8 mm, straight, smooth, slightly twisted when dry. **Capsule** 0.6–1 mm, ovate to shortly oblong-cylindric, straight; operculum conic, obliquely apiculate; peristome usually not splitting or appearing to be more than four. **Calyptra** smooth or somewhat plicate, yellowish. **Spores** smooth or finely papillose, 10–16 μ m.

Species 2 (2 in the flora): North America, South America (Chile); Eurasia, Pacific Islands (New Zealand).

1. Plants with numerous flagelliform shoots, protonematal flaps less than 0.5 mm 1. *Tetrodontium repandum*
1. Plants without flagelliform shoots, protonematal flaps 0.5–2.5 mm 2. *Tetrodontium brownianum*

1. *Tetrodontium repandum* (Funck) Schwägrichen, Sp.

Musc. Frond. Suppl. 2(1,2): 102. 1824 [F]

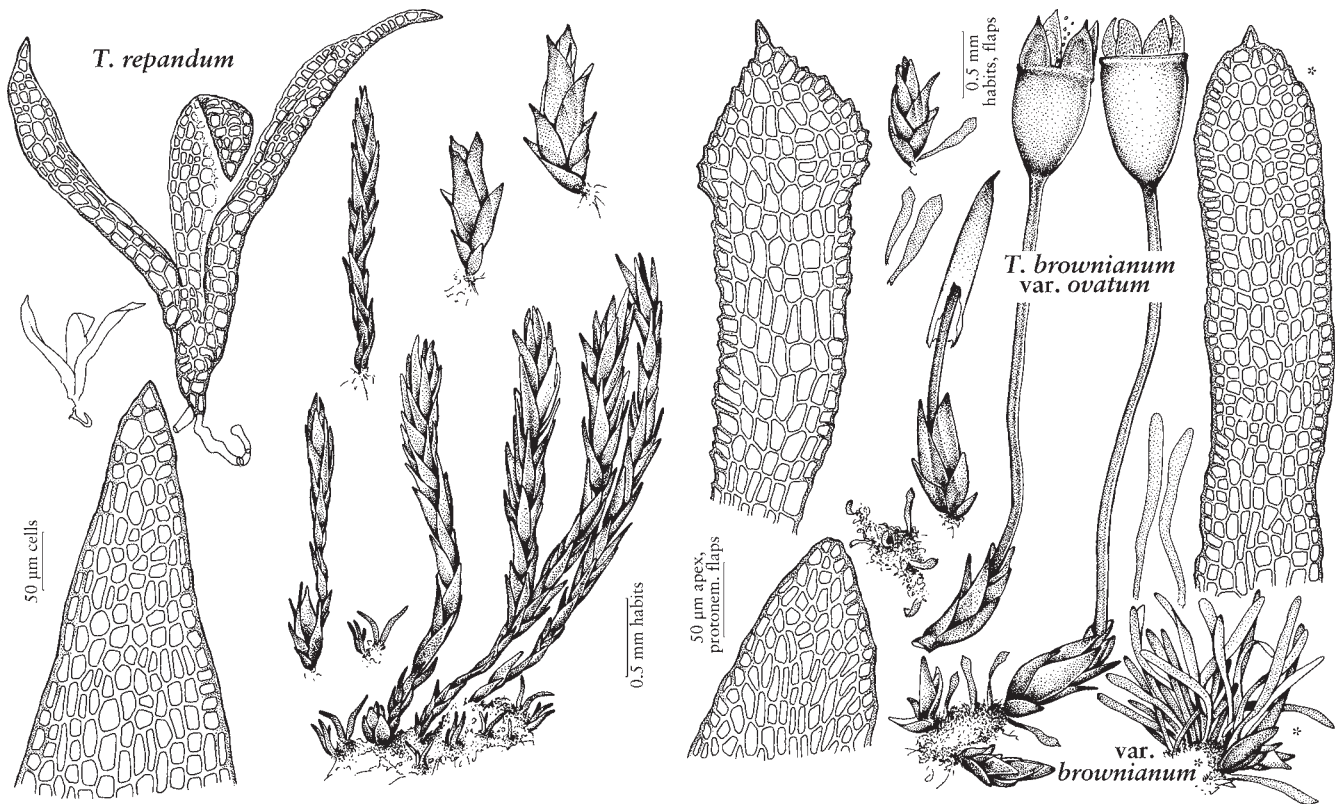


Tetraphis repanda Funck in J. Sturm et al., Deutschl. Fl. 2(17): plate 4. 1819; *T. brownianum* var. *repandum* (Funck) Limpricht

Plants with numerous flagelliform shoots, these 2–5 mm with 3-ranked, tightly appressed linear to lanceolate leaves at the base of the stem. **Thallose protonematal**

flaps ovate-lanceolate, without a distinct mucronate point, margins \pm dentate, less than 0.5 mm. **Leaves** with costa absent. **Spores** about 16 μ m.

Capsules rare to very rare, maturing late summer. Often growing inverted under rock ledges or in crevices, especially in areas of high humidity sometimes mixed in with other bryophytes; in North America it occurs in subalpine areas; B.C.; Alaska, Wash.; Europe; Asia (Japan).



TETRODONTIUM

2. *Tetodontium brownianum* (Dickson) Schwägrichen, Sp. Musc. Frond. Suppl. 2(1,2): 102. 1824 [F]



Georgia browniana (Dickson) Müller Hal.; *Tetraphis browniana* (Dickson) Greville

Plants without flagelliform shoots. Thallose protonematal flaps narrowly linear-lanceolate acute, occasionally with a short mucronate point, margins usually entire, up to 2.5 mm. Leaves with costa

weak or sometimes absent, present only in distal leaves. Spores about 10–12 µm.

Varieties 2 (2 in the flora): North America, Eurasia.

1. Protonematal flaps narrow, linear, acute, to 2.5 mm, usually entire, sometimes with a short mucronate point; stem leaves acuminate, sharply pointed 2a. *Tetodontium brownianum* var. *brownianum*
1. Protonematal flaps ovate-lingulate, less than 0.5 mm, dentate, with a large acute apical cell, often mixed in with linear, mucronate flaps; stem leaves obtuse 2b. *Tetodontium brownianum* var. *ovatum*

2a. *Tetodontium brownianum* (Dickson) Schwägrichen var. *brownianum* [F]



Protonematal flaps narrow, linear, acute up to 2.5 mm, usually entire, sometimes with a short mucronate point. Stem leaves acuminate, sharply pointed.

Capsules rare to very rare, mature late summer. Often growing inverted under rock ledges or in crevices, especially in areas of high humidity, sometimes mixed in with other bryophytes; low to high elevations; N.B., Nfld. and Labr. (Nfld.); Mich., N.Y., Ohio, Wash.; Europe; Asia (Japan); Pacific Islands (New Zealand).

2b. Tetrodontium brownianum var. **ovatum** (Funck)

Wijk & Margadant, Taxon 9: 52. 1960 [F]



Tetraphis ovata Funck, Bot.
Taschenb. Anfänger Wiss.
Apothekerkunst 13: 41. 1802;
T. rigida Hedwig; *Tetrodontium*
ovatum (Funck) Schwägrichen

Protonematal flaps ovate-lingulate, less than 0.5 mm, dentate, with a large acute apical cell, often mixed in with linear,

mucronate flaps. **Stem leaves** obtuse.

Capsules rare to very rare, mature late summer. Often growing inverted under rock ledges or in crevices, especially in areas of high humidity, sometimes mixed in with other bryophytes, in North America predominantly coastal; B.C., N.B., P.E.I.; Maine; c Europe.