

## DICRANUM BREVIFOLIUM NEW TO THE MOSS FLORA OF MICHIGAN AND THE EASTERN UNITED STATES

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While studying the moss genus *Dicranum* (Dicranaceae) for the Bryophyte Flora of North America project, I discovered a sterile specimen of *D. brevifolium* (Lindberg) Lindberg from Michigan in the herbarium of the Smithsonian Institution. It had been misidentified as *D. undulatum* Bridel, a related and more common species that occurs in bogs in both the Upper and Lower Peninsula of the state (Darlington 1964). The specimen of *D. brevifolium*, which is from Marquette Co. in the Upper Peninsula of Michigan, represents a species that is not only new to the state but is also the first record from the continental United States east of the Mississippi River (Bellolio-Trucco & Ireland 1990). It is an arctic-alpine species so its occurrence in the Upper Peninsula was not totally unexpected. G.E. Nichols (1935) first commented on the arctic-alpine bryophyte element in the vegetation of the Upper Peninsula, citing such species as *Polytrichastrum alpinum* (Hedwig) G.L. Smith (as *Polytrichum alpinum* Hedwig) and *Andreaea rupestris* Hedwig (as *A. petrophila* Ehrhart). Later, W.C. Steere (1937) also discussed the arctic-alpine bryophyte element in the flora of the Upper Peninsula.

The specimen data for the *D. brevifolium* record are as follows: Michigan, Marquette Co., 11 mi. ESE of Marquette, along Lake Superior on Michigan Route 28, *F.J. Hermann 28551*, 29 July 1978 (US). Det. as *Dicranum undulatum* Bridel. *Cladonia-Vaccinium* understory of sandy jack pine plain.

Besides occurring in Michigan's Upper Peninsula, the species has been found to occur mainly in western North America, with a number of scattered localities in the northeastern part of the continent as determined from my recent field collections and some confirmed herbarium specimens by other collectors. It occurs elsewhere in North America on humus or soil over rock, rarely rotted wood, exposed or shaded bluffs or cliffs, 70–3700 m. The distribution of *D. brevifolium* (Fig. 1) is still very sketchy and incompletely known because of its confusion with several other species discussed in this paper. Thus far, it is known to occur in the following localities (specimens have been examined in a number of North American herbaria but only representative specimens verified in the herbaria of the Canadian Museum of Nature (CANM) or the Smithsonian Institution (US) are cited here): Greenland (CANM), Canada (Alberta (US), British Columbia (CANM, US), Manitoba (CANM), Newfoundland (CANM), Northwest Territories (CANM), Nunavut (CANM), Ontario (CANM), Quebec (CANM), Yukon Territory (CANM)) and the United States (Alaska (US), Colorado (CANM),



often weakly undulate in the distal part, crisped when dry, standing out from the stems often at wide angles, concave below, keeled above; laminae often with some bistratose regions above, commonly on margins and near costa, sometimes entirely bistratose with tristratose margins (especially on plants at high altitudes in Alberta); costa percurrent or shortly excurrent, very prominent and conspicuously rounded, usually noticeable below the leaf middle; cross section of leaves very distinctive, shaped like a pair of tongs (i.e., like outside calipers with the tips bent inward), abaxial epidermal layer of costal cells differentiated but no adaxial epidermal layer cells enlarged, and cell walls between lamina cells nearly always strongly bulging. Illustrations of the species, as well as the other *Dicranum* species mentioned in this paper, may be found in Bellolio-Trucco & Ireland (1990) and Nyholm (1954, 1956).

*Dicranum brevifolium* was originally described as a variety of *D. muehlenbeckii* Bruch, Schimper & W. Gümbel by S.O. Lindberg in the 1860's but he later raised it to a species in the 1870's. Since then others have usually recognized it either as a species (Nyholm 1986; Williams 1913) or as a variety (Nyholm 1954; Podpěra 1954).

The species is best known by its gametophytic characters. It is easily distinguished from *D. muehlenbeckii*, which has tubulose leaves in the distal half, rather than keeled leaves, and costae that are much less prominent on the abaxial surface than those of *D. brevifolium*. In cross section of the distal half of the leaves, *D. muehlenbeckii* has unistratose laminae, a tubular outline, cell walls between the lamina cells that are smooth and an adaxial epidermal layer of costal cells that are differentiated. This is in contrast to *D. brevifolium* whose leaves have a tong-shaped outline, cell walls between the lamina cells strongly bulging and an adaxial epidermal layer of costal cells undifferentiated.

Other species that can be confused with *D. brevifolium* are *D. acutifolium*, *D. fuscescens* Turner and some forms of *D. undulatum*.

*Dicranum brevifolium* is probably the most difficult to distinguish from *D. acutifolium*. The latter differs by its erect-spreading to slightly curled leaves when dry, its costae that are usually moderately distinct and sometimes nearly flat on the abaxial surface and its V-shaped leaves in cross section. In comparison, the former has crisped leaves standing out from the stems at wide angles, costae that are prominent and conspicuously rounded on the abaxial surface, and tong-shaped leaves in cross section. Sporophytically, *D. acutifolium* has shorter capsules, 2.0–2.5 mm, compared to the longer capsules, 3–4 mm, of *D. brevifolium*.

*Dicranum fuscescens* differs from *D. brevifolium* by its much less prominent costae on the abaxial leaf surface, by its V-shaped leaves in cross section, instead of tong-shaped leaves, by its laminae that are only bistratose on the margins, instead of having bi- to tristratose regions on the margins and scattered throughout, and by its weakly bulging or nearly smooth cell walls, rather than strongly bulging ones, as seen in cross section.

*Dicranum undulatum* can easily be differentiated from *D. brevifolium* by its broadly acute leaf apices and costae that are subpercurrent, compared to the narrowly acute leaf apices and percurrent to shortly excurrent costae that are characteristic of the latter species. Occasionally, there are forms of *D. undulatum*

with narrowly acute leaf apices that can be confused with *D. brevifolium* but the broadly recurved leaves in the distal half of the leaves of the former will easily distinguish the species from the latter species that has incurved leaves.

*Dicranum brevifolium* probably occurs elsewhere in Michigan's Upper Peninsula and in many other arctic-alpine localities throughout North America. It should be found on humus or soil over rock, rotting wood, and exposed or shaded bluffs and cliffs.

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