

DICRANELLA

*Dicranella lindigiana* is a rare species only known in the flora area from Leon County. It has leaf margins that are narrowly recurved proximally and smooth, subglobose capsule with short, papillose peristome teeth that are entire or somewhat perforate along the middle.

2. *Dicranella palustris* (Dickson) E. F. Warburg, Trans. Brit. Bryol. Soc. 4(2): 247. 1962 [F]



*Bryum palustre* Dickson, Fasc. Pl. Crypt. Brit. 4: 11. 1801; *Dicranella squarrosa* (Schrader) Schimper

**Plants** relatively robust, 2–11 cm, in loose, light-green or yellow, ± shiny tufts. **Leaves** not crowded, 2.5–3 mm, abruptly narrowed to a narrow, squarrose limb from an erect, oblong or obovate base, subtubulose and generally ± twisted-crispate when dry, concave when moist, often cucullate at a rounded though often narrow apex, decurrent at base; margins erect, irregularly crenate at the extreme tip; costa subpercurrent, smooth abaxially; distal cells elongate, 4–9:1, the basal

cells longer, yellow at the insertion, often ± differentiated at extreme basal angles. **Sexual condition** dioicous. **Seta** 10–30 mm, dark red. **Capsule** 1–1.5 mm, curved-inclined, smooth; annulus present or absent; operculum stoutly conic-rostrate; peristome teeth ca. 500–650 µm, divided about 1/2 way distally, vertically papillose-striolate. **Spores** 16–25 µm, smooth or papillose.

Capsules mature spring. Wet soil in springy places, often at roadsides, sometimes temporarily submerged, probably an acidophile; low to medium elevations; Greenland; Alta., B.C., N.B., Nfld. and Labr. (Nfld.), N.S., Que., Yukon; Alaska, Calif., Maine, Mont., N.H., Ohio, Oreg., Wash.; Europe; Asia (Japan, Turkey).

*Dicranella palustris* is known by its squarrose-spreading, decurrent leaves ending in a narrow but rounded and crenulate tip. Lax, relatively large expressions of *D. schreberiana*, often given recognition as var. *robusta*, are smaller and have leaves with slender, acute tips, serrated margins, and broad cells. The New Hampshire and California reports were by A. J. Grout (1928–1940, vol. 1, as *D. squarrosa*) and D. H. Norris and J. R. Shevock (2004), respectively.

3. *Dicranella schreberiana* (Hedwig) Hilferty ex H. A. Crum & L. E. Anderson, Mosses E. N. Amer. 1: 169. 1981



*Dicranum schreberianum* Hedwig, Sp. Musc. Frond., 144, plate 33, figs. 6–10. 1801; *Anisothecium grevilleanum* (Bridel) Arnell & C. E. O. Jensen; *A. schreberianum* (Hedwig) Dixon; *A. schreberianum* var. *elatum* (Schimper) Wijk & Margadant; *Cynodontium canadense* Mitten; *Dichodontium*

*canadense* (Mitten) Lesquereux & James; *Dicranella canadense* (Mitten) Austin; *D. grevilleana* (Bridel) Schimper; *D. schreberi* (Swartz ex Anonymous) Schimper; *D. schreberi* var. *elata* Schimper; *D. schreberi* var. *grevilleana* (Bridel) Mönkemeyer; *D. schreberi* var. *occidentalis* Austin; *D. schreberi* var. *robusta* Braithwaite; *D. schreberiana* var. *robusta* (Braithwaite) H. A. Crum & L. E. Anderson; *Leptotrichum canadense* (Mitten) A. Jaeger

**Plants** 5–20 mm (or rarely more), yellowish. **Leaves** to 3 mm, abruptly narrowed from an oblong to obovate, sheathing base to a flexuose-spreading or squarrose limb, blunt or acute at a slender apex, entire or ± toothed above or only at the apex; costa percurrent or shortly excurrent, often somewhat toothed abaxially above; cells rectangular, 7–15 μm wide, 2–3:1. **Sexual condition** dioicous (also reportedly autoicous). **Seta** red, 7–12 (–25) mm. **Capsule** nodding, curved-asymmetric, usually somewhat strumose at base, smooth or faintly or rarely distinctly striate, 0.8–1 mm; annulus none; operculum curved-rostrate; peristome teeth 360–450 μm, forked less than 1/2 distally. **Spores** 13–18 μm, smooth or nearly so.

Capsules mature fall. Wet soil of banks, especially roadside ditches, or in crevices of cliffs; medium to high elevations; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.W.T., N.S., Ont., Que., Yukon; Alaska, Calif., Colo., Idaho, Maine, Mass., Mich., Mont., N.J., N.Y., Ohio, Oreg., Pa., S.Dak., Utah, Wash., Wis., Wyo.; n, c Europe; e Asia (Japan); Pacific Islands (New Zealand); Australia.

*Dicranella grevilleana* is scarcely distinct from *D. schreberiana*. In its best expression, its leaves are mostly entire, with cells only about 6 μm wide, and capsules faintly or rarely distinctly striate when dry and empty. *Dicranella schreberiana*, in a narrow sense, has leaves usually denticulate above, with broader cells, 8–14 μm wide, and smooth capsules. The differences, small and scarcely constant, can perhaps be related to relative environmental wetness. *Dicranella schreberiana* var. *robusta* also seems no more than an ecotype of particularly wet habitats. It is larger and has serrated leaf margins and particularly broad leaf cells. A large expression of the species greatly resembles *D. palustris*, which has leaves entire except for crenulations at the

extreme apex. Literature reports among the states cited were: New Jersey and Oregon (E. Lawton 1971), Massachusetts (F. J. Hilferty 1960), and Utah (S. Flowers 1973).

4. *Dicranella varia* (Hedwig) Schimper, Coroll. Bryol. Eur., 13. 1856



*Dicranum varium* Hedwig, Sp. Musc. Frond., 133. 1801; *Anisothecium rubrum* Lindberg; *A. varium* (Hedwig) Mitten; *Dicranella howei* Renaud & Cardot; *D. langloisii* Renaud & Cardot; *D. rubra* Lindberg

**Plants** 4–15 mm, dirty to light green or yellowish. **Leaves** erect-spreading or ± falcate-secund, to 2 mm, gradually narrowed from a lanceolate base to a linear-lanceolate, ± keeled limb, blunt or acute at a narrow tip; margins irregularly recurved above the basal portion of the leaf, entire except at the extreme apex; costa percurrent; distal cells oblong-linear, ca. 6–9:1. **Sexual condition** dioicous. **Seta** red or pale, reddish yellow, 5–8 (–16) mm. **Capsule** 0.7–1 mm, shortly ovoid, erect or more often inclined to horizontal, curved-asymmetric, smooth, not strumose at base, contracted below the mouth; annulus none; operculum 0.5–0.7 mm, stoutly rostrate; peristome teeth 330–410 μm, divided 1/3 of its length distally. **Spores** 14–20 μm, smooth or indistinctly roughened.

Capsules mature spring. Wet, calcareous soil, especially clay, in open, disturbed places, such as roadside ditches; low to high elevations; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que., Yukon; Ala., Alaska, Ariz., Calif., Colo., Conn., Del., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Mass., Mich., Minn., Miss., Mo., Mont., Nebr., N.H., N.J., N.Y., N.C., N.Dak., Ohio, Okla., Oreg., Pa., S.C., Tenn., Tex., Vt., Va., Wash., W.Va.; Mexico; West Indies (Haiti); Central America (Honduras); Europe; Asia; n Africa; Atlantic Islands (Azores, Madeira, Canary Islands)

The nodding, short, curved-asymmetric, smooth capsules of *Dicranella varia* have a disproportionately large peristome, and the leaf margins are narrowly recurved proximally or scarcely so. *Dicranella howei* has been segregated in the past (A. C. Crundwell and E. Nyholm 1977) by its plane leaf margins, costa filling the subula (which is accordingly described as 2-stratose beyond mid leaf), and side walls of exothelial cells no thicker than end walls. *Dicranella howei* intergrades with the species throughout its range from Iran to Great Britain and on the west coast of North America. Crundwell and Nyholm commented on *D. howei* and *D. varia* that there are a small portion of intermediate forms that they have seen from several places in Europe, as well as British Columbia and California. Localities reported above for

the United States include literature reports for Alaska (I. A. Worley and Z. Iwatsuki 1970), Alabama (J. C. Wilkes 1965), and Montana (E. Lawton 1971). Keying to *Dicranella varia* is *D. staphylina*, reported for the flora area by H. L. K. Whitehouse (2001), which differs in lanceolate distal leaves, medial laminal cells 10–14  $\mu\text{m}$  wide, perichaetial leaves long-acuminate from a sheathing base, and capsules erect.

5. *Dicranella pacifica* W. B. Schofield, Bryologist 73: 703. 1970 [E] [F]



**Plants** 2.5–4 cm, yellowish, brownish, or dark green. **Leaves** erect-spreading and flexuose-cripsed when dry, 2.5–4 mm, gradually narrowed from an ovate base to a long, slender, subtubulose subula; margins distinctly recurved below, erect or incurved above, serrulate at or

near the slender apex; costa percurrent, filling most of the subula; distal cells subquadrate, 1–2:1 (ca.  $17 \times 10 \mu\text{m}$ ), 2-stratose at the margins. **Sexual condition** dioicous. **Seta** red, 5–8 mm. **Capsule** inclined to horizontal, 0.8 mm, obovoid-oblong, curved, not strumose, smooth; annulus none; operculum-conic; peristome teeth ca. 425  $\mu\text{m}$ , divided  $\frac{1}{2}$  length distally. **Spores** 15–17  $\mu\text{m}$ , smooth.

Capsules mature fall and winter. Wet, silty soil of roadside ditch banks and soil of cliff crevices; low to medium elevations; B.C.; Calif., Wash.

Distinctive features of *Dicranella pacifica* include slender, flexuose-cripsed, subtubulose leaves with margins recurved below but 2-stratose and incurved above, high-conic opercula, and annulus absent.

6. *Dicranella rufescens* (Withering) Schimper, Coroll. Bryol. Eur., 13. 1856



*Bryum rufescens* Withering, Syst. Arr. Brit. Pl. ed. 4, 3: 801. 1801; *Dicranella hutchinsonii* Krajina

**Plants** to 23 mm, dull brown to red-brown. **Leaves** erect-spreading to subsecund, narrowly lanceolate, gradually acuminate, acute,  $\pm$  keeled above; margins plane, sinuate-dentate distal to the

shoulders, serrulate at apex; costa subpercurrent or, in perichaetial leaves, shortly excurrent; distal cells long-rectangular, 5–10:1, usually slightly inflated in a marginal row. **Seta** to 7 mm, red-brown. **Capsule** 0.3–0.8 mm, erect and symmetric or nearly so, smooth (or rarely  $\pm$  furrowed when old and empty); annulus none; operculum 0.3–0.5 mm, conic, short-rostrate; peristome teeth ca. 300  $\mu\text{m}$ , divided  $\frac{1}{2}$  length distally. **Spores** 10–18  $\mu\text{m}$ , nearly smooth.

Capsules mature spring and summer. Wet soil on banks of roads and streams; low to medium elevations; B.C., N.B., N.S., P.E.I., Que.; Ala., Alaska, Calif., Conn., Del., Ga., Idaho, Ill., Iowa, Ky., Md., Mass., Mo., N.H., N.J., N.Y., N.C., Ohio, Okla., Oreg., Pa., Tenn., Vt., Va., Wash., W.Va.; Europe (England, Germany, Russia, Sweden); e Asia (Japan).

The best characters for identifying *Dicranella rufescens* are the smooth, erect capsule and sinuate-dentate leaf margins with clear, somewhat inflated marginal cells. The distribution of the species above includes reports by H. A. Crum and L. E. Anderson (1981), R. K. Lampton (1970), B. D. Mahler and W. F. Mahler (1980), J. A. McCleary and P. L. Redfearn Jr. (1979), D. H. Norris and J. R. Shevock (unpubl.), Redfearn (2001), J. A. Snider and B. K. Andreas (1996), Snider et al. (unpubl.), J. C. Wilkes (1965), and I. A. Worley and Z. Iwatsuki (1970). Specimens under this name from Costa Rica and Honduras are misidentified.

7. *Dicranella hilariana* (Montagne) Mitten, J. Linn. Soc., Bot. 12: 31. 1869



*Dicranum hilarianum* Montagne, Ann. Sci. Nat., Bot., sér. 2, 12: 52, plate 1, fig. 2. 1839; *Dicranella herminieri* Beschereille; *D. laxiretis* Renaud & Cardot; *D. leptotrichoides* Renaud & Cardot; *Microdus debilis* (T. Drummond) Paris; *M. laxiretis* (Renaud & Cardot) Paris; *M. leptotrichoides*

(Renaud & Cardot) Paris

**Plants** 3–8 mm, yellow-brown to dull green. **Leaves** erect-flexuose to subsecund, 1–2 mm, narrowly lanceolate, gradually tapered to a narrow, blunt or rounded, usually serrulate tip; margins  $\pm$  recurved, often strongly so; costa subpercurrent, sometimes  $\pm$  rough abaxially above, about  $\frac{1}{4}$  the leaf base; cells subquadrate to short-rectangular. **Sexual condition** dioicous. **Seta** yellow becoming brown or reddish with age, 5–7 mm. **Capsule** erect and symmetric, oblong-ovoid to subcylindric, 0.8–1 mm, smooth, usually  $\pm$  contracted below the mouth when dry and empty; annulus compound; operculum long-rostrate, inclined, about as long as the urn; peristome teeth 250–290  $\mu\text{m}$ , divided more than  $\frac{1}{2}$  length distally. **Spores** 16–20  $\mu\text{m}$ , finely papillose.

Capsules mature late summer. Moist clay on ditch banks at low elevations; Ala., Fla., Ga., La., Miss., S.C.; Mexico; West Indies; Central America (Belize, Costa Rica, Guatemala, Honduras, Panama), South America (Brazil, Peru).

Distinctive features of *Dicranella hilariana* include the yellowish seta, erect, smooth capsule, short leaf cells, and leaf tips that are often blunt and crenulate. The species is subject to considerable variation in length and thickness

of cell walls, which vary from subquadrate, this often only at the tips of leaves, to long-rectangular or, even linear owing to thickened side walls. The setae are yellow, but with age they take on a dull brownish or even a reddish hue. Various names have been used for plants with short laminal cells, those with somewhat longer, thin-walled cells, and those with cells linear because of thick and often golden walls. As suggested by the large number of synonyms, differences are at best trivial and completely intergradient. The South Carolina report was by H. A. Crum and L. E. Anderson (1981).

**8. *Dicranella cerviculata*** (Hedwig) Schimper, Coroll. Bryol. Eur., 13. 1856



*Dicranum cerviculatum* Hedwig, Sp. Musc. Frond., 149. 1801; *Bartleya ohioensis* H. Robinson; *Dicranella cerviculata* var. *americana* Grout; *D. cerviculata* var. *pusilla* (Hedwig) Schimper; *D. ohioensis* (H. Robinson) H. A. Crum; *D. polaris* Kindberg; *D. pusilla* (Hedwig) E. Britton; *Dicranum pusillum* Hedwig

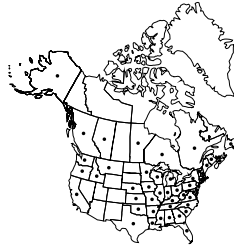
**Plants** to 6 mm (or rarely, when sterile, to 30 mm), in dull, yellow-brown tufts. **Leaves** 2.5–3 mm, erect-spreading and flexuose or secund, linear-lanceolate, gradually subulate, slenderly acute or ± blunt; margins erect, entire or slightly serrulate near the apex; costa long-excurrent, occupying about 1/2 the leaf base; distal cells long-rectangular, 5–10:1. **Sexual condition** dioicous. **Seta** 5–6(–12) mm, yellow, becoming brownish with age. **Capsule** 0.7–1 mm, nodding and curved-asymmetric, short-oval, strumose, furrowed when dry and empty; annulus a single row of small, persistent cells; operculum slenderly long-rostrate, curved; peristome teeth 270–350 μm, divided 1/2 length distally or more. **Spores** 16–21 μm, smooth to indistinctly roughened.

Capsules mature summer. Disturbed sand, clay, or peaty soil, often on roadbanks; low to medium elevations; Alta., B.C., N.B., Nfld. and Labr. (Nfld.), N.W.T., N.S., Ont., P.E.I., Que., Yukon; Alaska, Ky., Maine, Md., Mass., Mich., N.H., N.J., N.Y., Ohio, W.Va., Wisc.; n, c Europe; Asia (Japan, e Russia).

The leaves of *Dicranella cerviculata* are not wide-spreading from a clasping base, and the perichaetial leaves are scarcely differentiated from stem leaves. The costa occupies about 1/2 of the leaf base. The nodding, asymmetric, strumose capsule becomes variously striate or furrowed when dry and empty. *Bartleya ohioensis*, known solely from sterile material from West Virginia and Ohio, differs from *D. cerviculata* only in having a

somewhat better development of stereids in the costa. The report from Maryland (as *B. ohioensis*) was by H. Robinson and C. F. Reed (1987) and from Wisconsin by F. D. Bowers and S. K. Freckmann (1979). In Northwest Territories it is known only from Great Bear Lake and the Tuktoyaktuk Peninsula.

**9. *Dicranella heteromalla*** (Hedwig) Schimper, Coroll. Bryol. Eur., 13. 1856

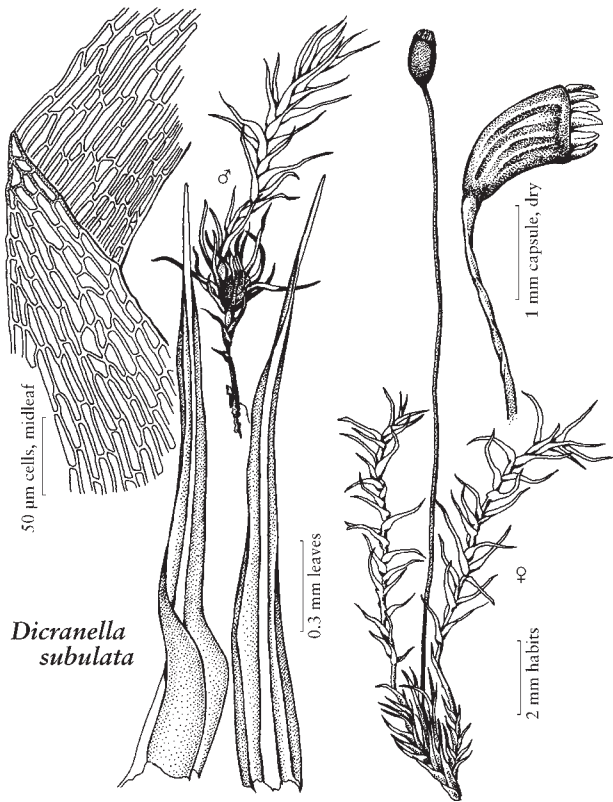


*Dicranum heteromallum* Hedwig, Sp. Musc. Frond., 128. 1801; *Campylopus henrici* Renaud & Cardot; *Dicranella fitzgeraldii* Renaud & Cardot; *D. heteromalla* var. *latinervis* Cardot & Thériot; *D. heteromalla* var. *orthocarpa* (Hedwig) A. Jaeger & Sauerbeck; *Dicranum orthocarpum* Hedwig

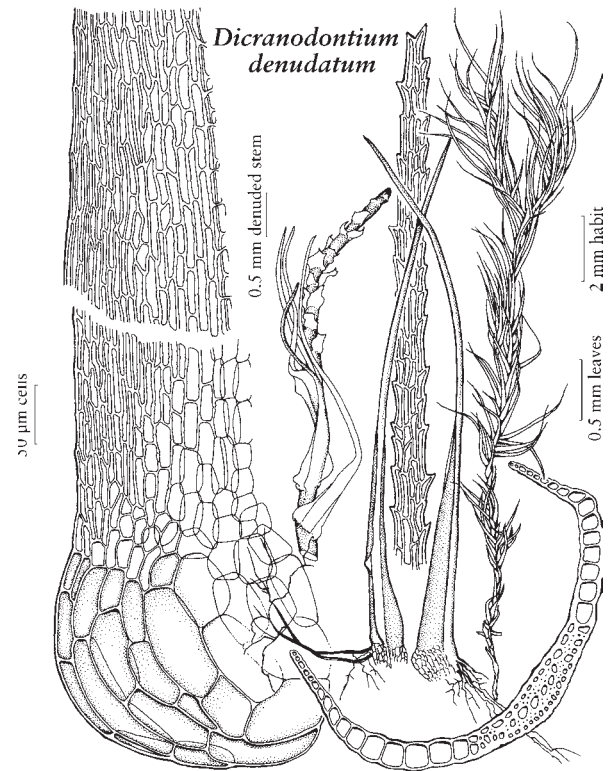
**Plants** to 10, rarely 40 mm, in rather shiny, yellow to dark green tufts. **Leaves** erect to falcate-secund, 2–3 mm, gradually narrowed from a lanceolate base to a subula largely occupied by the costa; margins erect, serrulate in the distal half of the limb; costa excurrent; cells in 1–3 rows above the leaf middle, rather short-rectangular, 11–14 × 4–7 μm. **Sexual condition** dioicous. **Seta** 5–15 mm, yellowish. **Capsule** 1–1.5 mm, suberect or sometimes inclined to horizontal, cylindrical, often curved, asymmetric, tapered at the neck, usually ± obliquely furrowed and constricted on 1 side below an oblique mouth; annulus consisting of 1 row of small cells, persistent; operculum long-rostrate; peristome teeth 400–500 μm, divided 1/2 length distally. **Spores** 14–18 μm, faintly roughened.

Capsules mature spring and summer. Soil of shaded banks, especially along woodland trails, and soil covering upturned roots; low to high altitudes; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que.; Ala., Alaska, Ark., Calif., Conn., Del., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Mont., Nebr., N.H., N.J., N.Y., N.C., Ohio, Okla., Oreg., Pa., R.I., S.C., Tenn., Tex., Vt., Va., Wash., W.Va., Wis.; Central America (Costa Rica, Honduras, Panama); South America (Colombia); Europe; Asia (China, e Himalayas, Japan); Atlantic Islands (Canary Islands, Madeira); n, e Africa.

*Dicranella heteromalla* is a common species recognized by suberect, obliquely furrowed capsules tapered toward the base and oblique at the mouth. The leaf margins are distinctly toothed above the middle. Reports for Oklahoma are by B. D. Mahler and W. F. Mahler (1980) and from Texas by E. Whitehouse and F. McAllister (1954).



DICRANELLA • DICRANODONTIUM



10. *Dicranella subulata* (Hedwig) Schimper, Coroll.  
Bryol. Eur., 13. 1856 [F]



*Dicranum subulatum* Hedwig, Sp. Musc. Frond., 128, figs. 1–5. 1801; *Dicranella curvata* (Hedwig) Schimper; *D. secunda* Lindberg; *D. stikinensis* Grout, as *stickinensis*; *D. subulata* var. *curvata* (Hedwig) Rabenhorst

Plants 3–10 mm, silky, yellowish.

Leaves loosely erect to falcate-secund, to 2 mm, lanceolate, gradually subulate; margins erect, sometimes finely denticulate at the extreme apex and obscurely denticulate near junction of base and blade; costa long-excurrent; lamina disappearing in the distal  $\frac{1}{3}$ – $\frac{1}{2}$  of the limb, with cells long-rectangular,  $30\text{--}40 \times 4\text{--}5 \mu\text{m}$  (7–8:1). Sexual condition dioicous. Perichaetial leaves to 3 mm, flexuose-spreading to squarrose, abruptly subulate from an oblong-sheathing base, finely erose or denticulate at the shoulders. Seta 9–13 mm, reddish, becoming dark with age. Capsule 0.7–1 mm, inclined or nodding, asymmetric, striate, not strumose; annulus compound; operculum ca. 1 mm, slenderly curved-rostrate from a conic base; peristome teeth 400  $\mu\text{m}$ , divided  $\frac{1}{2}$  way length distally. Spores 16–18  $\mu\text{m}$ , minutely roughened.

Capsules mature spring and summer. Damp soil on banks, often in rocky places at low to medium elevations; Greenland; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.S., P.E.I., Que., Yukon; Alaska, Calif., Colo., Idaho, Maine, Mass., Mich., Mont., N.H., N.Y., Wash., Wisc., Wyo.; n, c Europe; e Asia (Japan).

The leaves of *Dicranella subulata* have exceedingly slender subulae with a long-excurrent costa and very long cells. The perichaetial leaves are abruptly narrowed from a sheathing base to a spreading subula. The setae are red and the inclined capsules striate-furrowed but not strumose. *Dicranella stikinensis*, known from a single collection, is difficult to evaluate, as the sporophytes are not quite mature. The setae are reddish yellow, and the capsules seem erect and smooth, although a few of them are somewhat inclined and show a hint of ribbing that may become more pronounced with age. The peristome teeth are clearly striate at the base of forks but irregularly papillose basally. The most interior perichaetial leaves are somewhat shorter with shorter subulae than the exterior. However, in spite of apparent differences, it seems that the species can be dismissed as a juvenile expression of *D. subulata*. On describing *D. stikinensis*, Grout also saw some similarity to *D. subulata*, which has red setae, peristome teeth pitted-striolate basally, long, spreading leaf subulae, and perichaetial leaves not

differing in size and distinctly spreading from a clasping base.

Records for this species in the United States include reports by I. A. Worley and Z. Iwatsuki (1970), A. J. Grout (1928–1940, vol. 1), E. H. Ketchledge (1980), and F. D. Bowers and S. K. Freckmann (1979). *Dicranella curvata* var. *missourica* Cardot & Thériot seems to be far out of range and is unlikely to be related to *D. subulata*. Also, *D. subulata* is not recorded in the checklist of P. L. Redfearn Jr. (2001).

**11. *Dicranella crispa*** (Hedwig) Schimper, Coroll. Bryol. Eur., 13. 1856



*Dicranum crispum* Hedwig, Sp. Musc. Frond., 132. 1801;  
*Anisothecium crispum* (Hedwig) Lindberg; *A. vaginale* (Withering) Loeske; *Bryum vaginale* Dickson

**Plants** to about 5 mm, yellow-green. **Leaves** 0.6–2 mm, the distal leaves squarrose and linear-subulate from a sheathing base,

the proximal spreading-flexuose and lanceolate; margins

plane, usually serrulate at the apex; costa percurrent (nearly filling the slender apex); distal cells 2-stratose, long and narrow (6–8:1). **Sexual condition** dioicous (also reported to be autoicous). **Perichaetial leaves** 2–3 mm, plainly squarrose. **Seta** red, 5–18 mm. **Capsule** erect or nearly so, tapered to the base and ribbed when dry, 0.7–0.9 mm; annulus of 2 rows of cells, deciduous or persistent; operculum rostrate, sometimes curved; peristome teeth 300–350 µm, divided 1/2 of the length distally. **Spores** 17–20 µm, papillose to smooth.

Capsules mature spring and summer. Moist, often sandy or silty soil; medium to high elevations; Greenland; Alta., B.C., Man., Nfld. and Labr. (Nfld.), N.W.T., Nunavut, Ont., Que., Yukon; Alaska, Calif., Colo., Idaho, Mont., Oreg., Wash., Wyo.; n, c Europe.

The leaves of *Dicranella crispa*, particularly the distal, are wide-spreading from a clasping base, while the slender capsules are erect, tapered to the base, and distinctly striate. According to R. S. Williams (1913), the male inflorescence may be on a separate branch or separate plant. The distribution above includes reports by E. Lawton (1971) and D. H. Norris and J. R. Shevock (2004).

**9. DICRANODONTIUM** Bruch & Schimper, Bryol. Europ. 1: 157. 1847 • [Greek *dicranon*, pitchfork, and *odon*, tooth, alluding to forked peristome teeth]

Robert R. Ireland Jr.

**Plants** medium-sized to large, in loose to dense tufts, yellowish brown to dark green. **Stems** erect, simple or sparingly branched; rhizoids smooth, scattered along stems or present on branch bases. **Leaves** gradually or abruptly narrowed, tubulose to subtubulose proximally, weakly concave to subtubulose distally, lamina 1-stratose, acute, erect-flexuose to falcate-secund, occasionally somewhat spreading, sometimes somewhat auriculate at base; margins incurved, serrulate to nearly entire near apex; leaf apex setaceous; costa single, excurrent, broad, filling 1/5–1/2 of leaf base and most of subula, sometimes indistinct, rough distally on abaxial surface, rhizoids at base occasionally on adaxial and commonly on abaxial surfaces, with a median row of guide cells, two stereid bands, epidermal cells differentiated on both surfaces; cells incrassate nearly throughout, distal rectangular to linear, smooth or prorate on abaxial surface, becoming broader toward base, often pitted, alar cells thin-walled, inflated, hyaline or sometimes reddish. **Specialized asexual reproduction** by deciduous leaves. **Sexual condition** dioicous. **Perigonial leaves** broad at base, more abruptly narrowed to a shorter setaceous apex than stem leaves, paraphyses filamentous, antheridia few. **Perichaetial leaves** often with broader and longer bases more abruptly narrowed distally than stem leaves, paraphyses absent, archegonia few. **Seta** solitary, smooth, elongate, curved to cygneous, erect-sinuuous when dry. **Capsule** erect and symmetric, oblong-cylindric, smooth; annulus and stomata absent; operculum long-rostrate; peristome single, teeth 16, inserted below mouth, divided nearly to base, vertically striolate nearly to tips. **Calyptra** cucullate, smooth, entire at base, naked. **Spores** spherical, smooth.

Species 7 (3 in the flora): North America, Mexico, Central America, South America, Europe, Asia, Africa, Australia.

*Dicranodontium* can be confused with *Campylopus* but differs primarily in two features: (1) the rhizoids, in addition to being on both surfaces of the costa in the two genera, are scattered along the stems or present at branch bases in *Dicranodontium* while they are only at the branch bases and branch primordia in *Campylopus*; and (2) *Campylopus* usually has ridges or low lamellae on the abaxial surface of the costa near the leaf middle while the costa in the mid-leaf region of *Dicranodontium* is smooth. *Dicranodontium* rarely produces perichaetia and perigonia so sporophytes are extremely rare in North America.

SELECTED REFERENCES Frahm, J.-P. 1997. A taxonomic revision of *Dicranodontium* (Musci). *Ann. Bot. Fenn.* 34: 179–204.  
Ireland, R. R. 1989. The moss genus *Dicranodontium* (Dicranaceae) in Canada. *Canad. J. Bot.* 67: 640–649.

1. Leaf bases spreading from stem at ca. 45° or sometimes more when wet, sharply serrulate to serrate at shoulders . . . . . 2. *Dicranodontium asperulum*
1. Leaf bases appressed to spreading from stem at about 30° when wet, entire at shoulders.
  2. Leaves long, often 8 mm or more, not auriculate; costa distinct . . . . . 1. *Dicranodontium uncinatum*
  2. Leaves short, seldom reaching 8 mm, auriculate; costa indistinct . . . . . 3. *Dicranodontium denudatum*

1. ***Dicranodontium uncinatum*** (Harvey) A. Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1877–1878: 380. 1880



*Thysanomitrium uncinatum*  
Harvey, *Icon. Pl.* 1: plate 22, fig. 5. 1836

**Plants** brown proximally, yellowish green or yellowish brown to dark green distally, glossy, in loose to dense tufts. **Stems** 2–8(–14) cm, radiculose proximally with reddish brown

rhizoids. **Leaves** falcate-secund, especially at stem apices, sometimes erect and flexuose, spreading at ca. 30° when wet, 5–10 mm, occasionally deciduous, somewhat abruptly narrowed from an ovate to oblong base into a setaceous subula, subtubulose proximally, channeled distally, margins entire proximally, serrate to serrulate near apex, apex acute; costa distinct, occupying ca. 1/5–1/3 of leaf base; cells thick-walled and pitted only in leaf base, distal cells linear, 24–56 × 5–9 μm, basal cells broadly rectangular, hyaline, ca. 16 μm wide, alar cells not forming auricles, thin-walled, hyaline. **Seta** 8–11 mm, erect-sinuose to cygneous. **Capsule** 1–1.8 mm; operculum straight, ca. 1 mm. **Spores** 16–17 μm.

Dry or damp, acidic cliffs, primarily cliff ledges, sometimes on overturned tree roots and rotten logs in forests; low to moderate elevations (0–900 m); B.C.; Alaska; Europe; Asia.

Sporophytes are not known or reported for North American plants of *Dicranodontium uncinatum*. H. C. Gangulee (1971) reported them for eastern India where the plants fruited in October with capsules containing spores 16–17 μm. The largest North American species of the genus, *D. uncinatum* has stems usually 2–8 cm,

sometimes up to 14 cm. It is easily recognized by its hook-shaped leaves. It is often confused with *D. denudatum*, which has shorter leaves, mostly less than 8 mm, auriculate, with an indistinct costa and alar cells that are narrowly rectangular and usually reddish. In *D. uncinatum* the cells distal to the alar region and adjacent to the costa are broadly rectangular and hyaline.

2. ***Dicranodontium asperulum*** (Mitten) Brotherus in H. G. A. Engler and K. Prantl, *Nat. Pflanzenfam.* 208[1,3]: 336. 1901



*Dicranum asperulum* Mitten, *J. Linn. Soc., Bot., suppl.* 1: 22. 1859;  
*Campylopus virginicus* (Austin)  
Lesquereux & James; *Dicranum virginicum* Austin

**Plants** brown proximally, yellowish to dark green distally, dull to glossy, in loose tufts. **Stems** 1–6(–8) cm, radiculose proximally

with whitish to reddish brown rhizoids. **Leaves** erect-patent, flexuose, spreading at ca. 45° or more when wet, occasionally falcate-secund at stem apices, 3–8 mm, often deciduous, abruptly narrowed from an ovate base into a setaceous subula, subtubulose proximally, channeled distally, margins serrulate to serrate at shoulders, usually strongly serrate distally, apex acute; costa distinct, occupying ca. 1/3 of leaf base; cells not thick-walled or pitted, distal cells linear, 24–56 × 5–6 μm, basal cells broadly rectangular, hyaline, ca. 9 μm wide, alar cells sometimes forming indistinct auricles, hyaline. **Seta** 15–20 mm, erect-sinuose. **Capsule** 1.5–2 mm; operculum not seen, reportedly shorter than the capsule. **Spores** 9–14 μm.

Damp, shaded, acidic cliff faces and cliff shelves, occasionally on earth of overturned tree roots; 0–1200 m; B.C.; Alaska, Ga., Ky., N.C., Tenn., Va., W.Va.; Europe; Asia.

Sporophytes of *Dicranodontium asperulum* were seen in North America only in one British Columbia specimen. The wide-spreading leaves, standing out from the stem at 45° or more when wet, and the serrate to serrulate shoulders of the leaf bases make *D. asperulum* the most distinctive North American species of the genus. The leaves of the other species are appressed or weakly spreading when wet, with entire bases.

3. *Dicranodontium denudatum* (Bridel) E. Britton in N. L. Britton et al., N. Amer. Fl. 15: 151. 1913 [F]



*Dicranum denudatum* Bridel, Muscol. Recent., suppl. 1: 184. 1806; *Dicranodontium millsbaughii* E. Britton; *D. virginicum* E. Britton

**Plants** yellowish brown to dark green, glossy, in loose to dense tufts. **Stems** 2–4(–8) cm, radiculose proximally with reddish brown rhizoids. **Leaves** erect-

flexuose to falcate-secund, spreading at ca. 30°, 3–8 mm, often deciduous, setaceous, auriculate at base, subtubulose to tubulose throughout, margins entire proximally, serrulate near apex, apex acute; costa indistinct, occupying ca. 1/3–1/2 of leaf base; cells not thick-walled or pitted, distal cells rectangular to linear, 24–47 × ca. 7 μm, basal cells 9–14 μm wide, alar cells usually forming auricles, hyaline or reddish. **Seta** 8–12 mm, curved or cygneous. **Capsule** 1.6–2 mm, oblong-cylindric, erect; opercula about as long as capsule. **Spores** 10–15 μm.

Moist, shaded, acidic, rarely sandstone, outcrops and cliffs, damp humus, rotten logs and stumps, or on peat and in wet depressions in bogs; 0–2040 m; B.C., Nfld. and Labr. (Nfld.), Que.; Ala., Alaska, Fla., Ga., Ky., Maine, N.H., N.Y., N.C., Ohio, Pa., Tenn., Vt., Va., Wash., W.Va., Wis.; Mexico; Europe; Asia.

Sporophytes of *Dicranodontium denudatum* are rare in North America, and the season when capsules are mature is unknown. This species is more widespread in the flora area than the other two. It is recognized by the setaceous, erect-flexuose to falcate-secund leaves with auriculate bases with inflated, hyaline or sometimes reddish alar cells. The leaves are commonly deciduous leaving the stems often partially denuded, and revealing scars and whitish remnants of leaf bases that are very characteristic of the species. The cells above the alar region and adjacent to the costa are narrowly rectangular, hyaline or sometimes reddish.

At first glance this species is easily confused with sterile plants of species in other genera; e.g., *Dicranella heteromalla*, *Paraleucobryum longifolium*, *Ditrichum crispatisimum*, *D. flexicaule*, *D. pallidum*, *Dicranum fulvum*, and *Campylopus* spp. The distinctive features noted above, however, will aid in recognizing *D. denudatum*. In addition, it differs from all of the above except *Campylopus* spp. by the usual occurrence of rhizoids on the abaxial surface of the costa. It is easily distinguished from *Campylopus* by its costa smooth in the mid leaf region compared to the costa of the latter having ridges or lamellae.

**Species added in edit:**

*Dicranodontium subporodictyon* Brotherus, Symb. Sin. 4, fig. 20. 1929

Known in North America only from cliff faces, outcrops, or boulders near waterfalls, or rarely damp boggy places at low elevations in western British Columbia, this species has recently been transferred to *Campylopus* by B. H. Allen & Ireland. The costa of *Dicranodontium subporodictyon* has ridges or small lamellae on the abaxial surface, as well as a number of other morphological features characteristic of *Campylopus*. It differs from other species of *Dicranodontium* in the flora area by leaves gradually tapering from base to subula, and laminal cells elongate, incrassate, and pitted through most of the lamina.

10. DICRANOWEISIA Lindberg ex Milde, Bryol. Siles., 48. 1869 • [Genera *Dicranum* and *Weissia*, alluding to relationship with *Dicranum* and fancied resemblance to *Weissia*]

Wilfred B. Schofield

**Plants** densely tufted, light to dark green, dull. **Stems** 0.5–3 cm, erect, forked, with central strand, with rhizoids confined to base of stems and firmly affixed to substratum. **Leaves** lanceolate, flexuose, crisped or curled when dry, 1–3.5 mm; costa single, subpercurrent, narrow; margins plane to incurved or recurved, 1- or 2-stratose; proximal cells elongate, 15–30 μm, smooth; alar cells with a few enlarged cells on margins, often colored or undifferentiated; distal cells subquadrate 7–10 μm wide, smooth or with longitudinal cuticular ridges. **Specialized**



**asexual reproduction** sometimes present, multicellular, on abaxial surface, elliptic to short-linear, of 4–10 cells, 1-seriate or with occasional 2-seriate portions, smooth. **Sexual condition** autoicous; perigonal leaves abruptly narrowed to a long or short subula; perichaetial leaves variable, resembling vegetative leaves or broadly obtuse to acute or short-acuminate. **Seta** solitary, yellowish, 3–15 mm, smooth. **Capsule** light to dark brown when mature, elliptic to short-cylindric, 0.5–2 mm, smooth to longitudinally wrinkled when dry; annulus present, of 1–3 rows of cells, deciduous or absent; operculum rostrate, beak straight or oblique; peristome single, 16 teeth inserted below darkened cells of mouth, teeth entire to divided at apices, red-brown with hyaline tips. **Calyptra** cucullate, smooth, covering  $\frac{1}{3}$ – $\frac{1}{2}$  of capsule, entire at base. **Spores** spherical, 15–20  $\mu\text{m}$ , weakly papillose.

Species ca. 20 (2 in the flora): North America, South America, Europe, Asia, Africa, Pacific Islands (Hawaii, New Zealand), Australia, Antarctica.

Species of *Dicranoweisia* are usually epiphytic, epixylic, epilithic, or terrestrial and are found widespread throughout the world.

SELECTED REFERENCE Flowers, S. 1956. *Dicranoweisia crispula* and *D. cirrhata* [sic]. Bryologist 59: 239–244.

1. Leaf margins widely recurved in many leaves; 1-stratose excepting distal margins, cells smooth; alar cells not differentiated . . . . . 1. *Dicranoweisia cirrhata*
1. Leaf margins plane, erect or incurved to weakly and narrowly recurved; 1-stratose proximally and 2-stratose distally, distal cells usually longitudinally striolate (appearing papillose in transverse section); alar cells sometimes noticeably larger than adjacent cells and often colored . . . . . 2. *Dicranoweisia crispula*

1. *Dicranoweisia cirrhata* (Hedwig) Lindberg in C. Milde, Bryol. Siles., 49. 1869 [F]



*Weissia cirrhata* Hedwig, Sp. Musc. Frond., 69. 1801

Leaves crisped and incurved when dry, margins plane to narrowly incurved or recurved at middle, 1-stratose except on margins in distal half, cells smooth; alar cells undifferentiated. **Specialized asexual reproduction** frequent,

multicellular gemmae frequent on abaxial surface of leaves. **Capsule** with annulus of 1–3 rows of somewhat separating cells; peristome smooth basally, papillose distally.

Capsules mature late fall–winter. Forming short turf or tufts on tree trunks and decorticated logs, rarely in rock crevices; 1–1900 m; B.C.; Alaska, Ariz., Calif., Idaho, Mont., Oreg., Wash; Asia; n Africa.

2. *Dicranoweisia crispula* (Hedwig) Milde, Bryol. Siles., 49. 1869 [F]



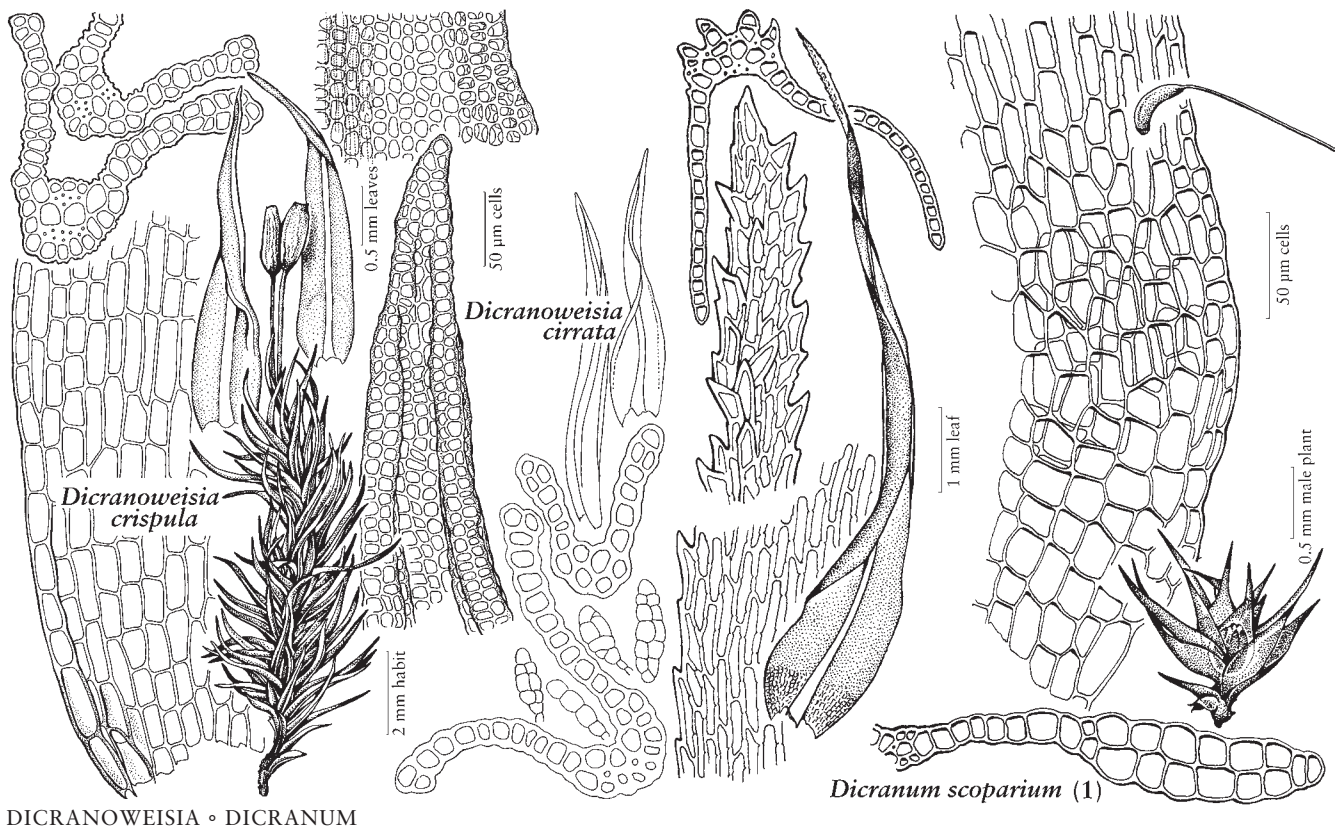
*Weissia crispula* Hedwig, Sp. Musc. Frond., 68. 1801; *Dicranoweisia*

*crispula* var. *compacta* (Schwägrichen) Lindberg; *D. contermina* Renaud & Cardot; *D. roellii* Kindberg; *Trichostomum alpinum* Kindberg; *Weissia compacta* Schwägrichen

Leaves crisped and curled when dry, plane in many leaves, 2-stratose in distal  $\frac{1}{2}$ , cells with longitudinal striolae in distal  $\frac{1}{2}$  of leaf; usually a few alar cells enlarged on margins, often colored. **Specialized asexual reproduction** absent. **Capsule** without differentiated annulus; peristome vertically striolate basally, weakly papillose distally.

Capsules mature spring–early summer. Forming cushions on siliceous rock or gravel, occasionally epiphytic or epixylic; 10–2000 m; Greenland; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.S., Nunavut, Ont., Que., Yukon; Alaska, Ariz., Calif., Colo., Idaho, Maine, Mich., Mont., Nev., N.H., N.Mex., N.C., Oreg., S.Dak., Tenn., Utah, Wash., Wyo.; Asia.

*Dicranoweisia crispula* is an extremely variable species. In stature the plants vary 1–6 cm, while the leaf length varies 1–3.5 mm. The capsules vary considerably from cylindric to short-elliptic, with the length ranging 0.5–2 mm. The shape and sheathing of the perichaetial leaves



is also variable. Although this species is autoicous, sex organs are often absent, especially in terrestrial plants, with sporophytes correspondingly infrequent. Differentiation of alar cells is often weak in North American material and the striolation can also be weak,

and is best observed on cells adjacent to the costa. This species is widespread mainly at higher elevations in western North America, but sporadic in the eastern part of the continent, again occurring mainly at higher elevations.

11. DICRANUM Hedwig, Sp. Musc. Frond., 126. 1801 • [Greek *dicranon*, pitchfork, alluding to peristome teeth]

Robert R. Ireland Jr.

**Plants** in loose to dense tufts, yellowish green to dark green, dull or shiny. **Stems** (0.5–)2–12 (–18) cm, erect, simple or forked, densely tomentose with white or reddish brown, smooth to papillose rhizoids, these sometimes nearly absent, rhizoids arising at bases of branches (macronemata) and sometimes in rows scattered along stems (micronemata). **Leaves** usually lanceolate, rarely ovate, proximal part concave, rarely flat, distal subula keeled to tubulose, erect-appressed, erect-patent or spreading, straight, weakly curled, crispate or cirrate when dry, generally falcate-secund, less often straight, undulate, rugose or smooth; apices acute to obtuse, tips sometimes deciduous, apparently a means of asexual reproduction; margins plane to incurved or involute, entire to serrate in distal part, entire proximally; laminae 1- or 2-stratose at margins or sometimes near costa; laminal cells smooth; costa single, ending before apex to excurrent, smooth or toothed on abaxial surface, sometimes with 2–4 serrated ridges abaxially, 1–2 rows of guide cells, two well-developed stereid bands above and below, sometimes slightly differentiated or absent, extending to apex, or ending before the apex, adaxial and (or) abaxial

epidermal layers of cells differentiated or undifferentiated, sometimes only a few cells in both layers enlarged; laminal cell walls weakly to strongly bulging, or bulges absent; leaf cells pitted or nonpitted, smooth or sometimes abaxially, rarely adaxially, mammillose, papillose or toothed by projecting cell ends, walls often thickened; distal and median laminal cells short or long, quadrate, rectangular or irregularly angled, proximal cells rectangular to linear, alar cells inflated, 1- or 2-stratose, rarely more, generally orange to brown, rarely poorly differentiated. **Specialized asexual reproduction** absent or as clusters of 1–6, deciduous, terete, flagelliform branchlets, borne in axils of distal leaves. **Sexual condition** dioicous or pseudomonocous; male plants as large as female plants or dwarfed and epiphytic on stem rhizoids of female plants; perigonial leaves ovate, concave, short-acuminate; perichaetial leaves usually convolute-sheathing, abruptly subulate or rarely interior leaves gradually acuminate. **Seta** solitary or up to 6 per perichaetium, smooth, elongate, erect, twisted when dry, yellow, brown or reddish. **Capsule** erect or inclined, cylindrical, straight or arcuate, smooth, striate or furrowed when dry, annulus of 1–3 rows of usually large, deciduous or persistent cells, sometimes indistinctly differentiated; operculum long-rostrate, straight or arcuate; peristome single, 16 teeth, split  $\frac{1}{3}$ – $\frac{1}{2}$  their length into 2, rarely 3, divisions, vertically pitted-striolate proximally, papillose above, reddish brown. **Calyptra** cucullate, smooth, naked, covering most of capsule, fugacious. **Spores** 12–30  $\mu\text{m}$ , spherical, finely papillose.

Species ca. 140 (26 in the flora): North America, Mexico, West Indies, Central America, South America, Europe, Asia, Africa, Australia.

For this treatment the segregate *Orthodicranum* is not recognized. Whether to recognize that genus or not has been debatable for years. W. L. Peterson (1979) listed the following six characters that he considered important in separating it from *Dicranum*: (1) capsules straight vs. curved; (2) capsules smooth to slightly wrinkled vs. ribbed; (3) alar cells 1-stratose vs. 2-stratose; (4) peristome teeth relatively narrow (ca. 60  $\mu\text{m}$ ) vs. relatively wide (70–95  $\mu\text{m}$  or more); (5) specialized asexual reproduction by broken leaf tips or flagellated branches common vs. rare; (6) specialized habitat of rocks and wood vs. habitat of wood or rock rare, usually on soil or humus. The species placed in *Orthodicranum* by him as well as by other bryologists are *D. flagellare*, *D. fulvum*, *D. montanum*, *D. tauricum*, and *D. viride*. *Dicranum fragilifolium* is another species in the flora area that also has been placed in *Orthodicranum* by some bryologists (e.g., J. Podpěra 1954). The problem with recognizing that genus is that some of the members otherwise remaining in *Dicranum* share one or more of the six character states Peterson outlined for the segregate genus. *Dicranum fragilifolium* and *D. rhabdocarpum* are two of the species that commonly have some of the characters of *Orthodicranum* and some of those of *Dicranum*. Other species in *Dicranum* less commonly have characters of both genera. If for no other reason but the sake of utility it is more practical at this time to leave all the species in one genus so they can be keyed out together and compared more readily. Perhaps when a world monograph of *Dicranum* is done it will become more evident whether it is important to recognize *Orthodicranum* and perhaps even other segregate genera.

Leaf cross sections are necessary to observe cell features of the costa and laminal cells. The costa stereid and guide cells, the adaxial and abaxial epidermal cells, the number of layers of alar and laminal cells, and the bulges in the cell walls between the laminal cells are all observable in cross section. These characters are extremely important because they can reliably differentiate many species of *Dicranum*. The leaf cross section characters are usually less variable and less influenced by the environment than other gametophytic characters, such as leaf habit, shape, margins and costa length characters, and are utilized to a great extent since they are considered much more dependable in species identification than some of the other characters in the genus.

SELECTED REFERENCES Allen, B. H. 1998b. The genus *Orthodicranum* (Musci: Dicranaceae) in Maine. *Evansia* 15: 9–20. Allen, B. H. 1998c. The genus *Dicranum* (Musci: Dicranaceae) in Maine. *Evansia* 15: 45–80. Bellolio-Trucco, G. and R. R. Ireland. 1990. A taxonomic study of the moss genus *Dicranum* (Dicranaceae) in Ontario and Quebec. *Canad. J. Bot.* 68: 867–909. Ireland, R. R. 1971b. *Dicranum*. In: E. Lawton. 1971. Moss Flora of the Pacific Northwest. Nichinan. Pp. 72–81. Peterson, W. L. 1979. A Revision of the Genera *Dicranum* and *Orthodicranum* (Musci) in North America North of Mexico. Ph.D. thesis. University of Alberta.

1. Leaves mostly straight, erect-spreading, the tips deciduous and absent.
  2. Costa without stereid bands, with 1–2 layers of cells above and below the guide cells in the basal part of the leaf; alar cells 1-stratose; capsule straight, erect . . . . . 24. *Dicranum tauricum*
  2. Costa with stereid bands, although sometimes weak, with 2–3 layers of cells above and below the guide cells in the basal part of the leaf; alar cells 1- or 2-stratose; capsule straight and erect or arcuate
  3. Leaves shiny, with proximal cells pitted, distal cells rectangular, alar cells 2-stratose or with a few 1-stratose regions, lamina rarely with 2-stratose regions . . . . . 21. *Dicranum fragilifolium*
  3. Leaves dull, with proximal cells not pitted (or with few pits), distal cells quadrate, alar cells 1-stratose or with few 2-stratose regions, lamina often with 2-stratose regions . . . . . 23. *Dicranum viride*
1. Leaves rarely straight, usually crisped or falcate, the tips mostly present.
  4. Distal leaf cells usually elongate, sinuose, pitted.
    5. Costa with 2 rows of guide cells, without abaxial ridges; leaves 10–15 mm; setae often aggregate . . . . . 6. *Dicranum majus*
    5. Costa with 1 row of guide cells, often with abaxial ridges; leaves often less than 10 mm; setae solitary or aggregate.
      6. Leaves keeled distally, margins strongly serrate to toothed in distal half; costa with 2–4 well-developed dentate ridges on abaxial surface in distal part of leaf.
        7. Leaves spreading, strongly undulate; setae aggregate, 3–6 per perichaetium . . . . . 1. *Dicranum polysetum*
        7. Leaves falcate-secund, not or slightly undulate; setae solitary, rarely 2 per perichaetium.
          8. Interior perichaetial leaves abruptly acuminate . . . . . 2. *Dicranum scoparium* (in part)
          8. Interior perichaetial leaves gradually acuminate . . . . . 3. *Dicranum howellii*
    6. Leaves tubulose to somewhat keeled distally, margins entire to serrate in distal half; costa without or with poorly developed dentate ridges distally on abaxial surface.
      9. Costa subpercurrent to percurrent; alar cells usually 1-stratose, rarely 2-stratose in part; capsule slightly arcuate to straight and erect.
        10. Leaves spreading to slightly falcate-secund, margins serrate near apex; capsule 1.5–3.5 mm. . . . . 7. *Dicranum rhabdocarpum*
        10. Leaves erect-spreading to erect-appressed, margins entire; capsule 1.5–2 mm. . . . . 20. *Dicranum groenlandicum* (in part)
    9. Costa subpercurrent to excurrent; alar cells 2-stratose; capsule slightly to strongly arcuate.
      11. Leaves with a long, narrow subula, apex acute to somewhat obtuse . . . . . 17. *Dicranum spadiceum*
      11. Leaves with a short subula, apex obtuse to somewhat acute.
        12. Leaves usually with twisted apex when dry; portion of some stems julaceous and composed of short, broad, concave, appressed, somewhat obtuse leaves; proximal leaf margins ± involute . . . . . 5. *Dicranum leioneuron*
        12. Leaves seldom or never with twisted apex when dry; without julaceous portions of stems; proximal leaf margins flat.
          13. Leaves not or little rugose-undulate, dull, cells often somewhat rough on abaxial surface . . . . . 2. *Dicranum scoparium* (in part)
          13. Leaves rugose-undulate, shiny, cells smooth on abaxial surface . . . . . 4. *Dicranum bonjeanii*

[4. Shifted to left margin.—Ed.]

4. Distal leaf cells usually short (quadrate, rectangular, or irregularly angled), neither sinuose nor pitted (or with few pits).
  14. Proximal leaf cells not pitted (or with few pits); alar cells usually 1-stratose, rarely 2-stratose; capsule generally straight; plants small, seldom more than 4 cm.
    15. Leaf lamina mostly 2-stratose above, costa usually more than  $\frac{1}{4}$  the width of leaf base . . . . . 22. *Dicranum fulvum*
    15. Leaf lamina 1-stratose above, costa less than  $\frac{1}{4}$  the width of leaf base
      16. Plants without flagelliform branchlets; usually with weak, slender, brood branches with linear, strongly crisped leaves when dry; leaves semi-keeled distally and strongly papillose on abaxial surface, generally strongly cirrate when dry; distal leaf cells regularly quadrate . . . . . 25. *Dicranum montanum*
      16. Plants with 2–6 flagelliform branchlets (rigid and terete branches with appressed leaves) in the distal leaf axils; brood branches absent; leaves tubulose distally and slightly papillose on abaxial surface, curled to crisped when dry; distal leaf cells short-rectangular to quadrate . . . . . 26. *Dicranum flagellare*
  14. Proximal leaf cells pitted; alar cells 1- or often 2-stratose; capsule generally arcuate; plants large, often more than 4 cm.
    17. Leaves tubulose in distal half; costa often indistinct and scarcely prominent on abaxial surface.
      18. Leaf cells strongly papillose in distal half of leaf; costa without stereid bands in distal  $\frac{1}{4}$ – $\frac{1}{3}$  of leaf, adaxial epidermal layer of cells gradually enlarged but not noticeably differentiated from cells below; capsule sometimes strumose, 1–3 per perichaetium; nw North America . . . . . 16. *Dicranum pallidisetum*
      18. Leaf cells smooth or weakly papillose in distal half of leaf; costa with stereid bands in distal part of leaf as well as below, adaxial epidermal layer of cells noticeably enlarged and differentiated from stereid cells below; capsule not strumose, solitary; across North America.
        19. Leaves cirrate to crisped when dry; distal leaf cells short-rectangular to quadrate, with thin walls, proximal cells 9–12  $\mu\text{m}$  wide; costa with adaxial epidermal layer of cells enlarged (seen in cross section near leaf middle); capsule 2–4 mm . . . . . 18. *Dicranum muehlenbeckii*
        19. Leaves erect-appressed or slightly curled when dry; distal leaf cells elliptical to rectangular, with thick walls, proximal cells 5–6  $\mu\text{m}$  wide; costa with only a few cells in adaxial epidermal layer enlarged; capsule 1–2 mm.
          20. Proximal leaves with acute apices; proximal leaf cells usually less than 40  $\mu\text{m}$ , median cells pitted mainly proximal to middle of leaf . . . . . 19. *Dicranum elongatum*
          20. Proximal leaves often with blunt apices; proximal leaf cells usually more than 40  $\mu\text{m}$ , median cells pitted well beyond middle of leaf . . . . . 20. *Dicranum groenlandicum* (in part)
    17. Leaves keeled in the distal half; costa prominent and rounded on abaxial surface.
      21. Leaves plane or indistinctly undulate near apex.
        22. Leaves strongly cirrate to crisped when dry, proximal cells usually less than 45  $\mu\text{m}$ ; cells walls between lamina cells strongly bulging as seen in cross section; capsule 2–4 mm . . . . . 13. *Dicranum brevifolium* (in part)
        22. Leaves straight to  $\pm$  curled when dry, proximal cells usually more than 45  $\mu\text{m}$ ; cell walls smooth or only slightly bulging between lamina cells as seen in cross section; capsule mostly 1–3 mm.
          23. Leaves with distal margins  $\pm$  involute, laminae with few 2-stratose regions on margins in the distal part; leaf cells smooth to slightly papillose on abaxial surface in distal part of leaf . . . 14. *Dicranum acutifolium* (in part)
          23. Leaves with distal margins erect, laminae with one or both distal margins 2-stratose; leaf cells papillose on abaxial surface in distal part of leaf . . . . . 15. *Dicranum fuscescens*

[21. Shifted to left margin.—Ed.]

- 21. Leaves undulate or rugose (*D. condensatum* indistinctly undulate).
  - 24. Costa ending well before apex, rarely nearly percurrent . . . . . 8. *Dicranum undulatum*
  - 24. Costa percurrent to excurrent.
    - 25. Leaves erect-spreading to erect and compressed when moist; distal-median leaf cells irregularly angled, with unequally thickened walls.
    - 26. Leaves gradually narrowed to a long-acuminate apex; costa with a few differentiated cells in adaxial epidermal layer, cell walls between lamina cells not bulging. . . . . 10. *Dicranum drummondii*
    - 26. Leaves acute to gradually narrowed to a short-acuminate apex; costa absent differentiated cells in adaxial epidermal layer, cell walls between lamina cells weakly to strongly bulging.
      - 27. Leaves broadly lanceolate, not arched, slightly crisped when dry, not imbricate . . . . . 11. *Dicranum condensatum*
      - 27. Leaves ovate to ovate-lanceolate, concave and arched, loosely imbricate when dry . . . . . 12. *Dicranum spurium*
  - 25. Leaves falcate-secund when moist; distal-median leaf cells short-rectangular to quadrate, with equally thickened walls.
    - 28. Leaf margins strongly toothed distally, laminae with toothlike projections scattered distally on abaxial surface; setae often aggregate, (1–)2–5 per perichaetium; capsule not strumose . . . . . 9. *Dicranum ontariense*
    - 28. Leaf margins slightly serrate distally, laminae smooth to slightly rough distally on abaxial surface; seta always solitary; capsule ± strumose.
      - 29. Leaves strongly crisped to cirrate when dry, proximal leaf cells usually less than 45 µm; stems densely tomentose . . . . . 13. *Dicranum brevifolium* (in part)
      - 29. Leaves straight to curled when dry, proximal leaf cells often more than 45 µm; stems somewhat tomentose . . . . . 14. *Dicranum acutifolium* (in part)

1. *Dicranum polysetum* Swartz, Monthly Rev., ser. 2, 34: 538. 1801



*Dicranum rugosum* (Funck) Bridel

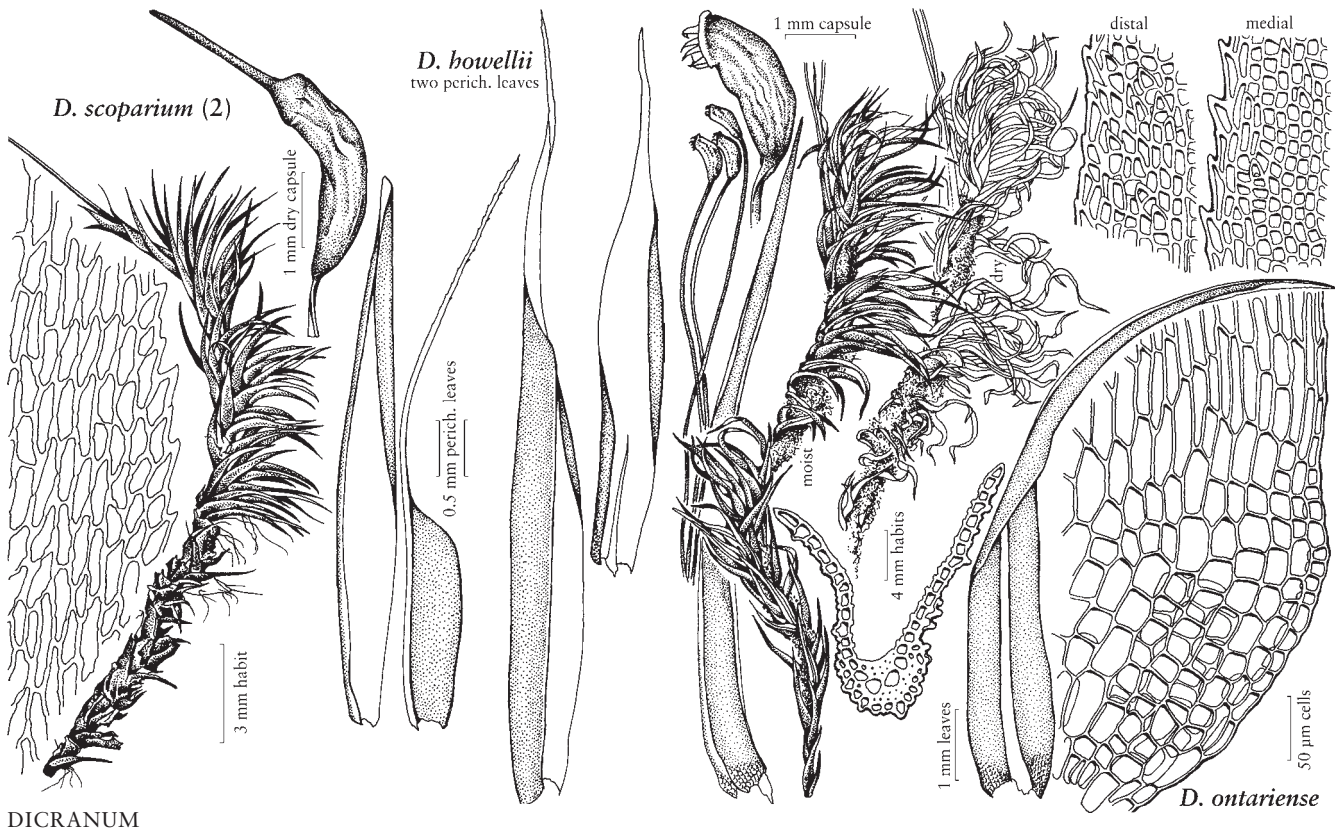
**Plants** in loose tufts, light green, glossy. **Stems** 4–15 cm, densely tomentose with whitish or reddish rhizoids. **Leaves** erect to spreading, ± flexuose, little changed when dry, strongly undulate, (5.5–)7–9.5(–10.5) × 1–2 mm, lanceolate, concave

proximally, keeled above, acute; margins strongly toothed in the distal half; laminae 1-stratose; costa ending before apex, occupying ca. 1/16–1/8 of leaf base, strong, with two toothed ridges distally on abaxial surface, with one row of guide cells, two stereid bands, adaxial epidermal layer of cells not differentiated, abaxial layer with a few cells enlarged; cell walls between lamina cells not bulging; leaf cells smooth; alar cells 2-stratose, well-differentiated, not extending to costa; proximal laminal cells elongate, pitted, (45–)78–129(–156) × (5–)9–10(–14) µm; distal laminal cells shorter, sinuose, pitted, (42–)64–68(–115) × (4–)9–10(–13)µm. **Sexual condition** pseudomonocous; dwarf male plants on stem rhizoids of female plants; interior perichaetial leaves abruptly long-acuminate, convolute-

sheathing. **Seta** 1.5–4 cm, usually aggregate, 3–6 per perichaetium, brown or reddish brown. **Capsule** 2–3.5 mm, arcuate, inclined to horizontal, furrowed when dry, yellowish brown or reddish brown; operculum 2–4 mm. **Spores** 12–24 µm.

Capsules mature spring. Commonly on humus, soil over acidic or calcareous rock, and decaying wood in deciduous or more often coniferous forests; occasionally in bogs, fens, and swamps; 10–2100 m; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.W.T., N.S., Nunavut, P.E.I., Que., Sask., Yukon; Alaska, Colo., Conn., Idaho, Ill., Ind., Iowa, Ky., Maine, Md., Mass., Mich., Minn., Mo., Mont., N.H., N.J., N.Y., N.C., N.Dak., Ohio, Oreg., Pa., S.Dak., Tenn., Vt., Va., Wash., W.Va., Wis., Wyo.; Europe; Asia.

W. L. Peterson (1979) recorded *Dicranum polysetum* from Nunavut. It is one of the largest, most conspicuous, and most easily recognized species in the genus in North America. The species is immediately recognized by the large stems, 4–15 cm, with a dense mat of whitish or reddish tomentum, giving the stems a thickened appearance, by the shiny, strongly undulate, wide-spreading leaves with margins strongly toothed in the distal half and by the clustered sporophytes (3–6 per perichaetium). Microscopically, the species is readily



DICRANUM

distinguished by the elongate, abundantly pitted cells throughout the leaf and by the toothed ridges on the abaxial surface of the costa in the distal part of the leaf. *Dicranum polysetum* is one of the few species in North America that has no apparent intergradations with any other species of the genus. It is common in southeastern Canada, northeastern United States, and the Canadian Rocky Mountains, where it extends south to Wyoming and Colorado, occurring in both states in a small number of localities. It is rare west of the Rockies, where it is known from only a few localities in northwestern Montana, southern Idaho and northeastern Washington and Oregon.

2. *Dicranum scoparium* Hedwig, Sp. Musc. Frond., 126. 1801 [F]



*Dicranum latifolium* J. J. Amann

Plants in loose to dense tufts, light to dark green, glossy to sometimes dull. Stems 2–10 cm, tomentose with white to brown rhizoids. Leaves very variable, usually falcate-secund, rarely straight and erect, slightly contorted and crisped when dry, sometimes slightly rugose or undulate, (4–)5–8.5(–15) × 0.8–1.8 mm,

concave proximally, keeled above, lanceolate, apex acute to somewhat obtuse; margins strongly serrate in the distal  $\frac{1}{3}$  or rarely slightly serrulate; laminae 1-stratose; costa percurrent, excurrent, or ending before apex,  $\frac{1}{10}$ – $\frac{1}{5}$  the width of the leaves at base, usually with 2–4 toothed ridges above on abaxial surface, with a row of guide cells, two thin stereid bands, adaxial epidermal layer of cells not differentiated, the abaxial layer interrupted by several enlarged cells that form part of the abaxial ridge, not extending to the apices; cell walls between lamina cells not bulging; leaf cells smooth; alar cells 2-stratose, well-differentiated, sometimes extending to costa; proximal laminal cells linear-rectangular, pitted, (25–)47–100(–132) × (5–)7–12(–13)  $\mu\text{m}$ ; distal laminal cells shorter, broad, sinuose, pitted, (11–)27–43(–53) × (5–)8–12(–20)  $\mu\text{m}$ . **Sexual condition** pseudomonocous or dioicous; dwarf males on rhizoids of female plants or male plants as large as females; interior perichaetial leaves abruptly long-acuminate, convolute-sheathing. **Seta** 2–4 cm, solitary, rarely two per perichaetium, yellowish brown to reddish brown. **Capsule** 2.5–4 mm, arcuate, inclined to horizontal, smooth to striate when dry, yellowish brown to reddish brown; operculum 2–3.5 mm. **Spores** 14–24  $\mu\text{m}$ .

Capsules mature spring. Soil, humus, humus over rock, decaying stumps and logs, tree bases in dry to mesic woodlands; sometimes bogs, fens and swamps;