

## 3. ANDREAEACEAE Dumortier

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Plants dark green to black, small to large, often in dense turf. **Stems** erect, irregularly branched, bearing rhizoids at base; central strand absent. **Leaves** erect or secund, sometimes falcate-secund, short- to long-lanceolate or panduriform; costa absent or single or branched, narrow to broad, percurrent or ending before the apex; in section of uniform cells, lamellae absent; margins plane to weakly incurved, seldom recurved; laminal cells short throughout or occasionally elongate in leaf base, 1-stratose or 2- to multistratose. **Specialized asexual reproduction** rare, as filamentous gemmae from laminal cells. **Sexual condition** usually autoicous, mainly cladautoicous but occasionally gonioautoicous or dioicous; perichaetial leaves commonly differentiated, larger, convolute-sheathing. **Sporophytes** terminal on an elongate gametophytic stalk, the pseudopodium. **Seta** essentially absent. **Capsule** erect, elliptic, opening by usually 4 lateral longitudinal valves; stomata, annulus, operculum and peristome absent. **Calyptra** tiny, campanulate-mitrate, often fugacious. **Spores** spheric, oval or tetrahedral, small to large, 10 to occasionally more than 100  $\mu\text{m}$ , papillose.

Genus 1, species ca. 45 (11 in the flora): cosmopolitan.

The Andreaeaceae shares with Sphagnaceae the sporophyte raised on a pseudopodium, but the spore sac is derived from the endothecium, not the amphithecium as in the latter family. The spore sac arches over the massive, persistent columella. The longitudinal valves bulge open when the capsules are dry, closing when wet. Erect, thallose protonemal appendages are common and distinctive.

1. ANDREAEA Hedwig, Sp. Musc. Frond., 47. 1801 • [For J. G. R. Andreae, 1724–1793, apothecary of Hanover, Germany]

**Plants** commonly cemented to substrate. **Stems** with stalked mucilage hairs in leaf axils, stalks usually brown. **Leaves** spiraling around stem in several rows, usually brittle, commonly ending in a distinct apiculus of a single cell; costa sometimes poorly differentiated, sometimes not reaching the leaf insertion; laminal cells with thick longitudinal walls and often pitted or sinuose, transverse walls thin. **Capsule** 0.5–2 mm.

Species about 45 (11 in the flora): cosmopolitan.

*Andreaea* is easily recognized in the field by the dark green to blackish dense turf strongly adherent to a rock habitat, the brittle leaves, and capsule opening by four longitudinal lateral slits. These species are largely temperate montane to arctic-alpine in distribution, not uncommon on exposed acid rock surfaces. The present treatment follows B. M. Murray's (1987, 1988, 1988b) detailed and thorough study closely except that *Andreaea alpestris* is treated as a synonym of *A. rupestris* and *A. crassinervia* as a synonym of *A. rothii*, following M. F. V. Corley et al. (1981), while infraspecific taxa are not recognized. The costa may be interpreted as strongly excurrent when it fills the leaf subula.

SELECTED REFERENCES Murray, B. M. 1988b. The genus *Andreaea* in Britain and Ireland. *J. Bryol.* 15: 17–82. Schultze-Motel, W. 1970. Monographie der Laubmoosgattung *Andreaea*. 1. Die costaten Arten. *Willdenowia* 6: 25–110.

- 1. Costa absent, leaves mostly lanceolate to ovate or panduriform.
  - 2. Proximal laminal margins denticulate; Greenland . . . . . 1. *Andreaea alpina*
  - 2. Proximal laminal margins entire (occasionally crenulate).
    - 3. Cells of basal laminal margins quadrate . . . . . 2. *Andreaea mutabilis*
    - 3. Cells of basal laminal margins mostly rectangular.
      - 4. Leaves narrowly lanceolate, medial cell walls pitted and sinuose . . . . . 3. *Andreaea sinuosa*
      - 4. Leaves short-lanceolate to panduriform, medial cell walls variously pitted, straight.
        - 5. Leaves generally curving or secund, short-lanceolate, widest proximally, apices oblique or symmetric . . . . . 4. *Andreaea rupestris*
        - 5. Leaves mostly straight, panduriform, widest in distal half, apices usually symmetric . . . . . 5. *Andreaea obovata*
- 1. Costa present, leaves mostly subulate.
  - 6. Leaf margins crenulate to strongly denticulate, laminal papillae present, strong; perichaetial leaves little differentiated . . . . . 6. *Andreaea nivalis*
  - 6. Leaf margins entire or occasionally weakly crenulate, laminal papillae absent; perichaetial leaves differentiated, convolute-sheathing.
    - 7. Spores ca. 10–20 µm; basal laminal cells mostly rectangular, cell walls smooth and straight . . . . . 7. *Andreaea blyttii*
    - 7. Spores 20–60 µm; basal laminal cells mostly rounded or quadrate to short-rectangular, walls commonly pitted and sinuose.
      - 8. Costa weak, flattened distally, commonly not reaching the leaf insertion . . . . . 8. *Andreaea heinemannii*
      - 8. Costa moderately differentiated to strong, terete, reaching the leaf insertion.
        - 9. Spores usually 50–90 µm . . . . . 9. *Andreaea megistospora*
        - 9. Spores usually 35–60 µm.
          - 10. Spores usually 35–60 µm . . . . . 10. *Andreaea rothii*
          - 10. Spores usually 20–30 µm . . . . . 11. *Andreaea schofieldiana*

**1. *Andreaea alpina*** Hedwig, Sp. Musc. Frond., 49, plate 7, fig. 2p. 1801



**Plants** reddish brown to black. **Leaves** erect-spreading to squarrose, straight, panduriform, widest distally, apex symmetric; costa absent; leaf margins denticulate along leaf base; basal laminal cells rectangular to long-rectangular, marginal cells similar, walls pitted, nodose; medial

laminal cells rounded-quadrate to ovate, 1-stratose entirely or sometimes 2-stratose distally, lumens rounded;

laminal papillae rare, low. **Sexual condition** cladautoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 18–28 µm.

Wet acidic or basic rock; Greenland; s, w South America; n Europe.

The spores of *Andreaea alpina* are of two types, the brown spores generally smaller than the green, and apparently abortive. This comparatively robust species is easily identified by the panduriform leaves with basal marginal denticulations.

2. *Andreaea mutabilis* Hooker f. & Wilson, London J. Bot. 3: 536. 1844



**Plants** reddish to black. **Leaves** erect-spreading, straight or sometimes secund, lanceolate, widest proximally, apex symmetric; costa absent; leaf margins entire; basal laminal cells rectangular to long-rectangular, marginal cells quadrate, walls little pitted; medial laminal cells

rounded-quadrate to ovate, 1-stratose entirely or sometimes 2-stratose in patches distally, lumens rounded; laminal papillae rare, low. **Sexual condition** cladautoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 12–20(–30)  $\mu\text{m}$ .

Acidic rock faces, occasionally thin soil; moderate elevations; B.C.; South America (Argentina, Ecuador); nw Europe; Asia (e China); Atlantic Islands (Kerguelen Island); Pacific Islands (including New Zealand); Australia.

3. *Andreaea sinuosa* B. M. Murray, Bryologist 89: 189, figs. 1–17. 1987



**Plants** reddish brown to black. **Leaves** weakly spreading, straight or sometimes secund, narrowly lanceolate, widest proximally, apex symmetric; costa absent; leaf margins entire; basal laminal cells rectangular, marginal cells not different in shape, walls thickened, pitted, sinuose; medial laminal

cells rounded-quadrate to ovate, 1-stratose entirely or sometimes 2-stratose in patches distally, lumens rounded; laminal papillae low, large, brown to whitish, mainly medial. **Sexual condition** apparently dioicous, possibly cladautoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 12–20  $\mu\text{m}$ .

Acidic rock in snow beds; low to moderate elevations; B.C.; Alaska; nw Europe.

*Andreaea sinuosa* is uncommon, and is distinguished from the similar *A. rupestris* by the symmetric and often rounded leaf apex and sinuose basal laminal cells.

4. *Andreaea rupestris* Hedwig, Sp. Musc. Frond., 47, plate 7, fig. 2g–o. 1801



*Andreaea alpestris* (Thedenius) Schimper; *A. papillosa* Lindberg; *A. parvifolia* Müller Hal.; *A. rupestris* var. *acuminata* (Schimper) Sharp; *A. rupestris* var. *alpestris* (Thedenius) Sharp; *A. rupestris* var. *papillosa* (Lindberg) Podpěra; *A. rupestris* var. *sparsifolia* (Zetterstedt) Sharp; *A. sparsifolia* var. *sublaevis* Kindberg

**Plants** reddish black, black or greenish brown. **Leaves** curved or secund to straight, wide-spreading to squarrose, short-lanceolate, widest proximally, apex oblique or symmetric; costa absent; leaf margins entire; basal laminal cells short- to long-rectangular, marginal cells rounded-quadrate to short-rectangular, walls sometimes thickened, usually pitted, straight; medial laminal cells quadrate to short-rectangular, 1-stratose or occasionally 2-stratose in patches, lumens rounded, rectangular or irregularly stellate; laminal papillae usually present, commonly large, whitish. **Sexual condition** cladautoicous or autoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 20–32(–50)  $\mu\text{m}$ .

Neutral to acidic boulders, cliffs and walls, generally wet sites; low to moderate elevations; Greenland; Nunavut, Que.; Alaska; nw Europe. **Note:** see errata.

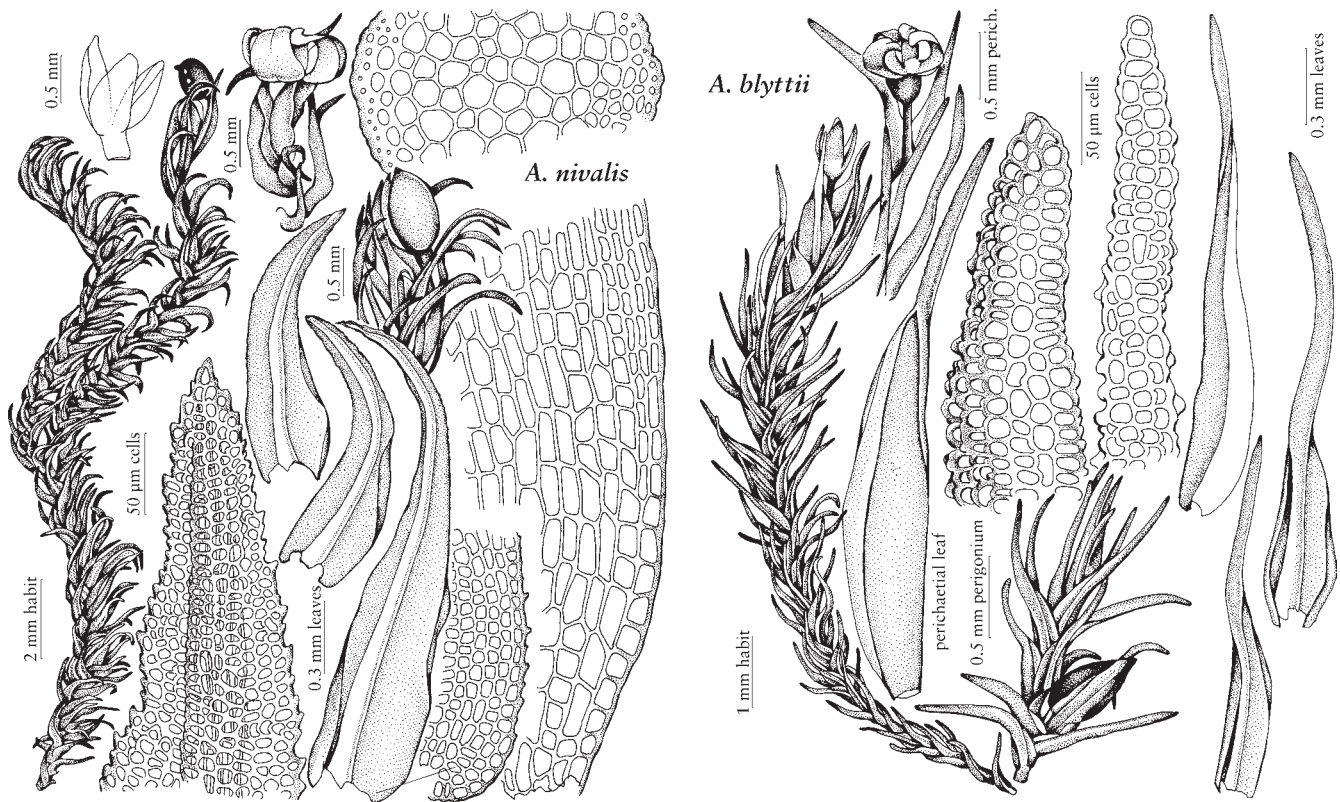
*Andreaea rupestris* is a species of many morphological variants, more commonly identified by simple elimination. It is similar to *A. obovata*, but is distinguished by the leaves generally curving or secund, short-lanceolate, widest proximally, apices oblique or symmetric. The degree of expression of laminal papillae is variable on the same plant. Plants identified as *A. alpestris*, said to differ by straight leaves with low papillae, is probably best considered a high elevation form.

5. *Andreaea obovata* Thedenius, Nya Bot. Not. 1849: 78, plate 1, figs. 27–36. 1849



**Plants** red-brown to purple-black. **Leaves** straight to secund, panduriform, widest in distal half, apex usually symmetric; costa absent; leaf margins entire; basal laminal cells rectangular to long-rectangular, marginal cells rectangular, walls thick, pitted-nodose; medial laminal cells

quadrate, 1-stratose, lumens irregularly stellate to rhombic; laminal papillae low or absent. **Sexual condition** autoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 20–35  $\mu\text{m}$ .



ANDREAEAEA

Rock or soil in streams; low to moderate elevations; Greenland; B.C., Nfld. and Labr. (Labr.), Nunavut, Yukon; Alaska; n Eurasia; c Africa.

Like *Andreaea alpina*, *A. obovata* has spores in two size classes, the smaller apparently abortive. It is very rare in the flora area and can be distinguished from *A. rupestris* by the panduriform leaves.

6. *Andreaea nivalis* Hooker, Trans. Linn. Soc. London 10: 395, plate 31, fig. 4. 1811 [F]



*Andreaea baileyi* (Holzinger) Holzinger; *A. macounii* Kindberg; *A. nivalis* var. *baileyi* Holzinger

**Plants** reddish brown to brownish green. **Leaves** secund to falcate-secund, mostly subulate, widest in proximal half of leaf, apex symmetric; costa present, percurrent and filling the leaf apices, strong, terete, reaching the leaf insertion; leaf margins crenulate to strongly denticulate; basal and medial laminal cells quadrate to short-rectangular, 1-stratose, walls thin and straight, lumens smoothly rounded, quadrate to short-rectangular on the margins; laminal papillae strong, usually distant. **Sexual condition** dioicous; perichaetial

leaves not differentiated beyond being larger than the cauline. **Spores** (18–)20–30(–40) µm.

Wet rocks in streams, snow flushes, seeping outcrops; moderate to high elevations; Greenland; B.C., Nfld. and Labr. (Nfld.), Yukon; Alaska, Calif., Oreg., Wash.; Europe; Asia (Japan, Russia).

The salient distinguishing traits of *Andreaea nivalis* are the crenulate to strongly denticulate leaf margins, strong papillae occurring mostly on the abaxial surface of the lamina, and perichaetial leaves larger, more sharply cordate at the basal angles, but otherwise not much different from the cauline leaves.

7. *Andreaea blyttii* Schimper in P. Bruch and W. P. Schimper, Bryol. Europ. 6: 155, plate 635. 1855 [F]



**Plants** brown to black. **Leaves** erect, curved or secund, becoming subulate from an ovate or narrow-rectangular base, widest in proximal half of leaf, apex symmetric; costa present, percurrent and filling the leaf apices, strong, terete, usually reaching the leaf insertion; leaf margins entire or crenulate;

basal laminal cells rectangular, walls thin and straight; medial laminal cells usually quadrate, 1-stratose or rarely

2-stratose juxtacostally, lumens rounded-quadrate; laminal papillae rare. **Sexual condition** dioicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** (10–)13–15(–20)  $\mu\text{m}$ .

Rock, alluvium, edges of snow melt areas; low to high elevations; Greenland; B.C., Nfld. and Labr., N.W.T., Nunavut, Que.. Yukon; Alaska, Calif., Oreg., Wash.; n Europe; n Asia; Atlantic Islands (Iceland).

*Andreaea blyttii* is distinguished by leaves with long, narrow subula, nearly filled with the strong costa, and rectangular basal cells, and small spores. Collections commonly lack sporophytes. Distal laminal cells may be minutely mammillose abaxially, and the leaf margins are thus crenulate.

8. *Andreaea heinemannii* Hampe & Müller Hal., Bot. Zeitung (Berlin) 4: 324, plate 2. 1846



*Andreaea blyttii* var. *angustata* (Limpricht) Schultze-Motel;  
*A. blyttii* var. *obtusifolia* (Berggren) Sharp;  
*A. crassinervia* var. *obtusifolia* Berggren

**Plants** brown to black. **Leaves** erect to spreading, occasionally secund, broadly subulate from an ovate base, widest in proximal half

of leaf, apex symmetric; costa present, percurrent and filling the leaf apices, weak, flattened distally, often not reaching the leaf insertion; leaf margins entire or occasionally weakly crenulate; basal laminal cells quadrate to occasionally short-rectangular, a few marginal cells rectangular, walls usually sinuose; medial laminal cells quadrate, 1-stratose or sometimes 2-stratose in patches, lumens rounded-quadrate; laminal papillae rare, low. **Sexual condition** apparently autoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 20–30(–40)  $\mu\text{m}$ .

Acidic rocks; low to moderate elevations; Greenland; B.C., Yukon; Alaska, Calif., Colo., Oreg.; s Europe; se Asia; Atlantic Islands (Canary Islands, Kerguelen Island, Madiera Island).

*Andreaea heinemannii* is a relatively small species in the genus, having irregularly divergent leaf apices of a flat subula. The weak costa commonly does not reach the leaf insertion, and this species may be mistaken for *A. rupestris*.

9. *Andreaea megistospora* B. M. Murray, Bryologist 90: 18, figs. 9–23, 25–28. 1987



*Andreaea megistospora* var. *epapillosa* (B. M. Murray) H. A. Crum & L. E. Anderson;  
*A. megistospora* subsp. *epapillosa* B. M. Murray

**Plants** brown to black. **Leaves** erect-spreading or secund, subulate-lanceolate from an ovate base, widest in proximal half of

leaf, apex symmetric; costa present, percurrent and sometimes filling the leaf apices, strong but narrow, bulging abaxially, usually reaching the leaf insertion; leaf margins entire or occasionally weakly crenulate; basal laminal cells quadrate to short-rectangular, marginal cells mostly rounded-quadrate, walls weakly pitted-sinuose; medial laminal cells rounded-quadrate, 1-stratose or 2-stratose in patches or completely, lumens rounded; laminal papillae smooth to papillose. **Sexual condition** cladautoicous or gonioautoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** (40–)50–90 (–110)  $\mu\text{m}$ .

Acidic rock; low to moderate elevations; B.C.; Alaska, Wash.; nw Europe.

*Andreaea megistospora* is distinguished from the similar *A. rothii* by its large spores, and may simply prove to be a large form of the latter. The variety *epapillosa* is a minor variant commonly occurring in mixture with the typical variety, and doubtfully warrants a name.

10. *Andreaea rothii* F. Weber & D. Mohr, Bot. Taschenbuch, 386, plate 11, figs. 7, 8. 1807



*Andreaea crassinervia* Bruch;  
*A. huntii* Limpricht; *A. rothii* var. *crassinervia* (Bruch) Mönkemeyer

**Plants** brown to black. **Leaves** erect-spreading, occasionally secund, broadly subulate from an ovate base, widest in proximal half of leaf, apex symmetric; costa present, percurrent and usually

filling the leaf apices, moderately differentiated to strong, terete, reaching the leaf insertion; leaf margins entire or occasionally weakly crenulate; basal laminal cells quadrate to occasionally short-rectangular, marginal cells mostly quadrate or rounded, walls usually sinuose; medial laminal cells quadrate, 1-stratose to nearly completely 2-stratose, lumens rounded-quadrate; laminal papillae rare, low. **Sexual condition** clad- or gonioautoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 35–60(–70)  $\mu\text{m}$ .

Siliceous rock, cliffs, boulders; low to high elevations; Greenland; B.C., N.B., Nfld. and Labr., N.S., Ont.; Ala., Alaska, Calif., Conn., Fla., Ga., Maine, Md., Mich., N.Y., N.C., Ohio, Oreg., Pa., Tenn., Vt., Va., Wash., W.Va.; n, c Europe.

H. A. Crum and L. E. Anderson (1981) did not recognize as *Andreaea crassinervia* those eastern North American specimens otherwise referable to *A. rothii* with excurrent or poorly defined costae (not bordered by laminal cells in the subula). B. M. Murray (1987) excluded *A. crassinervia* from the Arctic, while M. F. V. Corley et al. (1981) submerged it in *A. rothii*. The essentially European *A. rothii* var. *falcata* (Schimper) Lindberg (*A. rothii* var. *papillosa* Müller Hal.) is only poorly distinguished from the typical variety and does not warrant recognition here, at least on the basis of the single specimen reported for the flora area. The previously used traits of spore size and costa filling the acumen or not intergrade between those taxa.

rectangular, marginal cells grading to short-rectangular, walls usually sinuose, sometimes slightly pitted; medial laminal cells rounded-quadrate, 2-stratose entirely or in large patches except near costa where commonly 1-stratose, rarely 1-stratose throughout, lumens rounded; laminal papillae rare, low. **Sexual condition** cladautoicous; perichaetial leaves differentiated, convolute-sheathing. **Spores** 20–30  $\mu\text{m}$ .

Dry rock outcrops; moderate elevations; B.C.; Calif.

The small spores immediately separate *Andreaea schofieldiana* from the similar *A. rothii*.

**11. *Andreaea schofieldiana*** B. M. Murray, Bryologist  
90: 15, figs. 1–7. 1987 [E]



Plants greenish brown to brown-black. Leaves spreading, straight to secund, broadly subulate from an ovate base or lanceolate, widest in proximal half of leaf, apex symmetric; costa present, percurrent and usually filling the leaf apices, moderately differentiated to more often strong, terete, commonly reaching the leaf insertion; leaf margins entire or occasionally weakly crenulate; basal laminal cells