

23. BRUCHIACEAE Schimper

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Plants minute or merely small, gregarious to densely tufted. **Stems** erect, simple or branching, with a central strand. **Leaves** mostly lanceolate or subulate, straight or somewhat curved, base oblong to ovate; in several rows; margins plane, entire or serrulate distally; costa single, well developed, subpercurrent to shortly excurrent as a sometimes roughened or denticulate subula, in section poorly differentiated or with 1 row of guide cells and 2 (sub-)steroid bands, adaxial band much reduced; lamina cells smooth or abaxially papillose; basal cells broader, narrower towards the margins, those of basal angles not differentiated or forming a marginal border; distal cells short- to long-rectangular, walls firm. **Specialized asexual reproduction** not known. **Sexual condition** autoicous or paroicous [dioicous]; perigonia axillary or on short branches adjacent to perichaetia or basal on the plant; perichaetial leaves usually differentiated, longer and somewhat sheathing. **Seta** short to elongate, usually yellow or brown; capsules immersed to exerted, cylindric or obovate with a distinct inflated-tapering to elongate neck, erect to curved; cleistocarpous, gymnostomous, or peristomate; annulus, when present, usually of 2–3 rows of larger cells, commonly revoluble; peristome, when present, single, of 16 simple, forked, or perforate teeth; operculum, when present, obliquely long-rostrate. **Calyptra** cucullate or mitrate. **Spores** often large, spheric to ovoid or weakly reniform, finely to coarsely papillose, spiculate, reticulate, or pitted.

Genera 4, species ca. 140 (2 genera, 16 species in the flora): cosmopolitan, greatest occurrence in temperate regions.

Species of Bruchiaceae commonly occur on soil, often as colonizers. The family was well-characterized by W. R. Buck (1979), who recognized four genera and suggested a transitional position between Dicranaceae and Ditrichaceae. The two genera represented in the flora area are quite different but share the salient well-developed capsule neck.

SELECTED REFERENCES Britton, E. G. 1913c. Bruchiaceae. In: N. L. Britton et al., eds. 1905+. North American Flora.... 47+ vols. New York. Vol. 15, pp. 47–54. Buck, W. R. 1979. A re-evaluation of the Bruchiaceae with the description of a new genus. Brittonia 31: 469–473.

1. Capsule cleistocarpic, immersed to short-exserted, neck conic to ovate 1. *Bruchia*, p. 434
1. Capsule stegocarpic, long-exserted, neck conic to long-cylindric 2. *Trematodon*, p. 437

1. BRUCHIA Schwägrichen, Sp. Musc. Frond. Suppl. 2(1,2): 91. 1824 • [For Philipp Bruch, 1781–1847, German pharmacist and bryologist]

Leaves not contorted when dry, lanceolate to linear-lanceolate from a somewhat broadened ovate or oblong base, 1–2 mm, apex acute to acuminate, margins entire or serrulate; costa subpercurrent to shortly excurrent; distal laminal cells short- to long-rectangular. **Perichaetial leaves** little different from cauline to distinctly larger and somewhat sheathing. **Seta** short, 0.3–0.4 mm. **Capsule** immersed to short-exserted, pyriform or obovate, neck weakly to strongly inflated, obovate, tapering, or short-cylindric; peristome and operculum not differentiated. **Calyptra** mitrate. **Spores** rather large, 25–45 µm, papillose, spinose, reticulate, or pitted.

Species 17 (10 in the flora): worldwide, mainly in the temperate zones.

The taxonomic concept for *Bruchia* follows that of A. E. Rushing (1986). The large percentage of species that are endemic to the flora area may indicate an overly narrow species concept for the genus held by past monographers. The protonema of some species appears persistent. *Bruchia bolanderi* and *B. vogesiaca* approach *Trematodon* in size and appearance of sporophyte but the capsules are cleistocarpic.

SELECTED REFERENCES Rushing, A. E. 1985. Spore morphology in the genus *Bruchia* Schwaegr. (Musci). Amer. J. Bot. 72: 75–85. Rushing, A. E. 1986. A revision of the genus *Bruchia* Schwaegr. (Musci). J. Hattori Bot. Lab. 60: 35–83.

1. Seta (1.5–)3–7 mm, spores warty.
 2. Distal leaves 0.7–3 mm, leaf base ovate to oblong. 1. *Bruchia bolanderi*
 2. Distal leaves 1.8–4.7 mm, leaf base long-oblong to long-elliptical 2. *Bruchia vogesiaca*
1. Seta usually less than 3 mm, spores spinose, papillose or pitted.
 3. Leaves ovate to lanceolate.
 4. Spores densely spinose 3. *Bruchia hallii*
 4. Spores pitted 4. *Bruchia fusca*
 3. Leaves subulate beyond an ovate, oblong-ovate, obovate, or elliptic base.
 5. Spores pitted.
 6. Calyptra papillose; leaves long-subulate 5. *Bruchia caroliniae*
 6. Calyptra smooth; leaves short-subulate 6. *Bruchia brevifolia*
 5. Spores papillose, spinose, or reticulate.
 7. Calyptra papillose 7. *Bruchia ravenelii*
 7. Calyptra smooth.
 8. Spores spinose 8. *Bruchia flexuosa*
 8. Spores reticulate.
 9. Leaves short-subulate, distal laminal cells short-rectangular; capsule obovate, tapered to base 9. *Bruchia texana*
 9. Leaves long-subulate, distal laminal cells long-rectangular; capsule rounded-truncate at base 10. *Bruchia drummondii*

1. ***Bruchia bolanderi*** Lesquereux, Mem. Calif. Acad. Sci. 1: 5. 1868 [E] [F]



Distal leaves lanceolate to long-lanceolate or subulate, 0.7–3 mm, leaf base ovate to oblong; distal laminal cells long-rectangular. **Sexual condition** autoicous. **Seta** 1.5–5.5 mm. **Capsule** neck long-tapering and nearly cylindric. **Spores** warty (irregularly papillose in groups). **Calyptra** smooth.

Capsules mature summer. Soil; moderate to high elevations; Calif., Oreg.

Bruchia bolanderi has an elongate capsule neck that is reminiscent of that of *Trematodon*, but the capsule is cleistocarpic. Unlike in other species of the genus, the capsules of both *B. bolanderi* and *B. vogesiaca* have a weak but not functioning line of dehiscence where a capsule mouth might be.

2. *Bruchia vogesiaca* Schwägrichen, Sp. Musc. Frond. Suppl. 2(1,2): 91, plate 127. 1824



Bruchia longicollis Eaton

Distal leaves long-subulate, 1.8–4.7 mm, leaf base weakly differentiated, long-oblong to long-elliptical; distal laminal cells long-rectangular. **Sexual condition** autoicous. **Seta** 3–7 mm. **Capsule** neck long-tapering and almost cylindrical. **Spores** warty. **Calyptra** smooth

Capsules mature summer. Soil, decayed log in swamp; moderate elevations; N.H., N.Y.; Europe; Asia (China).

Bruchia vogesiaca is much like *B. bolanderi*, but is a larger plant with a more strongly defined costa.

3. *Bruchia hallii* Austin, Bull. Torrey Bot. Club 5: 21. 1874 [E]



Distal leaves ovate to very short-lanceolate, 0.7–1.3 mm, leaf base not differentiated in shape; distal laminal cells short-rectangular. **Sexual condition** paroicous. **Seta** 0.4–1.7 mm. **Capsule** neck short, obovate. **Spores** densely spinose. **Calyptra** smooth

Capsules mature late winter–spring. Soil; low to moderate elevations; Ala., Ark., Ill., N.C., Tex.

The short leaves and short seta are good field characters for *Bruchia hallii*, but the spores must be examined to distinguish it from *B. fusca*.

4. *Bruchia fusca* E. Britton, Bull. Torrey Bot. Club 21: 361, plate 216. 1894 [E]



Distal leaves ovate, 0.6–1.3 mm, leaf base not differentiated in shape; distal laminal cells short-rectangular. **Sexual condition** autoicous. **Seta** 0.3–1.2 mm. **Capsule** neck short, obovate. **Spores** pitted. **Calyptra** smooth.

Capsules mature spring. Soil, commonly surrounding quartz pebbles; low to moderate elevations; Md., N.C., Tex.

Bruchia fusca is much like *B. hallii* and differs almost exclusively in the ornamentation of the spores, a trait that may prove to be an intraspecies genetic difference.

5. *Bruchia carolinae* Austin, Bull. Torrey Bot. Club 6: 144. 1877 [E]



Bruchia ravenelii var. *mollis* Lesquereux & James

Distal leaves long-subulate beyond an ovate or obovate base, 1–2.2 mm, leaf base strongly differentiated in shape; distal laminal cells short- to long-rectangular. **Sexual condition** autoicous. **Seta** 0.1–0.4 mm. **Capsule** neck very

short, flattened obovate. **Spores** pitted. **Calyptra** minutely papillose.

Capsules mature late winter–spring. Soil; generally low elevations; Fla., Ga., La., N.C., S.C., Tex.

Bruchia carolinae is one of the smallest species of the genus, and the very short seta and papillose calyptra are diagnostic.

6. *Bruchia brevifolia* Sullivant in A. Gray, Manual ed. 2, 617. 1856 [E]



Distal leaves short-subulate beyond an ovate or obovate base, 1–1.8 mm, leaf base strongly differentiated in shape; distal laminal cells short-rectangular. **Sexual condition** autoicous. **Seta** 0.3–0.7 mm. **Capsule** neck short, obovate. **Spores** pitted. **Calyptra** smooth.

Capsules mature early spring. Soil, sandy loam, commonly surrounding quartz pebbles; usually low but occasionally moderate elevations; Ala., Ariz., Ga., Kans., N.C., Ohio, S.C., Tex.

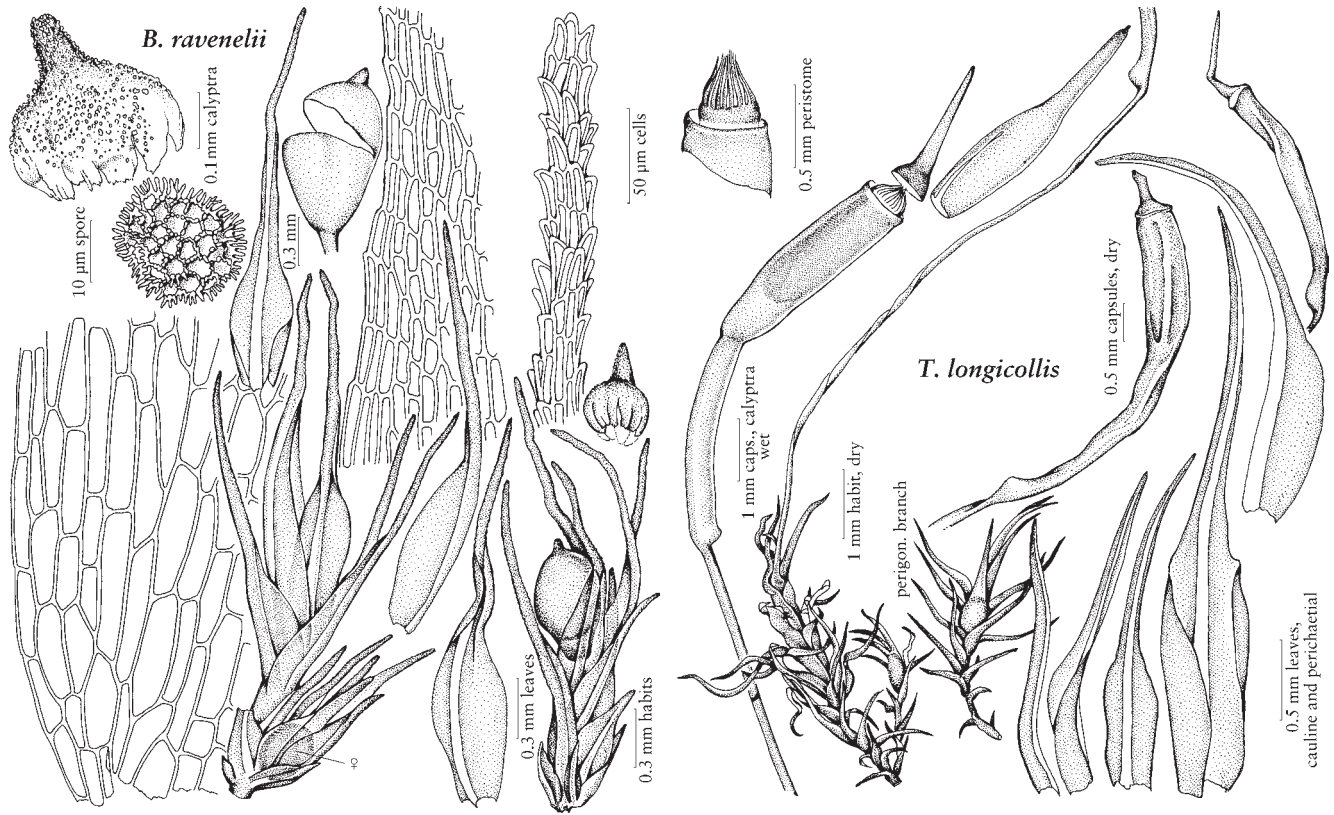
7. *Bruchia ravenelii* Wilson ex Sullivant in A. Gray, Manual ed. 2, 617. 1856 [E] [F]



Distal leaves long-subulate beyond an elliptic, ovate or obovate base, 1.2–2.7 mm, leaf base usually strongly differentiated in shape; distal laminal cells short- to long-rectangular. **Sexual condition** autoicous. **Seta** 0.2–0.5 mm. **Capsule** neck short, bluntly conic. **Spores** reticulate. **Calyptra** strongly papillose.

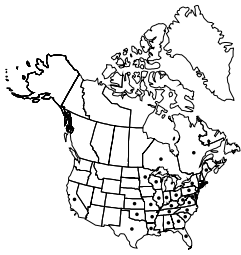
Capsules mature winter. Moist, sandy soil; mostly low but occasionally moderate elevations; Ala., Fla., Ga., Miss., N.C., Ohio, S.C., Tex.

Bruchia ravenelii is one of the most commonly collected species of the genus. The short, conic capsule neck is distinctive.



BRUCHIA • TREMATODON

8. *Bruchia flexuosa* (Schwägrichen) Müller Hal., Bot. Zeitung (Berlin) 5: 99. 1847



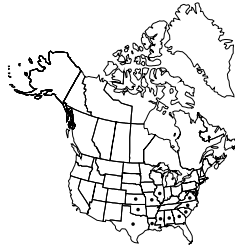
Phascum flexuosum Schwägrichen, Sp. Musc. Frond. Suppl. 2(1,1): 101. 1823; *Bruchia brevicollis* Lesquereux & James; *B. donnellii* Austin; *B. sullivanii* Austin

Distal leaves long-subulate beyond an ovate, obovate, or elliptic base, 0.9–3.1 mm, leaf base usually strongly differentiated in shape; distal laminal cells short- to long-rectangular. Sexual condition paroicous. Seta 0.5–3 mm. Capsule neck short, obovate. Spores spinose or occasionally spinose-reticulate. Calyptra smooth.

Capsules mature spring–summer. Most soil, fields, among grasses; low to moderate elevations; Ont., Que.; Ala., Ark., Calif., Conn., Del., D.C., Fla., Ga., Ill., Ind., Kans., Ky., La., Maine, Md., Mass., Minn., Mo., N.J., N.Y., N.C., Ohio, Okla., Pa., R.I., S.C., Tenn., Tex., Va., W.Va., Wis.; Europe.

As discussed in detail by A. E. Rushing (1986), *Bruchia flexuosa* is the most widely distributed and most morphologically variable species of the genus.

9. *Bruchia texana* Austin, Bull. Torrey Bot. Club 5: 21. 1874 [E]



Bruchia curviseta Lesquereux & James

Distal leaves short-subulate beyond an ovate, obovate, or broadly elliptic base, 0.9–2.1 mm, leaf base weakly to strongly differentiated in shape; distal laminal cells quadrate to short-rectangular. Sexual condition paroicous. Seta 0.7–2 mm. Capsule neck short, tapering, obovate. Spores reticulate. Calyptra smooth.

Capsules mature spring. Most soil; low to moderate elevations; Ala., Ga., Ill., Kans., La., Md., Miss., Mo., N.C., Okla., S.C., Tex., Va.

The capsule of *Bruchia texana* is clearly exserted beyond the perichaetial leaves, which reach only the base of the capsule.

10. *Bruchia drummondii* Hampe ex E. Britton, Bull. Torrey Bot. Club 21: 361. 1894 [E]



Distal leaves long-subulate beyond an ovate, obovate, or broadly elliptic base, 1–3.2 mm, leaf base strongly differentiated in shape; distal laminal cells long-rectangular. **Sexual condition** autoicous. **Seta** 0.2–0.7 mm. **Capsule** neck short, broadly obovate to truncate. **Spores**

The capsule of *Bruchia drummondii* is immersed in the perichaetial leaves or emergent, but not hidden by the leaf tips. This species is easily identified by the long-subulate leaves, relatively squat capsule, and reticulate spores.

reticulate. **Calyptra** smooth.

Capsules mature spring. Sandy soil; usually low elevations; Ala., Fla., Ga., La., Miss., N.C., S.C., Tex., Va.

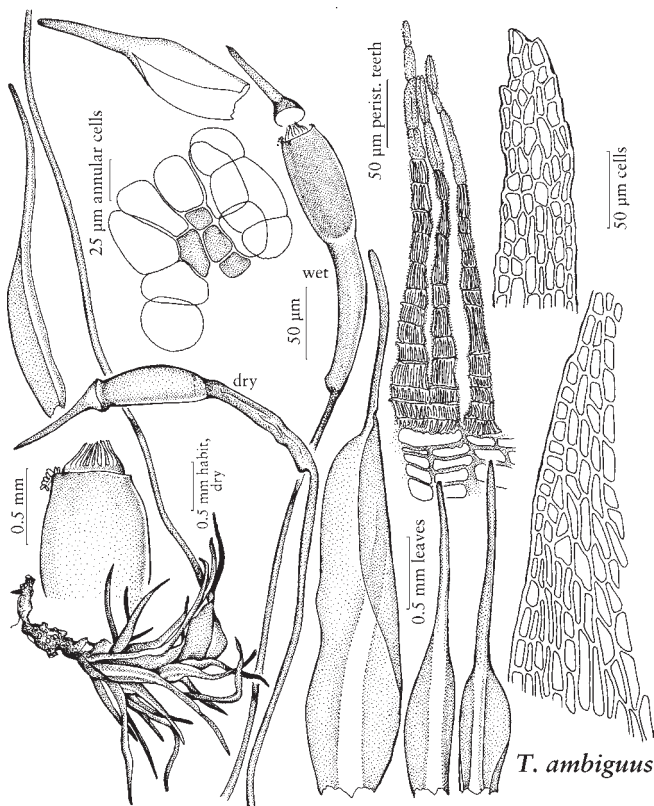
2. TREMATODON Michaux, Fl. Bor.-Amer. 2: 289. 1803 • [Greek *trema*, hole, and *odon*, tooth, alluding to perforate peristome teeth]

Leaves usually contorted when dry, lanceolate to broadly subulate from an ovate or oblong sheathing base, 1.5–4 mm, apex acute to narrowly obtuse, margins entire or with a few teeth apically; costa subpercurrent to excurrent as a subula; distal laminal cells subquadrate or short-rectangular. **Perichaetial leaves** distinctly larger than the cauline, convolute-sheathing. **Seta** elongate, 0.5–1.5 mm. **Capsule** long-exserted, cylindric with neck strongly differentiated, conic to long-cylindric; peristome absent or present, of 16 simple, forked or perforate teeth, vertically barred on external surface; operculum differentiated, obliquely long-rostrate. **Calyptra** cucullate. **Spores** medium-sized, 20–30 µm, papillose.

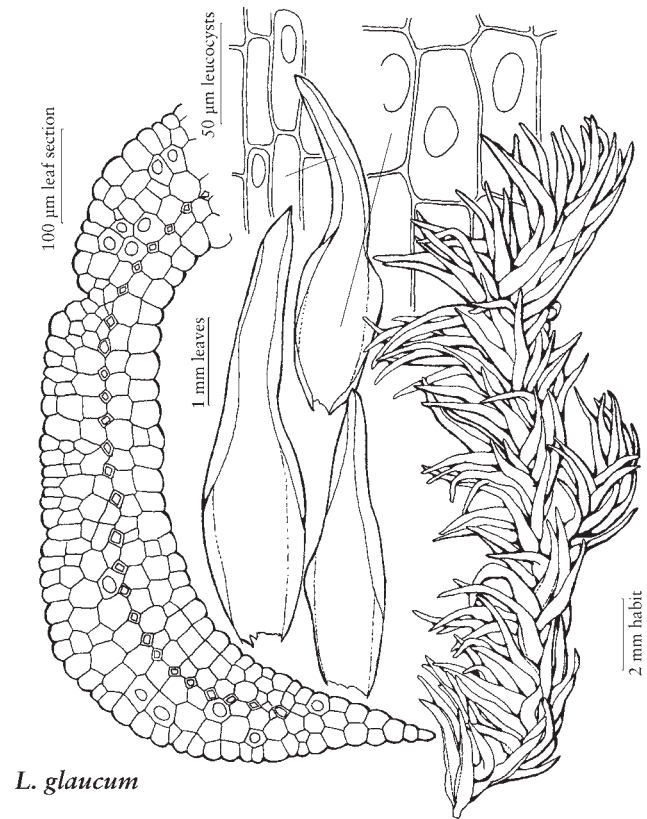
Species ca. 25 (6 in the flora): worldwide, mainly temperate areas.

Trematodon is clearly in need of revision, with more than 80 correct binomials extant but only about 25 species commonly accepted as well characterized. It clearly intergrades with *Bruchia*. Within the genus, only *T. ambiguus* and *T. longicollis* have strumose capsules.

- 1. Seta short, 1–4 mm; peristome teeth undivided, annulus simple.
- 2. Seta 1.5–2 mm; capsule neck short, barely as long as the urn, obovate; peristome fragile, often lost with dehiscence of operculum; leaves abruptly subulate, entire at apex 1. *Trematodon montanus*
- 2. Seta 1–4 mm; capsule neck slightly longer than the urn, tapering-conic; peristome persistent; leaves long-lanceolate, weakly denticulate apically 2. *Trematodon boasii*
- 1. Seta long, (4–)10–30 mm; peristome teeth split, or perforate basally or apically, occasionally entire, annulus usually compound, revoluble.
- 3. Capsule neck strumose.
- 4. Capsule neck about 2–3 times the length of urn 3. *Trematodon longicollis*
- 4. Capsule neck about the length of the urn 4. *Trematodon ambiguus*
- 3. Capsule neck not strumose.
- 5. Leaves broad, ovate-lanceolate; capsule somewhat curved, peristome teeth entire or perforate near apex 5. *Trematodon brevicollis*
- 5. Leaves narrow, mostly long-lanceolate; capsule straight, peristome teeth perforate medially and often split near apex 6. *Trematodon laetevirens*



TREMATODON • LEUCOBRYUM



1. *Trematodon montanus* Belland & Brassard,
Lindbergia 9: 1, figs. 1–9. 1983 [E]



Leaves abruptly subulate, entire at apex; costa excurrent. Seta short, 1.5–2 mm. Capsule erect, straight; neck short, barely as long as the urn, obovate; peristome teeth undivided, fragile, commonly lost with dehiscence of operculum; annulus simple, persistent.

Capsules mature summer. Soil; moderate elevations (700–800 m); Nfld. and Labr. (Nfld.)

2. *Trematodon boasii* W. B. Schofield, Bryologist 69:
204, figs. 1–14. 1966 [E]



Leaves long-lanceolate, weakly dentate at apex; costa excurrent. Seta short, 1–4 mm. Capsule erect, straight; neck short, slightly longer than the urn, tapering-conic; peristome teeth undivided, not fragile, commonly persistent; annulus simple, persistent.

Capsules mature probably summer. Late snowbed site; moderate elevations; B.C., Nfld. and Labr. (Nfld.).

3. *Trematodon longicollis* Michaux, Fl. Bor.-Amer. 2:
289. 1803 [F]



Trematodon ambiguus var.
longicollis (Michaux) Arnott

Leaves ovate-lanceolate to long-subulate from an ovate or obovate base, serrulate at apex; costa percurrent or ending before the apex. Seta long, 10–30 mm. Capsule inclined, curved; neck 2–3 times as long as urn when dry,

long-cylindric, strumose at base; peristome teeth 2-fid or irregularly perforate, not fragile, commonly persistent; annulus compound, revolvable.

Capsules mature spring–summer. Soil, sand; low to moderate elevations; Ala., Ark., Fla., Ga., Ky., La., Md., Miss., N.J., N.C., Ohio, Okla., Pa., S.C., Tex., Va.; Mexico; West Indies (Cuba, Puerto Rico); Central America; South America; Asia (China, Japan, Papua New Guinea); Pacific Islands (New Caledonia).

Trematodon longicollis is much like *T. ambiguus* but differs in the relative lengths of capsule urn and neck when dry, and is clearly more southern in distribution. The peristome may occasionally adhere to the operculum on dehiscence and the capsule may then falsely appear gymnostomous.

4. *Trematodon ambiguus* (Hedwig) Hornschuch, Flora 2: 88. 1819 [F]



Dicranum ambiguum Hedwig, Sp. Musc. Frond., 150. 1801;
Trematodon acicularis Kindberg

Leaves ovate-lanceolate to short-subulate from an ovate or obovate base, serrulate at apex; costa excurrent or at least filling the leaf apex. Seta long, 10–30 mm. Capsule inclined, curved;

neck as long as urn, long-cylindric, strumose at base; peristome teeth 2-fid or long-perforate, not fragile, commonly persistent; annulus compound, revoluble.

Capsules mature late summer–fall. Soil, humus; low to moderate, rarely high elevations; Greenland; B.C., N.B., Nfld. and Labr., N.S., Ont., P.E.I., Que.; Alaska, Maine, Md., Mass., Mich., Minn., N.H., N.Y., Pa., Vt., Va., Wis.; Central America; Europe; Asia (China, Japan).

The urn and capsule neck of *Trematodon ambiguus* and of *T. longicollis* are the same length in moist material, but the spore sac is relatively small in *T. longicollis*. The base of the urn collapses in dried specimens of the latter species, making its neck appear 2(–3) times as long as the urn.

5. *Trematodon brevicollis* Hornschuch, Flora 2: 88. 1819



Leaves ovate-lanceolate to short-subulate from an ovate or obovate base, entire at apex; costa percurrent or subpercurrent. Seta short, 4–6 mm. Capsule not or little inclined, slightly curved; neck equaling the urn in length, cylindric or obovate, not strumose but tapering instead; peristome

teeth entire or perforate near apex, not fragile, commonly persistent; annulus compound, revoluble.

Capsules mature late summer–fall. Soil, gravel, humus, crevices; generally alpine, high elevations; Greenland; Alaska; n Europe; c Asia (Kazakhstan, Mongolia).

I. A. Worley and Z. Iwatsuki (1970) reported both *Trematodon brevicollis* and *T. ambiguus* from Alaska.

6. *Trematodon laetevirens* Hakelier & J.-P. Frahm, Lindbergia 3: 223, fig. 1. 1976



Leaves long-lanceolate, occasionally ovate-lanceolate, entire at apex; costa percurrent or excurrent. Seta short, ca. 10 mm. Capsule not inclined, straight to weakly curved; neck about equal to the urn in length, cylindric or obovate, not strumose; peristome teeth perforate medially and often

split near apex, not fragile, commonly persistent; annulus not seen.

Capsules mature late summer–fall (Aug–Sep). Soil, humus, crevices; moderate elevations; Greenland; n Europe (Norway, Sweden).