

XXX. SCAPANIA (Dumortier) Dumortier, Recueil Observ. Jungerm. 14. 1835 \* [Greek *scapanion*, spade, alluding to the shape of the perianth]

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**Stem** with 1--5-stratose, slightly to sharply defined cortex with walls slightly thickened to bastfiber-like, cells pigmented or not pigmented, usually with smaller lumen and thicker walls than intracortical cells. **Leaves** entire to dentate and ciliate distally or basally, with distinctly acute to occasionally rounded keel; ventral lobe rounded to ovoid and lingulate, rarely lanceolate, subtransversely or arcuately inserted, non-decurrent, short to long-decurrent; median leaf cells thin- to occasionally thick-walled, with indistinct to coarsely bulging trigones, (8--15--25(--35)  $\mu\text{m}$  wide; vittae never present; cuticle smooth to moderately and coarsely papillose. **Specialized asexual reproduction** by gemmae, 1--2(--4 or 8)-celled, ovoid to rarely angular, exceptionally spheric. **Sexual condition** dioicous (rarely monoicous). **Perianth** mostly compressed to occasionally inflated, contracted to truncate at mouth, eplicate to pluriplicate; mouth laciniate-ciliate to entire. **Androecia** on main shoot. **Capsule wall** 2--7-stratose. **Elaters** 2(--3)-spiral.

Species about 90--100 (37 in the flora): mainly Northern Hemisphere.

Identification of *Scapania* is made difficult by the strong plasticity of the species, rather exacting criteria for identification, and considerable dependence on plant maturity for manifestation of many characters (H. Buch 1928; R. M. Schuster 1974). It is thus important that identifications be determined by a combination of many characters, of which some characters require special definitions. The shape of leaf lobes is given here by their width/length ratio. Lobe length corresponds to the length of the line segment from the lobe apex through the keel curvature to the stem; lobe width is a perpendicular to the line of lobe length in the broadest lobe sector. Length of a leaf lobe or gemma is measured from the point of connection with the plant, and is not simply the longest dimension. Often width of leaf lobes is greater than length. Lobe angle is the angle between the line defining the lobe length and the stem. Considerable variability of lobe angle persuades me to avoid exact measurements and use subjective definitions. When it is small (to ca.  $25^\circ$ ), the lobe is considered to be subparallel to the stem. If it is mostly larger, the lobe is described as divergent with the stem. Dorsal and ventral lobes are described as subparallel to each other when their angles with the stem differ slightly. The keel is usually an angulate area of leaf fold between lobes. It forms a lower lobe margin, grading occasionally into a keel wing, i. e., a strip several cells broad proximal to the keel. The keel is measured from its insertion to its distal end. When the keel is strongly arched such a measurement may represent a sum of lengths of several line segments. Degree of its change from keel base to distal end predetermines keel curvature identification, i. e., keel indistinctly, moderately or strongly arched.

Oil body characters are very useful in identifying fresh material. Oil body persistence is also a convenient character for identification of herbarium materials. In some species oil bodies persist for a very long time, often for 50--100 years. In most species, however, oil bodies disintegrate in several months after collecting; oil bodies usually are preserved in the herbarium longer if the specimens were dried gradually in natural conditions without special devices such as a dryer and freezer. Moistening of dried specimens may lead to quick oil body disintegration.

The degree of plant maturity affects the size of the plants, leaf measurements and proportions. Juvenile plants usually have more narrow leaf lobes, and slightly arched and often relatively longer keels (because of shorter ventral lobe). In the Arctic some species may exist as immature or impoverished phenotypes. This often hampers their correct identification. In such cases, oil body characteristics and field observations are particularly important. For detailed descriptions of Arctic *Scapania* see R. M. Schuster (1974, 1988), and R. M. Schuster and K. Damsholt (1974).

The infrageneric classification and the order of infrageneric taxa accepted below follows mainly A. D. Potemkin (2002) except the genus *Macrodiplophyllum* (H. Buch) Persson, which is treated separately in this flora.

North American *Scapania* species fall into 13 sections. Species 1--3 are sect. *Nemorosae* (K. Müller (Freiburg)) Buch, species 4 sect. *Gracilidae* Buch, species 5--6 are sect. *Aequilobae* (K. Müller (Freib.)) Buch; species 7 belongs to sect. *Compactae* (K. Müller (Freiburg)) Buch; species 8--10 are sect. *Callicolae* Schuster; species 11--12 are sect. *Planifoliae* (K. Müller (Freiburg)) Potemkin; species 13--15 are sect. *Ciliatae* Grolle; species 16--20 are sect. *Scapania*; species 21 and 22 belong to sect. *Cuspiduligerae* Buch and *Plicicalyx* (K. Müller (Freiburg)) Potemkin respectively; species 23--30 are sect. *Curtae* (K. Müller (Freiburg)) Buch; species 34--36 are sect. *Scapaniella* (Buch) Potemkin; species 37 belongs to sect. *Incurvae* Potemkin. Because of within-group variability, a key to species is given rather than to sections. The species known for the flora only on the basis of doubtful records are marked by asterisks (\*).

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1. Keel rounded at least basally.

Marginal sector of ventral leaf base hyaline, without chloroplasts and oil bodies. . . . .  
 . .21. *Scapania cuspiduligera*

2. Marginal sector of ventral leaf base not hyaline, its cells having chloroplasts and oil bodies.  
 3. Ventral lobe distinctly decurrent proximal to the keel insertion . . .17. *Scapania obscura*  
 (in part)

3. Ventral lobe not decurrent proximal to keel insertion, subtransversely or arcuately inserted .
4. Marginal cells of mature non-gemmiparous leaves thin-walled like median cells.
5. Ventral lobes broader, (0.6--0.75--1.2 times as wide as long, rounded to blunt at apex.
6. Often monoicous; trigones variable, acute to bulging; purple pigmentation absent; dorsal lobe mostly 0.9--1.2 times as wide as long and extending to far edge of stem and occasionally beyond (if dorsal lobe 0.55--0.9 times as wide as long, then not extending to far edge of stem) . . . . .7. *Scapania compacta* (in part)
6. Dioicous; trigones acute; purple pigmentation of ventral leaf base common; dorsal lobe 0.6--0.95 times as wide as long, not extending to far edge of stem.
7. Leaves entire or crenulate from gemma production, never denticulate; gemmae broadly ovoid, 12--24 x 14--36  $\mu\text{m}$ , green to purple . . . . .
- .28. *Scapania obcordata*
7. Leaves more or less often denticulate distally; gemmae more or less narrowly ovoid, 11--20 x 18--38  $\mu\text{m}$ , green, sometimes reddish in sun . . . . .
- . . . . .27. *Scapania curta* (in part)
5. Ventral lobes narrower 0.4--0.75(--0.8) times as wide as long, more or less sharply apiculate.
8. Specialized asexual reproduction by gemmae uniformly 1-celled, smaller, 7--11 x 11--18  $\mu\text{m}$ ; ventral lobe narrow, 0.45--0.6 times as wide as long; xylicolous . . . . .36. *Scapania apiculata* (in part)
8. Specialized asexual reproduction by gemmae 2-celled, larger, 10--19 x 15--36  $\mu\text{m}$ ; ventral lobe broader, 0.62--0.8 times as wide as long; on soil and rocks, rarely xylicolous.
9. Leaves upturned; marginal cells distinctly smaller than median. Usually on soil . .25. *Scapania zemliae* (in part)
9. Leaves not upturned; marginal cells almost not differentiated from median in size. On rocks, and decaying wood, occasionally on soil. . . . .23. *Scapania mucronata* (in part)
4. Marginal cells of mature non-gemmiparous leaves more thick-walled than median cells.
10. Ventral lobe broader, 0.6--0.95 times as wide as long; purple pigmentation of leaves occurs sporadically; gemmae green, red or brown; on soil.
11. Marginal cells distinctly smaller than median in size; dorsal lobe triangular and sharp pointed to mucronate at apex; purple pigmentation of leaves absent; gemmae common, mostly red or brown in sun . . . . .25. *Scapania zemliae* (in part)
11. Marginal cells hardly different from median in size; dorsal lobe rounded in blunt to mucronate apex; purple pigmentation of leaves frequent, at least near bases of ventral lobes; gemmae sporadic, green, sometimes reddish in sun . . . . .
- . . . . .27. *Scapania curta* (in part)
10. Ventral lobe more narrow, 0.45--0.6 (--0.7) times as wide as long, never purplish; gemmae reddish brown; mostly xylicolous, occasionally on sandstone and rocks.
12. Specialized asexual reproduction by gemmae mainly 1-celled at maturity; marginal leaf cells subisodiametric to tangentially elongated. . . . .35. *Scapania carinthiaca*

12. The majority of gemmae 2-celled at maturity; marginal leaf cells mostly subisodiametric . . . . .34. *Scapania glaucocephala*
1. Keel acute from base to sinus or absent.
13. Keel uniformly less than 0.05 times the length of ventral lobe or absent . . .12. *Scapania ornithopoides*
13. Keel usually more than 0.05 times the length of ventral lobe.
14. Ventral lobe decurrent proximal to keel insertion.
15. Marginal teeth spreading to bases of one or both lobes.
16. Terminal tooth cell slightly elongated, mostly to 1.5(--1.8) as long as wide.
17. Keel broadly winged, often dentate; dorsal lobe base never with branched teeth; purple pigmentation of ventral leaf base common; perianth mouth dentate like leaf margin . . . . .15. *Scapania undulata* (in part)
17. Keel narrowly winged and entire in American plants; dorsal lobe base mostly with branched teeth; purple pigmentation absent; perianth mouth lobulate-dentate . . . 4. *Scapania bolanderi* (in part)
16. Terminal tooth cell slender, mostly over 1.8 times as long as wide.
18. Keel moderately to strongly arched, wing more or less broad, often dentate . . . . .15. *Scapania spitsbergensis*
18. Keel indistinctly to moderately arched, wing narrow, entire . .13. *Scapania americana*
15. Marginal teeth not spreading to lobe bases or absent.
19. Dorsal lobe (0.3--0.65--0.95 times the size of ventral lobe; cuticle coarsely to slightly papillose (if dorsal lobe 0.3--0.65 times the size of the ventral, cuticle coarsely papillose).
20. Cuticle coarsely papillose.
21. Dorsal lobe 0.3--0.75 times the size of the ventral . . . . .5. \**Scapania aspera*
21. Dorsal lobe 0.75--0.95 times the size of the ventral.
22. Lobes 0.9--1.1 times as wide as long , strongly turned backward; trigones mostly large, nodose . . . . .11. *Scapania simmonsii* (in part)
22. Lobes 0.5--0.8 times as wide as long, stiffly spread from each other; trigones mostly small, acute to slightly bulging . . . . .22. *Scapania hians*
20. Cuticle moderately to slightly papillose.
23. Leaves strongly turned backward; dorsal lobe 0.75--0.95 times the size of the ventral . . . . .11. *Scapania simmonsii* (in part)
23. Leaves never strongly turned backward; dorsal lobe 0.65--0.8 times the size of the ventral.
24. Leaves invariably entire; keel wing absent; secondary pigmentation fuscous . . . . .17. *Scapania obscura* (in part)
24. Leaves dentate; keel wing narrow; secondary pigmentation red to brown.
25. Median cells with small acute trigones; marginal cells mostly thick-walled, sporadically thin-walled, 16--22  $\mu\text{m}$  where subisodiametric . . . . .16. *Scapania subalpina*
25. Median cells with bulging trigones; marginal cells mostly thin-walled, 20--26(--28)  $\mu\text{m}$  where subisodiametric . . . . .19. *Scapania serrulata*

19. Dorsal lobe 0.25-- 0.65(--0.7) times the size of the ventral; cuticle never coarsely papillose.
26. Dorsal lobe subparallel to stem; keel moderately to strongly arched, shorter, (0.05--)0.15--0.35 times the size of ventral lobe . . . . . 20. *Scapania uliginosa*
26. Dorsal lobe divergent with stem; keel indistinctly to moderately arched, longer, 0.25--0.55 times the size of ventral lobe.
27. Terminal tooth cell 2--3 times as long as wide; gemmae common, 1-celled, brown . . . . . 3. *Scapania nemorea*
27. Terminal tooth cell to 1.5 times as long as wide; gemmae sporadic to common, 2-celled, green to purple in sun or reddish brown.
28. Lobes broadly rounded to weakly pointed at apex; gemmae broadly ovoid, 10--17 x 12--23  $\mu\text{m}$ , green to purplish in sun; median cells with indistinct to moderate acute trigones; larger, 15--200 x 1.5--4.5 mm. . . . . 15. *Scapania undulata* (in part)
28. Lobes triangular and sharply pointed at apex; gemmae bacilliform to narrowly ovoid, 7--11 x 15--27  $\mu\text{m}$ , reddish brown; median cells with moderate acute to bulging trigones; smaller, 5--20 x 0.5--2.5 mm. . . . . 1. *Scapania umbrosa* (in part)
14. Ventral lobe subtransversely inserted or decurrent to keel insertion.
29. Dorsal lobe 0.75--0.95 times the size of ventral.
30. Leaves incurved and upturned; monoicous . . . . 37. *Scapania kaurinii* (in part)
30. Leaves never incurved and upturned; dioicous and monoicous.
31. Cuticle coarsely papillose; dioicous; perianth mouth lobulate-dentate . . . . . 6.\* *Scapania aequiloba*
31. Cuticle slightly to moderately papillose; monoicous and dioicous; perianth mouth entire to dentate . . . . . 7. *Scapania compacta* (in part)
29. Dorsal lobe less than 0.75 times the size of ventral.
32. Branched teeth common near dorsal lobe base . . . . 4. *Scapania bolanderi* (in part)
32. Teeth absent basally.
33. Ventral lobe mostly more than 0.85 times as wide as long.
34. Specialized asexual reproduction by gemmae usually present, mostly or entirely 1-celled; oil bodies usually persistent . . . . . 2. *Scapania brevicaulis* (in part)
34. Specialized asexual reproduction by gemmae unknown or occasionally present, mostly 2-celled; oil bodies usually not persistent/
35. Marginal cells more or less thick-walled; plants green to slightly brownish; gemmae unknown . . . . . 14. *Scapania hollandiae* (in part)
35. Marginal cells thin-walled; plants usually more or less brown to green or sometimes reddish or purplish-brown; gemmae occasionally present.
36. Dorsal lobe decurrent, extending far beyond stem, subparallel to slightly divergent with it . . . . . 33. *Scapania paludicola*
36. Dorsal lobe not decurrent, not or slightly extending beyond stem, divergent with it.
37. Keel wing mostly absent or indistinct.
38. Dorsal lobe 0.5--0.75(--0.8) times the size of ventral; gemmae broadly ovoid, 10--21 x 12--31(--33)  $\mu\text{m}$ , green to brown and

- purple; median cells with mostly bulging trigones . . . . .
- .32. *Scapania hyperborea*
38. Dorsal lobe 0.5--0.6 times the size of ventral; gemmae narrowly ovoid, 9--12 x 20--28  $\mu\text{m}$ , green; median cells with acute to bulging trigones .31. *Scapania irrigua*
37. Keel with mostly distinct, narrow to rarely broad wing.
39. Paroicous; leaves mostly upturned and incurved; keel wing narrow; trigones small to slightly bulging. . . . .37. *Scapania kaurinii* (in part)
39. Dioicous; leaves rarely upturned and incurved; keel wing narrow or rarely broad; trigones moderate to strongly bulging.
40. Leaf margin mostly irregularly dentate distally; keel wing more or less broad, often dentate; marginal cells large, 23--32  $\mu\text{m}$  where subisodiametric; gemmae broadly ovoid, green to purple and brown. . . . .32. *Scapania hyperborea*
40. Leaf margin denticulate distally to entire; keel wing more or less narrow, entire; marginal cells smaller, 15--20  $\mu\text{m}$  where subisodiametric; gemmae mostly elliptical-fusiform, brown . . . . .2. *Scapania brevicaulis* (in part)
33. Ventral lobe mostly less than 0.85 times as wide as long.
41. Mature gemmae 1-celled, common.
42. Specialized asexual reproduction by gemmae green . . . . .30. *Scapania fulfordiae*
42. Specialized asexual reproduction by gemmae pigmented, red or brown.
43. Oil bodies persistent; median cells with small acute to moderate bulging trigones; on soil . . . . .2. *Scapania brevicaulis* (in part)
43. Oil bodies not persistent; median cells with large bulging to moderate acute trigones; xylicolous . . . . .36. *Scapania apiculata*
41. Mature gemmae 2-celled, common, sporadic or unknown.
44. Marginal sector of ventral lobe base hyaline, without oil bodies and chloroplasts; oil bodies persistent; gemmae common.
45. Specialized asexual reproduction by gemmae more narrow and short, 12--17 x 20--32  $\mu\text{m}$ ; marginal cells thin-walled . . . . .10. *Scapania gymnostomophila*
45. Specialized asexual reproduction by gemmae usually broader and longer, (14--16--24 x 25--40  $\mu\text{m}$ ; marginal cells thick- to thin-walled.
46. Leaves entire to crenulate-denticulate (usually a few leaves with isolated teeth on every plant); gemmae green to brownish; perianth mouth subentire to denticulate . . . . .8. *Scapania pseudocalcicola*
46. Leaves (except female bracts) entire; gemmae yellowish to deep brown or reddish brown; perianth mouth laciniate-dentate . . . . .9. *Scapania ligulifolia*
44. Marginal sector of ventral lobe base not hyaline, with oil bodies and chloroplasts; oil bodies not persistent; gemmae frequent or unknown.
47. Marginal leaf cells thick-walled.
48. Dorsal lobe extending to far edge and often beyond stem; purple pigmentation absent; plants larger, 1.8--4.5 mm wide . . . . .14. *Scapania hollandiae* (in part)

48. Dorsal lobe not extending to far edge of stem; purple pigmentation frequent; plants smaller, 1--2.5(--3) mm wide.
49. Dorsal lobe distinctly divergent with stem; keel longer, 0.45--0.7 times the length of ventral lobe.
50. Leaves entire to denticulate distally; dorsal lobe 0.5--0.85 times the size of ventral, rounded in blunt to mucronate apex; gemmae more or less narrowly ovoid . . . . .27. *Scapania curta* (in part)
50. Leaves mostly denticulate to irregularly coarsely dentate distally; dorsal lobe 0.4--0.75 times the size of ventral, more or less triangular and pointed in apiculate to mucronate apex; gemmae variable in shape, from narrowly elliptic to broadly ovoid and obtusely angulate . . . .26. *Scapania lingulata* (in part)
49. Dorsal lobe subparallel to slightly divergent with stem; keel shorter, 0.25--0.5 times the length of ventral lobe.
51. Specialized asexual reproduction by gemmae reddish brown, bacilliform to narrowly ovoid, 7--11 x 15--27  $\mu\text{m}$  . . . . .  
.1. *Scapania umbrosa* (in part)
51. Specialized asexual reproduction by gemmae green, more or less narrowly ovoid, 7--13 x 18--25  $\mu\text{m}$  . . .5. *Scapania scandica* (in part)
47. Marginal leaf cells thin-walled.
52. Leaves usually incurved and upturned; paroicous. . . .37. *Scapania kaurinii* (in part)
52. Leaves not incurved and upturned; dioicous.
53. Dorsal lobe subparallel to slightly divergent with stem; keel shorter, 0.25--0.5 times the length of ventral lobe.
54. Specialized asexual reproduction by gemmae, reddish brown, bacilliform to narrowly ovoid, 7--11 x 15--27  $\mu\text{m}$  . . . . .  
. .1. *Scapania umbrosa* (in part)
54. Specialized asexual reproduction by gemmae, green, more or less narrowly ovoid, 7--13 x 18--25  $\mu\text{m}$  . . .29. *Scapania scandica* (in part)
53. Dorsal lobe distinctly divergent with stem; keel longer, 0.5--0.7 times the length of ventral lobe.
55. Marginal cells larger, 18--28  $\mu\text{m}$  where subsodiametric.
56. Leaves entire to denticulate distally; dorsal lobe 0.5--0.85 times the size of ventral, rounded in blunt to mucronate apex; gemmae more or less narrowly ovoid . . . . .27. *Scapania curta* (in part)
56. Leaves mostly denticulate to irregularly coarsely dentate distally; dorsal lobe 0.4--0.75 times the size of ventral, more or less triangular and pointed in apiculate to mucronate apex; gemmae variable in shape, from narrowly elliptic to broadly ovoid and obtusely angulate . . . .26. *Scapania lingulata* (in part)
55. Marginal cells smaller, 14--19  $\mu\text{m}$  where subsodiametric.
57. Dorsal lobe of mature leaves blunt to rounded at apex . . .7.  
\**Scapania helvetica*

57. Dorsal lobe of mature leaves apiculate to mucronate at apex .23. *Scapania mucronata* (in part)

**1. *Scapania umbrosa*** (Schrader) Dumortier, Recueil Observ. Jungerm. 14. 1835

*Jungermannia umbrosa* Schrader, Syst. Samml. Krypt. Gew. (2): 5. 1797

**Plants** 5--20 x 0.5--2.5 mm, green to reddish brown. **Leaves** usually more or less serrate distally, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.5 times the size of ventral, 0.5--0.7 times as wide as long, subtransversely inserted, not extending to far edge of stem, subparallel to it to slightly divergent, usually triangular and sharply pointed at apex; ventral lobe 0.45--0.65 times as wide as long, decurrent proximal to keel insertion to arcuately inserted, usually triangular and sharply pointed at apex, not hyaline near base margin; keel 0.25--0.45 times the length of ventral lobe, acute, indistinctly arched, wing often narrow, entire. **Median leaf cells** with moderate acute to bulging trigones; marginal cells often thick-walled, 14--19  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle moderately papillose. **Specialized asexual reproduction** by gemmae, frequent, reddish brown, 2-celled, bacilliform to narrowly ovoid, 7--11 x 15--27  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth entire.

Rotten wood and wet rocks in places with perpetually high atmospheric humidity in non-Arctic areas mostly of the eastern and western coasts; 0--1200 m; St. Pierre and Miquelon; B.C., N.B., Nfld., N.S., Ont., Que.; Alaska, Calif., Idaho, Maine, Mont., N.H., N.Y., Oreg., Wash., Wis.; Europe; Asia (Turkey, South Siberia, Sakhalin, Kamchatka ); Atlantic Islands.

There are no records of *Scapania umbrosa* for P.E.I. although the species may be expected to occur there. The most distinctive character of *Scapania umbrosa* is unique in *Scapania*, being bacilliform to narrowly ovoid, reddish brown gemmae. The species is exceedingly variable in the degree of ventral lobe decurrency, leaf dentition, and intensity of gemma production. Poor development of gemmae or their absence may result in confusion of *S. umbrosa* with *S. scandica* and with small forms of *S. undulata*. In such cases a complex analysis of characters and of their correlative variability is important. Non-gemmiparous *S. umbrosa* is usually distinct from *S. scandica* in leaf lobes being weakly divergent with each other and from small forms of *S. undulata* in more or less gradually triangular and sharply pointed lobe apices (vs. more or less rounded lobe apices).

**2. *Scapania brevicaulis*** Taylor, London J. Bot. 5: 272. 1846

*Scapania arnellii* Buch; *S. degenii* Schiffner ex K. Müller (Freiburg)

**Plants** 5--50 x (0.5--)0.8--4 mm, green to fuscous, rarely purplish postically. **Leaves** entire to dentate distally, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.5--0.75 times the size of ventral, 0.5--1.4 times as wide as long, subtransversely inserted, sometimes extending to far edge of stem or slightly beyond it, divergent with stem, obtusely to acutely pointed; ventral lobe 0.45--1.0(--1.12) times as wide as long, arcuately to subtransversely inserted, rounded to mucronate at apex, not hyaline near base margin; keel 0.3--0.65 times the length of ventral lobe, acute, indistinctly to strongly arched, wing narrow in robust forms, entire. **Median leaf cells** with small acute to moderate bulging trigones; marginal cells not differentiated, 15--20  $\mu\text{m}$  where subisodiametric; oil bodies mostly persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae usually present, brown, 1(--2)-celled, mostly

elliptical-fusiform, 10--16(--18) x 12--25(--28)  $\mu$ m. **Sexual condition** dioicous. **Perianth** more or less compressed, mouth shortly dentate to entire.

Tundra and alpine communities, mostly on slightly calcareous soil; 0--3000 m; Greenland; Alta., B.C., Man., Nfld., N.W.T., [[Nun.?]] Ont., Que.; Alaska, Colo., Minn., Mont., N.H.; Eurasia.

There are no records of *Scapania brevicaulis* for the Yukon although the species may be expected to occur there. The elevational range of *S. brevicaulis* is incompletely known. Problems of differentiation of *S. brevicaulis* are considered under *S. hyperborea* and *S. carinthiaca*. It may also be confused with *S. nemorea* subsp. *crassiretis*. Main distinctions from the latter are ventral lobes decurrent to keel insertion; moderately to strongly arched keel of robust plants (vs. indistinctly arched keel); at most moderate bulging (vs. large bulging) trigones; slightly elongated (to 1.5 times as long as wide) terminal tooth cells; and usual absence of purple pigmentation of ventral lobe bases (vs. usual presence of it). The leaves of *S. brevicaulis* are occasionally upturned. The synonymy of *S. brevicaulis* follows A. D. Potemkin (1999). Its robust broad leaved and most common phenotypes were previously treated as *S. degenii*.

### 3. *Scapania nemorea* (Linneaus) Grolle, Rev. Bryol. Lichenol.32: 160. 1963

*Jungermannia nemorea* Linneaus, Syst. nat. (ed.10) 2: 1337. 1759; *Scapania crassiretis* Bryhn; *S. nemorosa* (Linneaus) Dumortier

**Plants** 10--100 x 1.2--5.5 mm, green to fuscous and purplish brown. **Leaves** dentate distally, terminal tooth cell 2--3 times as long as wide; dorsal lobe 0.25--0.7 times the size of ventral, 0.8--1.4 times as wide as long, decurrent to arcuately inserted, extending to far edge of stem or slightly beyond it, divergent with stem, apiculate to bluntly pointed at apex; ventral lobe 0.55--1.0(--1.1) times as wide as long, decurrent proximal to keel insertion, broadly rounded to bluntly pointed at apex, not hyaline near base margin; keel 0.25--0.55 times the length of the length of the ventral lobe, acute, indistinctly to moderately arched, wing narrow to broad, rarely dentate. **Median leaf cells** with small acute to large bulging trigones; marginal cells often thick-walled, 10--20  $\mu$ m where subisodiametric; oil bodies occasionally persistent; cuticle moderately papillose. **Specialized asexual reproduction** by gemmae, common, brown, almost invariably 1-celled, ellipsoid, (7--8--13 x 12--22  $\mu$ m). **Sexual condition** dioicous. **Perianth** compressed, mouth dentate-ciliate to sparsely dentate and entire.

Subspecies 2 (2 in the flora): Greenland; Canada; United States; Eurasia; Atlantic Islands.

1. Dorsal lobe 0.25--0.5 times the size of ventral, mostly long-decurrent; leaves often coarsely dentate and then with teeth in distal parts of leaves mainly 2-celled at base; median leaf cells mostly with small to moderate trigones and non-persistent oil-bodies; perianth mouth dentate-ciliate to sparsely dentate. . . .3a. *Scapania nemorea* subsp. *nemorea*

1. Dorsal lobe 0.4--0.7 times the size of ventral, arcuately inserted to short-decurrent; leaves usually slightly dentate, with slender 1--2(3)-celled teeth 1-celled at base, or entire; median leaf cells with mostly large bulging trigones and persistent oil-bodies; perianth mouth sparsely dentate or entire. . . . .3b. *Scapania nemorea* subsp. *crassiretis*

#### 21a. *Scapania nemorea* (Linneaus) Grolle subsp. **nemorea**

**Leaves** often coarsely dentate and then with teeth in distal part of leaves mainly 2-celled at base; dorsal lobe 0.25--0.5 times the size of ventral, mostly long-decurrent. **Median leaf cells** usually with small acute to moderate, slightly bulging trigones; oil bodies mostly not persistent. **Perianths** common, mouth dentate-ciliate to sparsely dentate.

Exceedingly broad ecological amplitude, soil, rocks, decaying wood, bases of trees; 0--2000 m; Greenland?; St. Pierre and Miquelon; N.B., Nfld., N.S., Ont., Que.; Ala., Ark., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Nebr., N.H., N.J., N.Y., N.C., Ohio, Okla., Pa., R. I., S. C., Tenn., Tex., Vt., Va., W. Va., Wis.; Europe; Asia (Turkey); Atlantic Islands.

There are no records of *Scapania nemorea* subsp. *nemorea* for P.E.I. although the subspecies may be expected to occur there. The known Greenland material is certainly *S. nemorea*. It was found in Plantae Groenlandicae a Museo botanico Hauensi distributae as not well developed *S. gracilis* Lindb.; the collector and locality were not mentioned, but the specimen was annotated by R. M. Schuster in July 1954 as *S. nemorosa*. I, as well as R. M. Schuster (1974: 581), who cited no Greenland collection for *S. nemorosa*, doubt if the label corresponds to the specimen. Despite rather many reports of this subspecies from the Arctic, no identification has been confirmed. Distinction of *S. nemorea* subsp. *nemorea* from *S. undulata* is discussed under the latter taxon.

**21b. Scapania nemorea** subsp. **crassiretis** (Bryhn) Potemkin, J. Hattori Bot. Lab. 77: 277. 1994

*Scapania crassiretis* Bryhn, Rev. Bryol. 19: 7. 1892

**Leaves** slightly dentate, with slender 1--2(--3)-celled teeth 1-celled at base; dorsal lobe 0.4--0.7 times the size of ventral, arcuately inserted to short-decurrent. **Median leaf cells** with mostly large bulging trigones; oil bodies often persistent. **Perianths** rare, mouth sparsely dentate to entire.

Rocks and soil in the Arctic, spreading southward in mountains of Europe and East Siberia; 0--2000 m; Greenland; N.W.T., Que., Yukon; Alaska; Eurasia.

*Scapania nemorea* subsp. *crassiretis* may be confused with robust forms of *S. brevicaulis* (known as *S. degenii*). Their distinction is considered under *S. brevicaulis*. There is some similarity with *S. simmonsii* as well. The last, however, never produces gemmae, has larger dorsal lobes, slightly elongated terminal tooth cells, no purple pigmentation, a moderately arched keel, and often has a coarsely papillose cuticle. On the basis of molecular studies by Vilnet *et al.*, (2010) and Heinrichs *et al.* (2012) this subspecies is treated as a separate species *Scapania crassiretis*.

**4. Scapania bolanderi** Austin, Proc. Acad. Nat. Sci. Philadelphia (1869) 21: 218. 1870

*Scapania granulifera* Evans

**Plants** 10--50 x 1.5--3.5 mm, green to brown. **Leaves** dentate basally, near dorsal lobe base particularly, basal teeth often branched, terminal tooth cell 1.3--1.8 times as long as wide; dorsal lobe 0.3--0.6(--0.75) times the size of ventral, 0.85--1.1 times as wide as long, arcuately inserted, extending to far edge of stem or slightly beyond it, divergent with it, sharply to obtusely pointed

at apex; ventral lobe 0.5--0.75 times as wide as long, decurrent to or proximal to keel insertion, rounded to triangular and pointed at apex, not hyaline near base; keel 0.2--0.35 times the length of ventral lobe, acute, indistinctly arched, wing normally narrow, entire. **Median leaf cells** with moderate acute to bulging trigones; marginal cells thick- to thin-walled, 10--18  $\mu\text{m}$  where subisodiametric; oil bodies often persistent; cuticle slightly to rather coarsely papillose. **Specialized asexual reproduction** by gemmae sporadic, green, 2-celled, ellipsoid, 10--12 x 20--26  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** compressed, mouth lobulate-ciliate.

Rotten wood, bark of living trees, mainly gymnosperms, rarely also on soil in forested areas of western North America; 0--1500 m; B.C.; Alaska, Calif., Idaho, Oreg., Wash.; Asia (China, Japan, Russian Far East).

*Scapania bolanderi* is distinct from the other North American species of *Scapania* in its common development of branched teeth near the dorsal lobe base. Branched teeth infrequently occur near the dorsal lobe base of *S. spitsbergensis* and *S. ornithopoides*. The former, however, is distinct from *S. bolanderi* in paroicous sex distribution, common purple pigmentation and a keel with broad often dentate wing. The latter is isolated in its indistinct vestigial keel less than 0.05 times the length of the ventral lobe.

##### 5. \**Scapania aspera* M. & H. Bernet, Bernet H., Cat. Hép. S.-O. Suisse 42. 1888

**Plants** 10--50 x 1.5--5 mm, green to brown and brownish purple. **Leaves** dentate distally, terminal tooth cell 1.3--2 times as long as wide; dorsal lobe 0.3--0.75 times the size of ventral, 0.8--1.4 times as wide as long, decurrent to arcuately inserted, extending to far edge of stem or slightly beyond it, divergent with stem, pointed to almost cuspidate at apex; ventral lobe 0.6--0.9 times as wide as long, decurrent proximal to keel insertion, rounded to mucronate at apex, not hyaline near base margin; keel 0.3--0.65 times the length of ventral lobe, acute, indistinctly to moderately arched, wing occasionally narrow, entire. **Median leaf cells** with small to moderate acute, rarely bulging trigones; marginal cells more or less thick-walled, 12--20  $\mu\text{m}$  where subisodiametric; oil bodies occasionally persistent; cuticle more or less coarsely papillose. **Specialized asexual reproduction** by gemmae sporadic, green, 2-celled, ovoid to slightly angulate, 14--20 x 19--40  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** moderately compressed, mouth lobulate-dentate.

Habitats, elevation, and distribution of *Scapania aspera* in the area of the flora remain unclear; Nunavut (Baffin Island).

Mostly on calcareous soil and rocks in Europe; altitudinal range outside the territory of the flora 0--1500 m; range outside the territory of the flora; Europe; Asia (Turkey, SE China).

The only report of *Scapania aspera* for North America, from Baffin I. (N. Polunin 1947: 509), is based on identification by W. R. Sherrin, and is doubtful (R. M. Schuster 1974: 612). The specimen was unavailable for study. Recent finds of *S. aspera* in the northern East Siberia (E. Borovichev et al., 2016 unpublished; <http://kpabg.ru/h/?q=node/41912>) point out that its range is still imperfectly known and imply a possibility of its occurrence in northern North America. *Scapania aspera* may be confused there with *S. americana* from which the former differs in its entire ventral lobe base, coarsely papillose cuticle, less elongated terminal tooth cell (1.3--2.0 vs. 1.8--2.2 times as long as wide), and calciphilous ecology.

6. \**Scapania aequiloba* (Schwägrichen) Dumortier, Recueil Observ. Jungerm., 14. 1835

*Jungermannia aequiloba* Schwägrichen, Hist. Musc. Hep. Prodr., 24. 1814

**Plants** 10--50 x 1.5--3 mm, green to brown. **Leaves** dentate distally, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.75--0.95 times the size of ventral, 0.6--1.0 times as wide as long, arcuately inserted, extending to far edge of stem or slightly beyond it, divergent with stem, triangular and pointed at apex; ventral lobe 0.55--0.8 times as wide as long, arcuately inserted, triangular and pointed at apex, not hyaline near base margin; keel 0.5--0.75 times the length of ventral lobe, acute, indistinctly to moderately arched, wing occasionally narrow, entire. **Median leaf cells** with moderate, mostly acute trigones; marginal cells thick-walled, 10--16  $\mu\text{m}$  where subisodiametric; oil bodies occasionally persistent; cuticle coarsely papillose. **Specialized asexual reproduction** by gemmae sporadic, green, 2-celled, ovoid to slightly angulate, 10--17 x 20--30  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** moderately compressed, mouth lobulate-dentate.

Habitats, elevation, and distribution of *Scapania aequiloba* in the range of the flora remain to be unclear; Greenland; Nunavut (Ellesmere Island); Europe; Asia (Turkey).

*Scapania aequiloba* has been reported from Ellesmere Isl. (N. Bryhn 1906) and W. Greenland (K. Müller 1951--1958). Reports of this basically temperate and warm-temperate *S. aequiloba* from the high Arctic are extremely doubtful. Found among Mitten's collections at NY, the specimen of rather typical *S. aequiloba*, labeled "NW America, Plover Bay." This is virtually the only reason to keep the species in the Flora. Outside the territory of the flora the species occurs on calcareous soil and rocks, occasionally on rotten wood; to 2600 m. The leaves of *S. aequiloba* have lobes mostly stiffly spreading from each other.

7. *Scapania compacta* (A. W. Roth) Dumortier, Recueil Observ. Jungerm. 14. 1835

*Jungermannia compacta* A. W. Roth, Tentam. Fl. Germ. 375. 1800

**Plants** 3--50 x 1.2--4 mm, green to brown. **Leaves** entire to denticulate distally; dorsal lobe 0.75--0.95 times the size of ventral, 0.55--1.2 times as wide as long, subtransversely inserted, often extending to far edge of stem and occasionally beyond it, divergent with stem, rounded to obtusely pointed at apex; ventral lobe 0.6--1.2 times as wide as long, arcuately inserted, rounded to obtusely pointed at apex, not hyaline near base margin; keel 0.5--0.75 times the length of ventral lobe, rounded to subacute basally, acute near sinus, indistinctly arched, wing absent. **Median leaf cells** with small acute to moderate slightly bulging trigones; marginal cells not differentiated, 15--20  $\mu\text{m}$  where subisodiametric; oil bodies occasionally persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae sporadic, green to brown, 2-celled, broadly ovoid, 16--21 x 23--32  $\mu\text{m}$ . **Sexual condition** monoicous and dioicous. **Perianth** mostly compressed, mouth entire to dentate.

Stream alluvium; 50 m; Alaska; Europe: Asia (Turkey); Africa; Atlantic Islands.

*Scapania compacta* is exceedingly variable in lobe width/length ratio, keel expression and perianth compression. Common forms are rather robust and have dorsal lobes suberect and extending to the far edge of the stem and occasionally beyond it, but the ventral lobe is turned backward; the keel is usually rounded basally and acute near the sinus only; and the perianth is

strongly compressed. Such plants may be confused with forms of *S. hyperborea* with large dorsal lobes. They differ from the latter in frequent monoicous sex distribution, specific orientation of lobes with respect to each other, inability to produce large bulging trigones and purple gemmae. Sporadic occurrence of rather small narrow-leaved forms with dorsal lobes not crossing the stem and variable perianth compression (K. Damsholt and D. Long 1981; A. D. Potemkin 1995) makes differentiation of *S. compacta* from *S. obcordata* problematic. Such forms are easy to distinguish from *S. obcordata* when monoicous sexuality is obvious. They may be distinct also from *S. obcordata* in the ability to produce distinct trigones of leaf cells, absence of purple pigmentation of leaves and gemmae, slightly saccate male bracts, and female bracts usually larger than adjacent sterile leaves. The leaves of *S. compacta* have lobes mostly spreading from each other.

### 8. *Scapania pseudocalcicola* Schuster, Phytologia 63: 327. 1987

**Plants** 10--30 x 1--3(--4) mm, green to brownish. **Leaves** entire to crenulate-denticulate distally; dorsal lobe 0.5--0.65 times the size of ventral, (0.45--0.6--0.95 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, sharply to bluntly pointed at apex; ventral lobe (0.45--0.55--0.8 times as wide as long, arcuately inserted, sharply pointed at apex, hyaline near base margin; keel (0.4--0.5--0.65 times the length of ventral lobe, acute, indistinctly arched, wing locally narrow, entire. **Median leaf cells** with small acute to moderate slightly bulging trigones; marginal cells thick- to thin-walled, 17--23  $\mu\text{m}$  where subisodiametric; oil bodies persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae, common, green to brownish, 2-celled, ovoid to slightly angulate, 15--21 x 24--40  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** inflated, mouth denticulate to subentire.

Calcareous soil and rocks in the Atlantic Arctic and subarctic; of conservation concern; 0--200 m; Greenland; Nfld., Que.

*Scapania pseudocalcicola* without perianths appears similar to *S. ligulifolia*. It differs from the latter in the occurrence of small denticulations in distal parts of at least some leaves and in the usually green to brownish (vs. yellow to brown) gemmae in sun forms. Many specimens labeled *Scapania calcicola* are this species. The leaves of *S. pseudocalcicola* are usually upturned.

### 9. *Scapania ligulifolia* R. M. Schuster, Hepat. Anthocerotae N. Amer. 3: 306, f. 355. 1974

*Scapania calcicola* var. *ligulifolia* R. M. Schuster [heterotypic]

**Plants** 3--18 x 0.8--2.4(--2.7) mm, green to brown. **Leaves** entire; dorsal lobe 0.4--0.65 times the size of ventral, 0.7--1.1 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, bluntly to sharply pointed at apex; ventral lobe 0.65--0.77 times as wide as long, arcuately inserted, obtusely to sharply apiculate at apex, hyaline near base margin; keel 0.45--0.6 times the length of ventral lobe, acute, indistinctly to moderately arched, wing occasionally narrow, entire. **Median leaf cells** with small acute to moderate bulging trigones; marginal cells thick- to thin-walled, 15--19(--24)  $\mu\text{m}$  where subisodiametric; oil bodies persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae, common, yellowish (rarely reddish) to deep brown, 2-celled, ovoid to slightly angulate, 14--23 x 25--40  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** inflated, mouth laciniate-dentate.

Calcareous rocks and soil in the Arctic; 0--200 m; Greenland; N.W.T., Que.; Europe (Svalbard, Franz-Josef Land); Asia (n Russia).

*Scapania ligulifolia* without perianths may be confused with *S. pseudocalcicola*. Their distinction is considered under the latter species. The leaves of *S. ligulifolia* are more or less upturned and incurved.

#### 10. *Scapania gymnostomophila* Kaalaas, Bot. Not. 1896: 21. 1896

*Diplophyllum incurvum* Bryhn & Kaalaas

**Plants** 3--16(--20) x 0.7--2.4 mm, green to brown. **Leaves** entire; dorsal lobe 0.25--0.65 times the size of ventral, 0.5--0.75 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, triangular and pointed to obtuse at apex; ventral lobe 0.5--0.8 times as wide as long, arcuately inserted, pointed to rounded at apex, hyaline near base margin; keel 0.35--0.5 times the length of ventral lobe, acute, indistinctly to moderately arched, wing often narrow, entire. **Median leaf cells** with small trigones; marginal cells not differentiated, 10--15  $\mu\text{m}$  where subisodiametric; oil bodies persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae, common, brown to reddish brown, 2-celled, ovoid to rhomboid, 12--17 x 20--32  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** inflated, mouth lobulate-to fimbriate-ciliate.

Calcareous soil and rocks; 0--2500 m; Greenland; B.C., Nfld., N.W.T., [[Nun.??]] N.S., Ont., Que., Yukon; Alaska, Idaho, Maine, Mass., Mich., Minn., Mont., N.Y., Vt., Wis.; Eurasia.

The elevational range of *Scapania gymnostomophila* in the territory of the flora is imperfectly known. In Europe the species has been found at up to 2650 m. *Scapania gymnostomophila* is distinct from all other *Scapania* in having large plate-like brown persistent oil bodies occurring mostly 1 per cell. In addition, it may be distinguished from the similar *S. pseudocalcicola* and *S. calcicola* by smaller gemmae and entire, invariably unbordered leaves. The leaves of *S. gymnostomophila* are often upturned and incurved.

#### 11. *Scapania simmonsii* Bryhn & Kaalaas, Report 2nd Norw. Arct. Exped. Fram. 2(11): 51. 1906

**Plants** 10--60 x (1.5--2.5--3) mm, fuscous. **Leaves** dentate distally, terminal tooth cell to 1.5 times as long as wide; dorsal lobe convex, 0.75--0.95 times the size of ventral, 0.9--1.1 times as wide as long, decurrent, extending beyond stem, divergent with it, triangular and pointed to obtuse and rounded at apex; ventral lobe convex and strongly recurved, 0.9--1.1 times as wide as long, decurrent proximal to keel insertion, triangular and pointed to obtuse and rounded at apex, not hyaline near base margin; keel 0.25--0.5 times the length of ventral lobe, acute, moderately arched, wing mostly absent. **Median leaf cells** with mainly large bulging trigones; marginal cells thin- to thick-walled, 18--23  $\mu\text{m}$  where subisodiametric; oil bodies occasionally persistent; cuticle moderately to coarsely papillose. **Specialized asexual reproduction** by gemmae unknown. **Sexual condition** dioicous. **Perianth** compressed, mouth lobulate-ciliate.

Mostly on calcareous soil in the Arctic; 0--500 m; Greenland; N.W.T., Que., Yukon; Alaska; Europe (n Russia, Svalbard); Asia (n Russia).

*Scapania simmonsii* is a well defined species due to strongly turned backward leaves with subequal lobes about as wide as long and normally very coarse trigones. It may be mistaken only for *S. crassiretis*. The leaves are strongly turned backward.

**12. *Scapania ornithopoides*** (Withering) Waddell, Moss Exchange Club Cat. Brit. Hep., 4. 1897 "ornithopodioides"

*Jungermannia ornithopoides* Withering, Bot. Arr. Veg. Great Britain 2: 695. 1776

**Plants** 30--150 x 1.5--4.5 mm, brown to reddish brown. **Leaves** dentate-ciliate from apex to base, terminal tooth cell 2--4 times as long as wide; dorsal lobe mostly 0.35--0.6 times the size of ventral, 0.75--1.1 times as wide as long, arcuately inserted to short-decurrent, extending beyond stem, subparallel to divergent with it, sharply pointed to obtuse at apex; ventral lobe 0.55--0.85 times as wide as long, decurrent to or proximal to keel insertion, rounded to sharply pointed at apex, not hyaline near base margin; keel absent or less than 0.05 times the length of ventral lobe, acute, more or less strongly arched, wing broad, dentate. **Median leaf cells** with mainly large bulging trigones; marginal cells mostly not differentiated, 14--20  $\mu\text{m}$  where subisodiametric; oil bodies largely not persistent; cuticle smooth to coarsely papillose. **Specialized asexual reproduction** by gemmae rare (unknown for North American plants) brown to purple, 1--2-celled, broadly ellipsoid, 17--21 x 20--28  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth lobulate-dentate.

Usually on peaty wetland slopes and cliff terraces at higher elevations; confined to very oceanic climates of Pacific Islands and oceanic territories of the North Pacific Coast from Queen Charlotte Island to Aleutian Islands; 0--500 m; B.C.; Alaska; Europe (Great Britain, Faroes, Ireland, Norway); Asia (Assam, Bhutan, China, Darjeeling, Japan, Nepal, Sikkim, Taiwan); Pacific Islands (Hawaii, Philippines).

*Scapania ornithopoides* is distinct from the other North American species of *Scapania* in its invariably vestigial keel less than 0.05 times the length of the ventral lobe. Distinction from forms of *S. uliginosa* with very short keels are considered under that species. According to Art. 60.1 of International Code of Nomenclature for algae, fungi, and plants (Melbourne Code) (2012), the species epithet of *Scapania ornithopoides* must be given the original spelling of W. Withering (1776).

**13. *Scapania americana*** K. Müller (Freiburg), Bull. Herb. Boissier (ser.2) 3: 44. 1903 [1902] E

*Scapania bolanderi* var. *americana* (K. Müller (Freiburg)) Frye & Clark

**Plants** 10--30 x 1.5--3.5 mm, green to brown and purplish. **Leaves** dentate at least to postical leaf bases, terminal tooth cell mostly 1.8--2.2 times as long as wide; dorsal lobe 0.4--0.75 times the size of ventral, 1--1.3 times as wide as long, arcuately inserted or decurrent, extending beyond stem, divergent with it, rounded to sharply pointed at apex; ventral lobe 0.55--0.75 times as wide as long, decurrent proximal to keel insertion, mostly rounded to blunt at apex, not hyaline near base margin; keel 0.35--0.56 times the length of ventral lobe, acute, indistinctly to moderately arched, wing mostly absent. **Median leaf cells** with small acute to moderate bulging trigones; marginal cells thick- to thin-walled, 9--17(--20)  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth to moderately papillose. **Specialized asexual reproduction** by gemmae sporadic, deep purple to brownish, (1--)2-celled, broadly ellipsoid to ovoid, 12--16 x

15--26  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth lobulate-ciliate to dentate.

Generally on rocks in shaded sites of forested areas; 0--1500 m; Alta., B.C., N.W.T.; Alaska, Calif., Idaho, Mont., Oreg., Wash.

*Scapania americana* is frequently confused with *S. bolanderi*. It is distinct from the latter in slender teeth with spinose terminal cells, lacking branched marginal teeth spread primarily to the ventral lobe base, bearing pigmented gemmae, and in its saxicolous ecology. Forms of *S. americana* with large dorsal lobes resemble *S. subalpina* from which they are distinct in having slender marginal teeth spread to the ventral lobe bases.

#### 14. *Scapania hollandiae* Hong, Bryologist 83: 56. 1980 E

**Plants** 4--25 x 1.8--4.5 mm, green to slightly brownish. **Leaves** dentate distally to entire, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.55--0.75 times the size of ventral, 1.1--1.4 times as wide as long, arcuately inserted, crossing stem, divergent with it, broadly rounded at apex; ventral lobe (0.65--0.75--0.95(--1.1) times as wide as long, arcuately inserted, broadly rounded at apex, not hyaline near base margin; keel 0.25--0.5 times the length of ventral lobe, acute, indistinctly arched, wing narrow to rather broad, entire. **Median leaf cells** with small acute trigones; marginal cells smaller than median, more or less thick-walled, (10--12--15(--17)  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae unknown. **Sexual condition** dioicous. **Perianth** strongly compressed, mouth dentate.

Silt over rocks, peaty soil and rotten wood; 700--2500 m; B.C.; Wash., Wyo.

In leaf shape, insertion and dentition as well as in size of plants *S. hollandiae* is most close to robust phases of *S. brevicaulis* often recorded as *S. degenii*. It differs from them in its inability to produce gemmae and deep brown pigmentation, thick-walled marginal cells, and not persistent oil bodies.

#### 15. *Scapania spitsbergensis* (Lindberg) K. Müller (Freiburg), Bull. Herb. Boissier (ser.2) 1: 607. 1901 "spitzbergensis"

*Martinellius spitsbergensis* Lindberg, Kongl. Svenska Vet.-Akad. Handl.23(5): 31. 1889;  
*Scapania convexula* K. Müller (Freiburg)

**Plants** 10--75 x 1.5--3.5 mm, green to brown and purplish. **Leaves** dentate-ciliate basally, terminal tooth cell 2--3 times as long as wide; dorsal lobe 0.5--0.75 times the size of ventral, 1.0--1.35 times as wide as long, decurrent, extending beyond stem, divergent with it, rounded to obscurely pointed at apex; ventral lobe 0.85--1.15 times as wide as long, decurrent proximal to keel insertion, rounded to obscurely pointed at apex, not hyaline near base margin; keel 0.1--0.35 times the length of ventral lobe, acute, moderately to strongly arched, wing mostly broad, dentate. **Median leaf cells** with small acute to large bulging trigones; marginal cells usually thick-walled, 16--18  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to coarsely papillose. **Specialized asexual reproduction** by gemmae sporadic, green to purplish and brownish in sun, 2-celled, ovoid, ellipsoid, 11--19 x 23--34(--38)  $\mu\text{m}$ . **Sexual condition** monoicous (paroicous). **Perianth** strongly compressed, mouth dentate to lobulate-ciliate.

Soil and rocks in Arctic and in mountains southward; 0--1600 m; Greenland; B.C., N.W.T., Ont., Yukon; Alaska, Maine; Europe (Finland, Norway, Russia, Svalbard, Sweden); Asia (Russia).

*Scapania spitsbergensis*, on account of its frequently dentate keel, may be confused with *S. undulata* var. *oakesii* and some phases of *S. nemorea*. From both it is distinct in monoicous sexuality and in marginal teeth developed primarily near leaf bases. Male bracts that are proximal to the perianth in *S. spitsbergensis*, however, do not differ from sterile leaves, and the detection of antheridia in the bract axils is necessary for determining sexuality. Distinction from *S. undulata* is by the more narrow terminal tooth cells and frequent development of moderate often bulging trigones. An additional character distinguishing *S. nemorea* from *S. spitsbergensis* is the common production of 1-celled brown gemmae (vs. 2-celled green to pinkish gemmae).

**16. *Scapania subalpina*** (Nees ex Lindenberg) Dumortier, Recueil Observ. Jungerm., 14. 1835

*Jungermannia subalpina* Nees ex Lindenberg, Syn. Hep. Eur. 55.1829; *Scapania perlaxa* Warnstorf

**Plants** 10--50 x 1.5--4 mm, whitish green to reddish brown. **Leaves** denticulate distally to subentire, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.65--0.8 times the size of ventral, 0.85--1.4 times as wide as long, subtransversely inserted, mostly extending to far edge of stem or slightly beyond it, divergent with stem, broadly rounded to weakly pointed at apex; ventral lobe 0.8--1.1 times as wide as long, decurrent proximal to keel insertion, broadly rounded to weakly pointed at apex, not hyaline near base margin; keel (0.4--0.5--0.65 times the length of ventral lobe, acute, indistinctly arched, wing mostly narrow, entire. **Median leaf cells** with small acute trigones; marginal cells mostly thick-walled, 16--22  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth to slightly papillose. **Specialized asexual reproduction** by gemmae sporadic, green to reddish, 2-celled, broadly ovoid, 12--19 x 19--28  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth dentate.

Mostly on moist rocks in or near moving water, more rarely on moist soil and rotten wood, from Arctic to high altitudes southward; 200--3800 m; Greenland; Alta., B.C., Man., Nfld., N.W.T., N.S., Ont., Que., Sask., Yukon; Alaska, Ariz., Calif., Colo., Kans., Maine, Mich., Minn., Mont., Nebr., Nev., N.H., N.Mex., N.Y., N.Dak., Oreg., S.Dak., Tex., Utah, Wash., Wis., Wyo.; Eurasia; Atlantic Islands.

The elevational range of *Scapania subalpina* is incompletely known. *Scapania subalpina* may be confused with *S. undulata* and *S. obscura* considered above. It differs from the former in its larger dorsal lobe, usually whitish green (vs. grass-green) color of unpigmented forms and reddish brown (vs. vinaceous or purplish violet) color of pigmented forms. Small forms may be confused with *S. curta*. They are distinct in that the ventral lobe of *S. subalpina* is decurrent proximal to the keel insertion.

**17. *Scapania obscura*** (Arnell & Jensen) Schiffner, Oesterr. Bot. Z. 58: 377. 1908

*Martinellius obscurus* Arnell & Jensen, Naturwiss. Untersuch. Sarekgebirges Schwed.-Lappl., Bot. 91. 1907

**Plants** 3--20 x 1--2(--3) mm, green to fuscous or blackish. **Leaves** entire; dorsal lobe 0.65--0.8 times the size of ventral, 0.6--1.27 times as wide as long, subtransversely inserted or decurrent, mostly extending to far edge of stem or slightly beyond it, divergent with stem, rounded to bluntly pointed at apex; ventral lobe 0.4--1.0 times as wide as long, decurrent proximal to keel insertion, rounded to bluntly pointed at apex, not hyaline near base margin; keel 0.5--0.75 times the length of ventral lobe, rounded to acute, indistinctly to moderately arched, wing absent. **Median leaf cells** with very minute to small acute trigones; marginal cells mostly not differentiated, 16--23  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae sporadic, green to brown and purple, 1--2-celled, broadly ovoid, 7--14 x 12--21(--26)  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** compressed, mouth entire.

Confined to melt-water rivulets, brooks, springs, and seepages, upper subalpine and alpine zones, rarely in damp tundras; 200--2000 m; Greenland; B.C., N.W.T., Nunavut; Alaska, Ore., Wash.; Eurasia.

T. C. Frye and L. Clark (1937--1947) described *S. subalpina* var. *haynesiae* from Alberta. According to the original description it corresponds more to *S. obscura* than to *S. subalpina* in having leaves not bordered and entire; the keels that are 1 cell thick and rounded throughout their length; and the cortex differentiated by the color rather than by thickness of the cell walls. The reddish brown pigmentation of the plants, however, usually does not occur in *S. obscura* and is characteristic for *S. subalpina*. This makes the exact position of this variety ambiguous until revision of the original collections, which were unavailable for study. *Scapania obscura* is usually distinct from *S. subalpina* in the leaves being entire and not bordered with a weakly defined keel; cortex, defined by pigmentation mostly; fuscous (vs. reddish brown) pigmentation of plants; and 1--2-celled gemmae. The leaves of *S. obscura* are occasionally upturned. Impoverished plants of *S. obscura* illustrated by A. D. Potemkin (1998: Figs. 3: 1, 3--5) may be misidentified as species of *Lophozia* s. l. They are distinct from the latter in broadly ovoid gemmae, often conduplicate upper leaves and cells nearly without trigones.

### 18. *Scapania undulata* (Linneaus) Dumortier, Recueil Observ. Jungerm. 14. 1835

*Jungermannia undulata* Linneaus, Spec. Pl. (ed.1) 2: 1132. 1753

**Plants** 15--200 x 1.5--4.5 mm, green to brown and purple at least postically. **Leaves** dentate predominantly distally to entire, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.35--0.65 times the size of ventral, (0.6--0.95--1.3 times as wide as long, subtransversely inserted, mostly extending to far edge of stem or slightly beyond it, divergent with stem, broadly rounded to weakly pointed at apex; ventral lobe 0.7--1 times as wide as long, decurrent proximal to keel insertion, broadly rounded to weakly pointed at apex, not hyaline near base margin; keel 0.25--0.5 times the length of ventral lobe, acute, indistinctly to moderately arched, wing narrow to broad, occasionally dentate. **Median leaf cells** with minute to moderate acute trigones; marginal cells thick-walled and small, 12--16  $\mu\text{m}$  (terrestrial forms) to thin-walled and larger (aquatic forms), 16--20  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth. **Specialized asexual reproduction** by gemmae sporadic, green to purplish in sun, 2-celled, broadly ovoid, 10--17 x 12--23  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth dentate to entire.

Hydric to nearly xeric sites; mostly associated with moving water and rocks; 0--3300 m; Greenland; St. Pierre and Miquelon; Alta., B.C., Man., N.B., Nfld., N.W.T., N.S., Ont., P.E.I., Que., Sask., Yukon; Alaska, Ariz., Ark., Calif., Colo., Conn., Ga., Idaho, Kans., Ky., Maine, Mass., Mich., Minn., Miss., Mo., Mont., Nebr., Nev., N.H., N.J., N.Mex., N.Y., N.C., N.Dak., Ohio, Oreg., Pa., R. I., S. C., S.Dak., Tenn., Tex., Utah, Vt., Va., Wash., W. Va., Wis., Wyo.; Mexico?; Eurasia; n Africa; Atlantic Islands.

*Scapania undulata* is most often confused with *S. subalpina* considered above and with eastern North American *S. nemorea* subsp. *nemorea*. It is distinct from the latter in slightly elongated terminal tooth cells (mostly not over 1.5 times as long as wide); non-decurrent dorsal lobes; broadly ovoid, green to purplish 2-celled gemmae; predominantly not flattened cortical cells; small oil bodies, occluding considerably less than half of cell lumen (vs. more or less large oil bodies, occluding mostly half or more cell lumen).

**19. *Scapania serrulata*** R. M. Schuster, Hep. Anth. N. Am. 3: 539. 1974 E

**Plants** 10--25 x 1.8--3.1 mm, green to red and brown. **Leaves** dentate distally, terminal tooth cell to 1.5 times as long as wide; dorsal lobe 0.65--0.75 times the size of ventral, 0.95--1.15 times as wide as long, subtransversely to arcuately inserted, extending to far edge of stem or slightly beyond it, divergent with stem, broadly rounded at apex; ventral lobe 0.74--0.91 times as wide as long, decurrent proximal to keel insertion, broadly rounded at apex, not hyaline near base margin; keel 0.45--0.65 times the length of ventral lobe, acute, indistinctly to moderately arched, wing narrow to broad, entire to crispate. **Median leaf cells** with moderate bulging to acute trigones; marginal cells mostly thin-walled, often elongated, 20--26(--28)  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth. **Specialized asexual reproduction** by gemmae apparently frequent, green to red, 1--2-celled, broadly ovoid, 16--24 x 22--39  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** unknown.

Seepage-moistened soil between rocks, in turbulent streams from snow and ice fields in the Arctic; 200--1000 m; Greenland; N.W.T.

**20. *Scapania uliginosa*** (Lindenberg) Dumortier, Recueil Observ. Jungerm. 14. 1835

*Jungermannia undulata* var. *uliginosa* Lindenberg, Syn. Hep. Eur. 58. 1829; *Scapania paludosa* (K. Müller) K. Müller

**Plants** 20--200 x 1.5--6 mm, green to purple and brown. **Leaves** entire to dentate distally; terminal tooth cell to 1.8 times as long as wide; dorsal lobe 0.25--0.65(--0.8) times the size of ventral, 0.9--1.55 times as wide as long, decurrent, extending far beyond stem, subparallel it, rounded to obtusely pointed at apex; ventral lobe 0.8--1.45 times as wide as long, decurrent proximal to keel insertion, rounded at apex, not hyaline near base margin; keel (0.05--)0.15--0.35 times the length of ventral lobe, acute, moderately to strongly arched, wing narrow to broad, entire. **Median leaf cells** with small to moderate acute trigones; marginal cells thin-walled (entire-leaved forms) to more or less thick-walled (dentate-leaved forms), 15--21  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth to densely punctate papillose. **Specialized asexual reproduction** by gemmae very rare, green to red, 1-celled, ellipsoid, 8--10 x 13--19  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth entire to denticulate.

Stones in streams and seepage-moistened rocks in mountains and the Arctic, high elevations southward; 200--3800 m; Greenland; Alta., B.C., Nfld., N.W.T., Que., Yukon; Alaska, Colo., Idaho, Maine, Mont., N.H., Oreg., Vt., Wash.; Eurasia.

The elevational range of *Scapania uliginosa* is incompletely known. Forms of *S. uliginosa* with thin-walled marginal cells may be confused with *S. paludicola* from which they are distinct in the ventral lobes being broadly decurrent proximal to the keel insertion and mostly strongly turned backward, and in the usual absence of trigones in leaf cells. The synonymy of *S. uliginosa* and *S. paludosa* is accepted, following D. R. Zehr (1980), because of the minor taxonomic significance of characters ascribed to both names and their frequent occurrence in diverse combinations (A. D. Potemkin 1999a). Forms with dentate and bordered leaves (*S. paludosa*-phases) may be confused with *S. undulata* and *S. spitsbergensis*. They are distinct from the former in the dorsal lobes decurrent and subparallel to the stem and from the latter in marginal teeth not spread to leaf bases and to keel, slightly elongated terminal tooth cells and dioicous sexuality. Sporadic development of leaves with very short keels (to 0.05 times the length of the ventral lobe) may lead to confusion with *S. ornithopoides* from which *S. uliginosa* differs in marginal teeth not spreading to leaf bases and with slightly elongated terminal cells, inability to produce large trigones, and frequent development of purple pigmentation in the distal portion of leaves.

**21. *Scapania cuspiduligera*** (Nees) K. Müller (Freiburg), Rabenhorst, Krypogamenfl. Deutschlands (ed.2) 6(2): 472. 1915

*Jungermannia cuspiduligera* Nees, Naturges. Eur. Leberm.1: 180.1833

**Plants** 5--20 x 1--2.5 mm, green to fuscous. **Leaves** entire to faintly denticulate distally; dorsal lobe 0.5--0.9 times the size of ventral, 0.5--0.85 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, rounded to mucronate at apex; ventral lobe 0.5--0.85 times as wide as long, decurrent proximal to keel insertion, rounded to mucronate at apex, hyaline near base margin; keel 0.6--0.75 times the length of ventral lobe, rounded and subparallel to stem basally, more or less acute and divergent with stem distally, wing absent. **Median leaf cells** with small to moderate trigones; marginal cells thick-walled, 15--20  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth to moderately papillose. **Specialized asexual reproduction** by gemmae, common, brown at least in sun, 2-celled, broadly ovoid, 10--16 x 14--25  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** compressed, mouth entire to faintly denticulate.

Varieties 2 (2 in the flora): Greenland, Canada, United States, South America, Eurasia, Africa.

*Scapania cuspiduligera* is distinct from the other *Scapania* species in the following character states: keel rounded and subparallel to the stem basally and spread out only distally; sheathing leaf bases; rather long decurrent and hyaline ventral lobe base; constant production of brown, 2-celled gemmae with deeper pigmented internal walls; subequal bordered entire leaf lobes with broadly rounded apices.

1. Ventral leaf lobes not falcate, gemmiparous lobes entire; gemmae brown . . . 25a. *Scapania cuspiduligera* var. *cuspiduligera*

1. Ventral leaf lobes falcate, gemmiparous lobes occasionally denticulate; gemmae green becoming brown when mature . . . 25b. *Scapania cupiduligera* var. *diplophyllopsis*

**21a. *Scapania cuspiduligera* (Nees) K. Müller (Freiburg) var. *cuspiduligera***

**Ventral leaf lobes** not falcate, gemmiparous lobes entire. **Gemmae** brown.

Mostly calcareous soils and rocks from the high Arctic to New Mexico, southward at high elevations; 0--3100 m; Greenland; Alta., B.C., Man., N.B., Nfld., N.W.T., N.S., Ont., Que., Sask., Yukon; Alaska, Ariz., Calif., Colo., Idaho, Mich., Minn., Mont., Nev., N.Mex., Oreg., Utah, Vt., Wash., Wis., Wyo.; South America (Colombia), Eurasia; Africa (Republic of the Congo).

The gemmae of *Scapania cuspiduligera* var. *cuspidula* are brown, 2-celled, and have deeply pigmented internal cell walls.

**21b. *Scapania cuspiduligera* var. *diplophyllopsis*** R. M. Schuster, Hepat. Anthocerotae N. Amer. 3: 361. fig. 371: 1--14. 1974

**Ventral leaf lobes** falcate, gemmiparous lobes occasionally denticulate. **Gemmae** green but becoming brown when mature.

Habitat not given; low to moderate elevations; Greenland.

**22. *Scapania hians*** Stephani ex K. Müller (Freiburg), Nova Acta Acad. Caes. Leop. -Carol. German. Nat. Cur.83: 223. 1905

Subspecies 2 (1 in the flora): Canada; Asia (China, India (Sikkim: reported by T. Herzog (1939) as *S. papillosa* K. Müller (Freiburg)), Nepal).

**22a. *Scapania hians* subsp. *salishensis*** J. Godfrey & G. Godfrey, Bryologist 81: 362. 1978

**Plants** 5--22 x 0.85--1.6 mm, brownish green. **Leaves** entire to slightly denticulate distally; dorsal lobe 0.75--0.95 times the size of ventral, 0.55--0.7 times as wide as long, more or less arcuately inserted, crossing stem, divergent with it, triangular and pointed at apex; ventral lobe 0.5--0.65(--0.8) times as wide as long, decurrent proximal to keel insertion, triangular and pointed at apex, not hyaline near base margin; keel 0.4--0.7 times the length of ventral lobe, acute, indistinctly to moderately arched, wing mostly absent. **Median leaf cells** with more or less small acute to slightly bulging trigones; marginal cells smaller than median, thin- to slightly thick-walled, 10--14  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle coarsely papillose. **Specialized asexual reproduction** by gemmae, frequent, brown, (1--)2-celled, spherical to ovoid, 10--16 x 10--20(--24)  $\mu\text{m}$ . **Sexual condition:** perianth and sex organs unknown.

Silt over rocks, wet or submerged in glacier-fed mountain streams, forest to subalpine belts; of conservation concern; 500--1400 m; B.C.

*Scapania hians* is distinct from the other *Scapania* in its marsupelloid appearance with the ventral lobe decurrent proximal to the keel insertion and brown gemmae at shoot apices. It also

differs from the similar *S. aequiloba* in its long-decurrent (vs. short-decurrent) ventral lobe, brown (vs. green) gemmae, and weaker development of marginal denticulation and border. The subsp. *salishensis* has lobes mostly stiffly spreading from each other.

### 23. *Scapania mucronata* Buch, Meddeland Soc. Fauna Fl. Fenn. 42: 91. 1916

**Plants** 3--12 x 0.7--2.8(--3) mm, green to brown. **Leaves** entire or remotely denticulate distally; dorsal lobe 0.45--0.75(--0.85) times the size of ventral, 0.6--0.85 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, mucronate to apiculate at apex; ventral lobe 0.4--0.8 times as wide as long, subtransversely inserted, obtuse to mucronate at apex, not hyaline near base margin; keel 0.5--0.75 times the length of ventral lobe, rounded to acute, indistinctly to moderately arched, wing absent. **Median leaf cells** with moderate, acute to bulging trigones; marginal cells not differentiated, 14--20  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae, common, green, reddish or brownish in sun, 2-celled, ovoid, 10--19 x 18--36  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** slightly compressed, mouth lobulate-dentate.

Subspecies 2 (2 in the flora): Northern Hemisphere.

1. Dorsal lobe 0.45--0.55 times the size of ventral; keel 0.5 times the length of ventral lobe; leaves entire; gemmae green to rarely weakly reddish, 10--14 x 20--25(--29)  $\mu\text{m}$ . . .

. . . . .1a. *Scapania mucronata* subsp. *mucronata*

1. Dorsal lobe 0.65--0.85 times the size of ventral; keel 0.6--0.85 times the length of ventral lobe; leaves with occasional 1-celled teeth distally; gemmae green to reddish and brownish, 10--19 x 18--36  $\mu\text{m}$ . . . . .1b. *Scapania mucronata* subsp. *praetervisa*

#### 23a. *Scapania mucronata* Buch subsp. *mucronata*

**Leaves** normally entire; dorsal lobe 0.45--0.55 times the size of ventral; keel 0.5 times the length of ventral lobe, acute. **Specialized asexual reproduction** by gemmae, green to rarely weakly reddish, 10--14 x 20--25(--29)  $\mu\text{m}$ .

Rocks and decaying wood, occasionally on soil; 0--3000 m; Greenland; Alta., B.C., Man., N.B., Nfld., N.W.T., N.S., Ont., P.E.I., Que., Sask., Yukon; Ala., Alaska, Ariz., Ark., Calif., Colo., Conn., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Mont., Nebr., Nev., N.H., N.J., N.Mex., N.Y., N.C., N.Dak., Ohio, Oreg., Vt., Va., Wash., Wis., Wyo.; Eurasia; Atlantic Islands.

*Scapania mucronata* subsp. *mucronata* may be confused with *S. scandica*. It differs from the latter in having the dorsal lobe divergent with the stem, thin-walled marginal cells, invariable absence of purple pigmentation, and a lobulate-dentate perianth mouth. The oil bodies are 2--5 per cell.

#### 23b. *Scapania mucronata* subsp. *praetervisa* (Meylan) Schuster, Hep. Anth. N. A. 3: 437. 1974

*Scapania praetervisa* Meylan, Janresber. Naturf. Ges. Graubündes (ser.2) 64: 364. 1926

**Leaves** with occasional 1-celled teeth distally; dorsal lobe 0.65--0.75 times the size of ventral; keel 0.6--0.75 times the length of ventral lobe, acute to rounded basally. **Specialized asexual reproduction** by gemmae, green to reddish and brownish, 10--19 x 18--36  $\mu\text{m}$ .

Limy soil and rocks; 0--3700 m; Greenland; B.C., N.W.T.; Alaska, Colo., Idaho, Oreg.; Eurasia.

There are no records of *Scapania mucronata* subsp. *praetervisa* for Yukon and Washington although the subspecies should be expected to occur there. Differentiation of *S. mucronata* subsp. *praetervisa* and *S. zemliae* is considered under the latter species.

**24. \*Scapania helvetica** Gottsche, S. M. Gottsche and L. Rabenhorst, Hep. Eur. [Exsicc. ] n. 426.1868

**Plants** 9--20 x 1.8--2.4 mm, green to brown. **Leaves** entire or with few distal teeth associated with gemma formation; dorsal lobe 0.5--0.65 times the size of ventral, 0.75--0.87 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, blunt to rounded at apex; ventral lobe 0.75--0.85 times as wide as long, subtransversely inserted, more or less rounded at apex, not hyaline near base margin; keel 0.45--0.6 times the length of ventral lobe, acute, indistinctly to moderately arched, wing absent. **Median leaf cells** with moderate acute, rarely bulging trigones; marginal cells not differentiated, 15--19  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae sporadic, green, 2-celled, ovoid, 10--13 x 16--25  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** slightly compressed, mouth shortly dentate to subentire.

Habitat and elevation unknown; Greenland; B.C; Europe.

Habitats, elevation, and distribution of *Scapania helvetica* in the range of the flora remain unclear. Materials of the species from the territory of the flora were unavailable for study and this remains to be the only reason to include the species description in the flora. The record of the species from Greenland (H. W. Arnell 1922) is far outside its European range and may be based on impoverished plants of *S. hyperborea*. The report of *S. helvetica* from British Columbia is also very doubtful (R. M. Schuster 1974: 457). In Europe *S. helvetica* occurs on soil and rocks in alpine and subalpine areas; and as mentioned by K. Müller (1951--1958) at elevations to 1850 m. *Scapania helvetica* is distinct from the other species of the sect. *Curtae* in having mature leaves with blunt to rounded dorsal lobe apices. It may be distinguished from small phases of *S. hyperborea* by green ovoid (vs. often purple to brown, broadly ovoid) gemmae.

**25. Scapania zemliae** Arnell, Svensk Bot. Tidskr.41(2): 215. 1947

*Scapania invis*a Schuster

**Plants** 2--15 mm x 0.5--2 mm, green to brown. **Leaves** entire to denticulate distally; dorsal lobe 0.3--0.65 ventral, 0.69--0.83 times as wide as long, subtransversely inserted, not extending to distal edge of stem, divergent with it, triangular and sharp-pointed to mucronate at apex; ventral lobe, 0.7--0.8 times as wide as long, subtransversely to arcuately inserted, sharp-pointed to mucronate at apex, not hyaline near base margin; keel 0.45--0.75 times the length of ventral lobe, rounded basally to acute distally, moderately arched, wing mostly absent. **Median leaf cells** with small acute to moderately bulging trigones; marginal cells distinctly smaller than median, occasionally thick-walled, 14--25  $\mu\text{m}$  where subisodiametric; oil bodies not persistent;

cuticle moderately papillose. **Specialized asexual reproduction** by gemmae, common, green to reddish and brown in sun, 2-celled, broadly ovoid to ellipsoid and rhomboid, (11--14--18 x (15--20--35)  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** moderately compressed, mouth dentate.

An Arctic species, on soil over basaltic rocks and in lava crevices, 0--200 m; Greenland; Alaska; Eurasia (Russian Arctic from Novaya Zemlya to Chukotka, also in mountains of Yakutia in East Siberia,).

*Scapania zemliae* may be confused with *Scapania mucronata* subsp. *praetervisa* from which it differs in the bordered and upturned leaves, and more numerous (4--10 vs. 3--6) oil bodies in leaf cells. The leaves are upturned.

## 26. *Scapania lingulata* Buch, Meddeland Soc. Fauna Fl. Fenn.42: 92. 1916

*Scapania microphylla* Warnstorff

**Plants** 3--10(--20) x 1--2.5(--3) mm, green to brown, occasionally purple postically. **Leaves** denticulate to irregularly coarsely dentate distally, rarely entire, terminal tooth cell mostly not over x 1.8 as long as wide; dorsal lobe 0.4--0.75(--0.85) ventral, 0.5--0.9 times as wide as long, subtransversely inserted not extending to distal edge of stem, divergent with it, more or less triangular pointed into an apiculate to mucronate apex (apex exceptionally rounded to blunt); ventral lobe more or less lingulate, x 0.45--0.8 times as wide as long, subtransversely to arcuately inserted, rounded to triangular and pointed at apex, not hyaline near base margin; keel 0.4--0.55(--0.7) times the length of ventral lobe, acute, indistinctly to moderately arched, wing occasionally narrow, entire. **Median leaf cells** with moderate, acute to bulging trigones; marginal cells thin- to more or less thick-walled, 18--28  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle moderately papillose to smooth. **Specialized asexual reproduction** by gemmae, frequent, green to reddish and brownish, (1--2)-celled, narrowly elliptic to broadly ovoid and obtusely angulate, 9--20 x 17--32(--38)  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** more or less compressed, mouth lobulate-dentate to occasionally sinuate with solitary remote short teeth.

Acid cliffs, ledges, soil, and rotten wood ; 0--2800 m; Greenland; Ont., P.E.I.; Maine, Mass., Mich., Minn., Nevada, Vt., Wis.; Europe, Caucasus, Far East of Russia.

The considerable variability of *Scapania lingulata* in leaf shape, marginal border expression and perianth compression provides a basis for its confusion with other species with parallel variability ranges. It is distinct from *S. curta* in having often coarser leaf dentition, smaller dorsal lobe, gemmae that are variable in shape and, if there is dentate perianth mouth, in mostly spinous terminal tooth cells of the mouth about 2 times as long as wide (vs. more or less obtuse shorter cells); from the regional *S. scandica* in having larger cells with more numerous (6--12 vs. 2--5) oil bodies, divergent with stem dorsal lobe and with marginal cells hardly differentiated in size; from *S. mucronata* in having larger cells, more numerous (6--12 vs. 2--5) oil bodies, often coarsely dentate leaves and sporadic purple pigmentation of ventral lobe bases. Phases with moderately inflated perianths and gemmae, which are green to brownish in the sun (found in Nevada) may be confused with *S. pseudocalcicola* because of the similarity in leaf shape and the variability of the marginal border pattern. They are distinct from the latter in the absence of a hyaline area near the ventral lobe base; not persistent, smaller (5--7 x 6--9  $\mu\text{m}$  vs. 7--11 x 8--16  $\mu\text{m}$ ) and more numerous (6--13 vs. 2--4) oil bodies; often coarsely dentate leaves and in acidophylous ecological requirements (A. D. Potemkin 1999b).

**27. *Scapania curta*** (Martius) Dumortier, Recueil Observ. Jungerm. 14. 1835

*Jungermannia curta* Martius, Fl. Crypt. Erlang. 148. 1817; *Scapania perssonii* Schuster

**Plants** 3--15 x 1--2.5(--3) mm, green to brown and purple, especially postically. **Leaves** entire to denticulate distally; dorsal lobe 0.5--0.85 times the size of ventral, 0.5--1.0 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, rounded at the blunt to mucronate apex; ventral lobe 0.6--0.85(--0.95) times as wide as long, subtransversely inserted, broadly rounded to obtusely pointed at apex, not hyaline near base margin; keel 0.45--0.7 times the length of ventral, acute to more or less rounded, indistinctly to moderately arched, wing absent or narrow, entire. **Median leaf cells** with mostly small to moderate acute trigones; marginal cells hardly differentiated in size, thick- to thin-walled, 18--28  $\mu\text{m}$  where subsodiametric; oil bodies not persistent; cuticle smooth to slightly papillose. **Specialized asexual reproduction** by gemmae, sporadic, green, 2-celled, more or less narrowly ovoid, 11--20 x 18--38  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** more or less compressed, mouth subentire to dentate.

Bare acid to neutral soil and rocks, or weakly covered by bryophytes, from Arctic to uplands southward; 0--3700 m; Greenland; Alta., B.C., Man., Nfld., N.W.T., Nunavut, N.S., Ont., P.E.I., Que., Sask., Yukon; Alaska, Ariz., Calif., Colo., Idaho, Kans., Maine, Mich., Minn., Mont., Nebr., Nev., N.H., N.Mex., N.Y., N.Dak., Oreg., S.Dak., Tex., Utah, Wash., Wis., Wyo.; Eurasia; Africa (Mediterranean area); Atlantic Islands.

There are no records of *Scapania curta* for St. Pierre and Miquelon and N.B. although the species should be expected to occur there. Plants of *S. curta* without marginal borders of thick-walled cells may be confused with *S. obcordata*. They differ from the latter species in the leaves being sporadically denticulate distally with locally thick-walled marginal cells devoid of oil bodies and gemmae, which are more narrow, green or hardly reddish, when in sun. *Scapania perssonii* is considered as a large-celled phase of *S. curta* with or without a weakly defined marginal border. It corresponds to *S. curta* var. *grandiretis* Schuster (A. D. Potemkin 1999a). This large-celled variety may be confused with *S. lingulata*, from which it is distinct in its larger dorsal lobe, inability to develop coarse leaf dentition, rather uniform in gemma shape, and subentire to slightly dentate perianth mouth with obtuse terminal tooth cells. The leaves are occasionally upturned.

**28. *Scapania obcordata*** (Berggren) Arnell, Ark. Bot. (ser.2) 4(6): 117. 1959

*Sarcoscyphus obcordatus* Berggren, Kongl. Svenska Vetensk.-Akad. Handl.13: 96. 1875;  
*Scapania paradoxa* R. M. Schuster

**Plants** 3--18 x 0.8--2.8 mm, green to brown and purple. **Leaves** entire; dorsal lobe 0.55--0.95 times the size of ventral, 0.6--0.7 times as wide as long, subtransversely inserted, not extending to distal edge of stem, divergent with it, obtuse to triangular and narrowed to sharp apex; ventral lobe 0.72--0.95 times as wide as long, subtransversely inserted, obtuse to broadly rounded at apex, not hyaline near base margin; keel 0.37--0.75 times the length of ventral lobe, rounded at least basally, indistinctly arched, wing absent. **Median leaf cells** with small acute trigones; marginal cells usually not differentiated, 12--29  $\mu\text{m}$  where subsodiametric; oil bodies not persistent; cuticle smooth to slightly papillose. **Specialized asexual reproduction** by gemmae,

frequent, green to purple, (1--2)-celled, broadly ovoid, 12--24 x 14--36  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** more or less inflated, mouth entire to shallowly lobulate-dentate.

Tundra communities on mostly neutral to acid soils, late snow areas, and banks of water courses in Arctic and Subarctic territories; 0--1400 m; Greenland; N.W.T., Que.; Alaska; Eurasia (n Finland, Iceland, Norway, Russia, Svalbard, n Sweden).

There are no records of *Scapania obcordata* for Yukon although the species should be expected to occur there. *S. obcordata* is an exceedingly malleable Arctic species, producing diverse forms from lophozoid to typical scapanioid. Important distinctive characters of the species are entire emarginate leaves, invariably small acute trigones, broadly ovoid gemmae, and frequent (but not constant) development of purple pigmentation. Some populations of the species are characterized by the common development of *Radula*-type terminal branching, occurring rarely in the other species of *Scapania*. *S. paradoxa* is considered as a synonym of *S. obcordata* after A. D. Potemkin (1998b). The leaves are often upturned.

### 29. *Scapania scandica* (Arnell & H. Buch) Macvicar, Stud. Hand. Brit. Hep. (ed. 2): 394. 1926

*Martinellius scandicus* Arnell & H. Buch, Bot. Not. 1921: 1. 1921; *Scapania parvifolia* Warnstorf

**Plants** 5--20 x 1--2.5 mm, green to brown and purple, especially postically. **Leaves** dentate distally, teeth 1--3 cells long, terminal tooth cell mostly to 1.5 times as long as wide; dorsal lobe 0.35--0.65 times the size of ventral, 0.6--0.85(--1) times as wide as long, subtransversely inserted, not extending to distal edge of stem, subparallel to it, mucronate at apex; ventral lobe 0.45--0.75 times as wide as long, subtransversely inserted, rounded to triangular and pointed at apex, not hyaline near base margin; keel 0.25--0.5 times the length of ventral lobe, acute, indistinctly to moderately arched, wing absent. **Median leaf cells** with small acute to moderate bulging trigones; marginal cells strongly to slightly differentiated in size, thin- to thick-walled, 12--20  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae, frequent, green, 2-celled, narrowly ovoid, 7--13 x 18--25  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** more or less compressed, mouth entire to dentate-ciliate.

Mostly neutral to acid mineral, humic and peaty soils slightly covered by bryophytes; 0--1500 m; Greenland; B.C., Nfld., N.W.T., N.S., Ont., Que.; Alaska, Maine, Mass, N.Y., Wash., Wis.; Eurasia; Atlantic Islands.

There are no records of *Scapania scandica* for Yukon although the species should be expected to occur there. *S. scandica* is distinct from the other species of sect. *Curtae* in its dorsal lobe being mainly subparallel to the stem, free lobe dentition mostly connected with gemma production, and marginal cells strongly differentiated in size when they are thick-walled.

### 30. *Scapania fulfordiae* W. S. Hong, Bryologist 83(1): 46. 1980 E

**Plants** 3--6 x 0.5--1.2 mm, green to yellowish. **Leaves** entire; dorsal lobe 0.4--0.8 times the size of ventral, 0.6--0.8 times as wide as long, subtransversely inserted, not extending to far edge of

stem, divergent with it, blunt to triangular and pointed at apex; ventral lobe 0.5--0.75 times as wide as long, subtransversely inserted, broadly rounded to mucronate at apex, not hyaline near base margin; keel 0.3--0.6(--0.75) times the length of ventral lobe, cross section morphology unknown, indistinctly arched, wing absent. **Median leaf cells** with small acute trigones; marginal cells not differentiated, 10--14  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae, common, green, 1-celled, ovoid to narrowly ovoid, 5--8 x 14--20  $\mu\text{m}$ . **Sexual condition** perianth and sex organs unknown.

Wet humus over rocks along snow melt mountain streams in alpine forests; 3500 m; Colo., Wyo.

Material of the species was unavailable for study. This description is based on the original description and illustrations only (W. S. Hong 1980). The position of the species within the genus remains unclear. It is the only American species of *Scapania* with green 1-celled gemmae. *Scapania fulfordiae* should be considered an endemic of North America and a species of conservation concern.

### 31. *Scapania irrigua* (Nees) Nees, Syn. Hep., 67.1844

*Jungermannia irrigua* Nees, Naturgesch. Eur. Leberm.1: 175, 193.183.

**Plants** 10--50 x 2--4 mm, green to brown and red. **Leaves** entire to denticulate distally; dorsal lobe 0.5--0.6 times the length of the ventral, 0.65--1 times as wide as long, subtransversely inserted, mostly extending to far edge of stem or slightly beyond it, divergent with stem, obtuse to sharply pointed at apex; ventral lobe (0.75--)0.85--1.05(--1.15) times as wide as long, arcuately inserted, obtuse to sharply pointed at apex, not hyaline near base margin; keel 0.35--0.5 times the length of ventral lobe, acute, moderately arched, wing mostly absent. **Median leaf cells** with small acute to moderate bulging trigones; marginal cells not differentiated, 16--21  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae sporadic, green, 2-celled, narrowly ovoid, 9--12 x 20--28  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** compressed, mouth entire to dentate.

Boggy places, on decaying wet logs and moist soil; 0--3600 m ; Greenland; Alta., B.C., Man., N.B., Nfld., N.W.T., N.S., Ont., P.E.I., Que., Sask., Yukon; Alaska, Ariz., Calif., Colo., Conn., Idaho, Maine, Mich., Minn., Mont., Nebr., Nev., N.H., N.J., N.Mex., N.Y., N.Dak., Oreg., Pa., S.Dak., Tex., Utah, Vt., Wash., Wis., Wyo.; Eurasia; (n Africa); Atlantic Islands (Madeira).

*Scapania irrigua* is often confused with *S. hyperborea* considered above and with *S. paludicola*. It is distinct from *S. paludicola* in its narrower dorsal lobes which are not decurrent and divergent with the stem and invariably green gemmae. The latter character fails to work only for differentiation of *S. irrigua* and rare *S. paludicola* var. *viridigemma* Schuster.

### 32. *Scapania hyperborea* Jørgensen, Fl. Nord.-Reisen: 56. 1894

*Scapania pulcherrima* R. M. Schuster; *S. tundrae* (Arnell) Buch

**Plants** 10--30 x 1.5--4 mm, green to brown, rarely purplish postically. **Leaves** entire or crooked to dentate mostly distally with small to large broad-based teeth; terminal tooth cell to 1.5 times

as long as wide; dorsal lobe 0.5--0.75(--0.8) times the size of ventral, 0.8--1.3 times as wide as long, subtransversely inserted, mostly extending to far edge of stem or slightly beyond it, divergent with stem, rounded to acute at apex; ventral lobe 0.8--1.1(--1.15) times as wide as long, decurrent to keel insertion, rounded to triangular and pointed at apex, not hyaline near base margin; keel (0.2--0.3--0.5) times the length of ventral lobe, more or less acute, moderately to strongly arched, wing absent or occasionally broad, entire to dentate. **Median leaf cells** with moderate, mostly bulging trigones; marginal cells not differentiated, (14--16--20 to 23--32  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly to moderately papillose. **Specialized asexual reproduction** by gemmae sporadic, green to fuscous and deep purple, (1--2)-celled, broadly ovoid, 10--21 x 12--31(--33)  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** moderately compressed, mouth entire to dentate.

Peaty and sandy moist soil in tundra and alpine communities; 0--3800 m; Greenland; N.W.T., Ont.; Alaska, Colo., Maine, N.H.; Europe (Iceland, Norway, Finland, n Russia, Svalbard, Sweden); Asia (n Russia).

There are no records of *Scapania hyperborea* for Yukon, Quebec, and Newfoundland although the species should be expected to occur there. The Colorado record is doubtful. The extreme variability of *S. hyperborea* has led to its confusion with *S. irrigua*, *S. brevicaulis*, and *S. helvetica*. The most reliable distinctive feature of diverse forms of *S. hyperborea* is the broadly ovoid, easily turning purple or fuscous, mostly 2-celled gemmae vs. narrowly ovoid green gemmae of *S. irrigua* and *S. helvetica* and in most cases largely 1-celled brown gemmae of *S. brevicaulis*. One-celled gemmae are known for some forms of large-celled *S. tundrae* (K. Müller 1951--1958) considered to be a variety of *S. hyperborea* (*S. hyperborea* var. *tundrae* (Arnell) Potemkin (A. D. Potemkin 1999a). Additional distinction between typical variety of *S. hyperborea* and *S. brevicaulis* are the usually not persistent oil bodies and large bulging trigones. Differentiation of non-gemmiparous plants of the considered species is often very questionable. *S. hyperborea* var. *hyperborea* may be easily confused with plants of *S. brevicaulis* with largely 2-celled gemmae, known as *S. degenii* var. *dubia* Schuster. They are distinct from the latter in having a slightly arched keel usually without a wing, invariably entire leaves, mostly more broad and never citron-shaped, and frequently reddish gemmae. The leaves are sporadically upturned.

Varieties 2 (2 in the flora): their ecological requirements and distribution are similar.

1. Leaf margins smooth, never crooked. Marginal leaf cells (14)16--20  $\mu\text{m}$  ..... 32a. *Scapania hyperborea* var. *hyperborea*
2. Leaf margins more or less crooked to more or less dentate. Marginal leaf cells 23--32  $\mu\text{m}$  ..... 32b. *Scapania hyperborea* var. *tundrae*

### 32a. *Scapania hyperborea* Jørgensen var. **hyperborea**

**Leaf margins** smooth, never crooked. **Marginal leaf cells** (14)16--20  $\mu\text{m}$ .

Ecological requirements and distribution are listed above under species description.

32b. *Scapania hyperborea* var. **tundrae** (Arnell) Potemkin  
*Scapania pulcherrima* R. M. Schuster; *S. tundrae* (Arnell) H. Buch

**Leaf margins** more or less crooked to more or less dentate. **Marginal leaf cells** 23--32  $\mu\text{m}$ .

This variety is distinct from all species in the flora in having large cells (23--32  $\mu\text{m}$  along margins) and often crooked to dentate leaf margins. According to recent molecular studies (J. Heinrichs et al., 2012) *S. hyperborea* var. *tundrae* is distinguished as a separate species, *S. tundrae*.

Ecological requirements and distribution are listed above under species description.

### 33. *Scapania paludicola* Loeske & K. Müller (Freiburg), Lebermoose 2: 425. 1915

**Plants** 30--80 x 2.5--4.5 mm, green to brown, occasionally purplish postically. **Leaves** entire to rarely dentate distally, terminal tooth cell 1.3--2 times as long as wide; dorsal lobe 0.5--0.6 times the size of ventral, 1.3--1.5(--2) times as wide as long, decurrent, extending far beyond stem, subparallel to slightly divergent with it, rounded to pointed at apex; ventral lobe 0.85--1.35 times as wide as long, decurrent to about keel insertion, apiculate to rounded at apex, not hyaline near base margin; keel (0.05--)0.15--0.25(--0.3) times the length of ventral lobe, acute, strongly arched, wing mostly absent. **Median leaf cells** with moderate acute to bulging trigones; marginal cells not differentiated, 16--22  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle moderately papillose. **Specialized asexual reproduction** by gemmae rare, brown and purple, exceptionally green in sun, 2-celled, ellipsoid, 9--16 x 16--28  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** compressed, mouth dentate.

Restricted to bogs in taiga, also on peaty soil and wet rocks in tundra; 0--2000 m; Greenland; Alta., B.C., Man., N.B., Nfld., N.W.T., N.S., Ont., Que., Sask., Yukon; Alaska, Conn., Maine, Mich., Minn., Mont., N.H., N.Y., Vt., Wis.; Eurasia.

*Scapania paludicola* is distinct from the other species of sect. *Irriguae* in having dorsal lobes that are decurrent, obcordate, subparallel and crossing far beyond the stem. These characters of *S. paludicola* closely resemble those of *S. uliginosa* of the sect. *Scapania*. See discussion of that species.

### 34. *Scapania glaucocephala* (Taylor) Austin, Bull. Torrey Bot. Club 6: 85.1876

*Jungermannia glaucocephala* Taylor, London J. Bot. 5: 277. 1846; *Scapania saxicola* R. M. Schuster; *S. glaucocephala* var. *saxicola* (R. M. Schuster) Potemkin

**Plants** 3--10 x 0.85--1.5(--2.25) mm, green to brownish. **Leaves** entire to dentate distally; terminal tooth cell variable, 1--4 times as long as wide; dorsal lobe 0.5--0.75 times the size of ventral, 0.4--0.65 times as wide as long, subtransversely inserted, not extending to distal edge of stem, divergent with it, triangular and pointed to mucronate and apiculate at apex when non-gemmiparous; ventral lobe 0.45--0.65 times as wide as long, subtransversely inserted, blunt to mucronate and apiculate at apex when non-gemmiparous, not hyaline near base margin; keel 0.38--0.65 times the length of ventral lobe, rounded at least basally, moderately arched, wing absent. **Median leaf cells** with small to moderate acute to slightly bulging trigones; marginal cells more or less thick-walled mostly in non-gemmiparous leaves, 16--20(--24)  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle smooth to moderately papillose. **Specialized asexual reproduction** by gemmae, common, brown and reddish brown, at least half are 2-celled

at maturity, broadly to narrowly ovoid and ellipsoid, 8--14 x 8--23(--28)  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** more or less compressed, mouth entire to sinuate-lobed.

Largely xylicolous, mostly on decorticated spruce and fir logs in deep, shaded, humid spruce-fir forests and cedar-spruce swamps, more rarely on sandstone, igneous rocks, and humus; 0--2000 m; Alta., B.C., N.W.T., Ont., Que.; Calif., Mich., Minn., N.H., N.J., N.Y., Vt., Wis.; Eurasia.

An important distinctive character of xylicolous plants of *Scapania glaucocephala* is the frequent production of gemmiparous flagellae with small bilobed mostly unbordered leaves. Similar flagellae are characteristic of *S. apiculata*, which is distinct in its uniformly 1-celled gemmae and the absence of thick-walled marginal cells. Saxicolous plants of *S. glaucocephala* (= *S. glaucocephala* var. *saxicola* (R. M. Schuster) Potemkin (A. D. Potemkin 1999a) usually do not develop gemmiparous flagellae and may produce dentate leaves.

### 35. *Scapania carinthiaca* Lindberg, Rev. Bryol. 7: 77. 1880

*Scapania massalogii* (K. Müller (Freiburg)) K. Müller (Freiburg)

**Plants** (1--2--6 x 0.5--1.5(--1.75) mm, green to brown. **Leaves** entire to occasionally dentate distally, terminal tooth cell mostly not over 1.5 times as long as wide; dorsal lobe 0.5--0.75 times the size of ventral, 0.45--0.85 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, triangular and pointed to mucronate at apex; ventral lobe 0.45--0.7 times as wide as long, subtransversely inserted, triangular and pointed to mucronate at apex, not hyaline near base margin; keel 0.5--0.65 times the length of ventral lobe, rounded basally, acute distally, moderately arched, wing absent. **Median leaf cells** with small acute to large bulging, occasionally confluent trigones; marginal cells thick-walled, subisodiametric to tangentially elongated, 14--18 x 16--24  $\mu\text{m}$ , 12--17  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae, common, reddish-brown, largely 1-celled, ovoid, 6--12 x 11--16  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** slightly to strongly compressed, mouth entire.

Peaty soil, conglomerate-quartzite and sandstone cliffs; of conservation concern; 0--200 m; Nfld., N.S., Que.; Minn., Wis.; Eurasia.

*Scapania carinthiaca* is known from five localities in the study area. The report of this species (as *S. massalongii*) from Alaska (W. C. Steere and H. Inoue 1978) is based on material of *S. brevicaulis*. Distinct thick-walled marginal cells is the most convenient character to distinguish *S. carinthiaca* from *S. brevicaulis*.

### 36. *Scapania apiculata* Spruce, Hepat. Pyrenaicae [Exsicc.] n. 15. 1847

**Plants** 1.8--5 x 0.5--1.9 mm, green to brownish. **Leaves** entire; dorsal lobe 0.65--0.8 ventral, 0.5--0.7 times as wide as long, subtransversely inserted, not extending to far edge of stem, divergent with it, triangular and sharp-pointed at apex; ventral lobe 0.45--0.67 times as wide as long, subtransversely inserted, triangular and sharp-pointed at apex, not hyaline near base margin; keel 0.6--0.75 times the length of ventral lobe, rounded to acute basally, moderately arched, wing absent. **Median leaf cells** with large bulging to moderate acute trigones; marginal cells not differentiated, 16--20(--24)  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle moderately papillose. **Specialized asexual reproduction** by gemmae, common, red to brown, 1-

celled, broadly ovoid, 7--11 x 11--18  $\mu\text{m}$ . **Sexual condition** dioicous. **Perianth** strongly compressed, mouth entire to crenulate.

Moist decaying logs; 0--3000 m; Alta., B.C., Man., N.W.T., N.S., Ont., Que.; Alaska, Maine, Mich., Minn., Mont., N.H., N.Mex., N.Y., Wis.; Eurasia.

The elevational range of *Scapania apiculata* is poorly known. The species is distinct from *S. carinthiaca*, which also produces 1-celled gemmae, in its thin-walled marginal cells and in the strong reduction of the gemmiparous leaves.

### 37. *Scapania kaurinii* Ryan, Bot. Not. (1889): 210. 1889

**Plants** 5--30 x 1--3.5 mm, green to brown. **Leaves** entire; dorsal lobe (0.65--0.75--0.85 times the size of ventral, 0.75--1.3 times as wide as long, subtransversely inserted, mostly extending to far edge of stem or slightly beyond it, divergent with stem, obtuse at apex; ventral lobe 0.75--1.15 times as wide as long, arcuately inserted, rounded to obtusely pointed at apex, not hyaline near base margin; keel 0.35--0.55 times the length of ventral lobe, acute, indistinctly to strongly arched, wing mostly narrow, entire. **Median leaf cells** with small acute to moderate slightly bulging trigones; marginal cells not differentiated, 15--20  $\mu\text{m}$  where subisodiametric; oil bodies not persistent; cuticle slightly papillose. **Specialized asexual reproduction** by gemmae rare, green to brown and purple, (1--2)-celled, ovoid, 14--19 x 25--33  $\mu\text{m}$ . **Sexual condition** monoicous (paricous, more rarely autoicous). **Perianth** more or less compressed, mouth lobulate-laciniate to dentate.

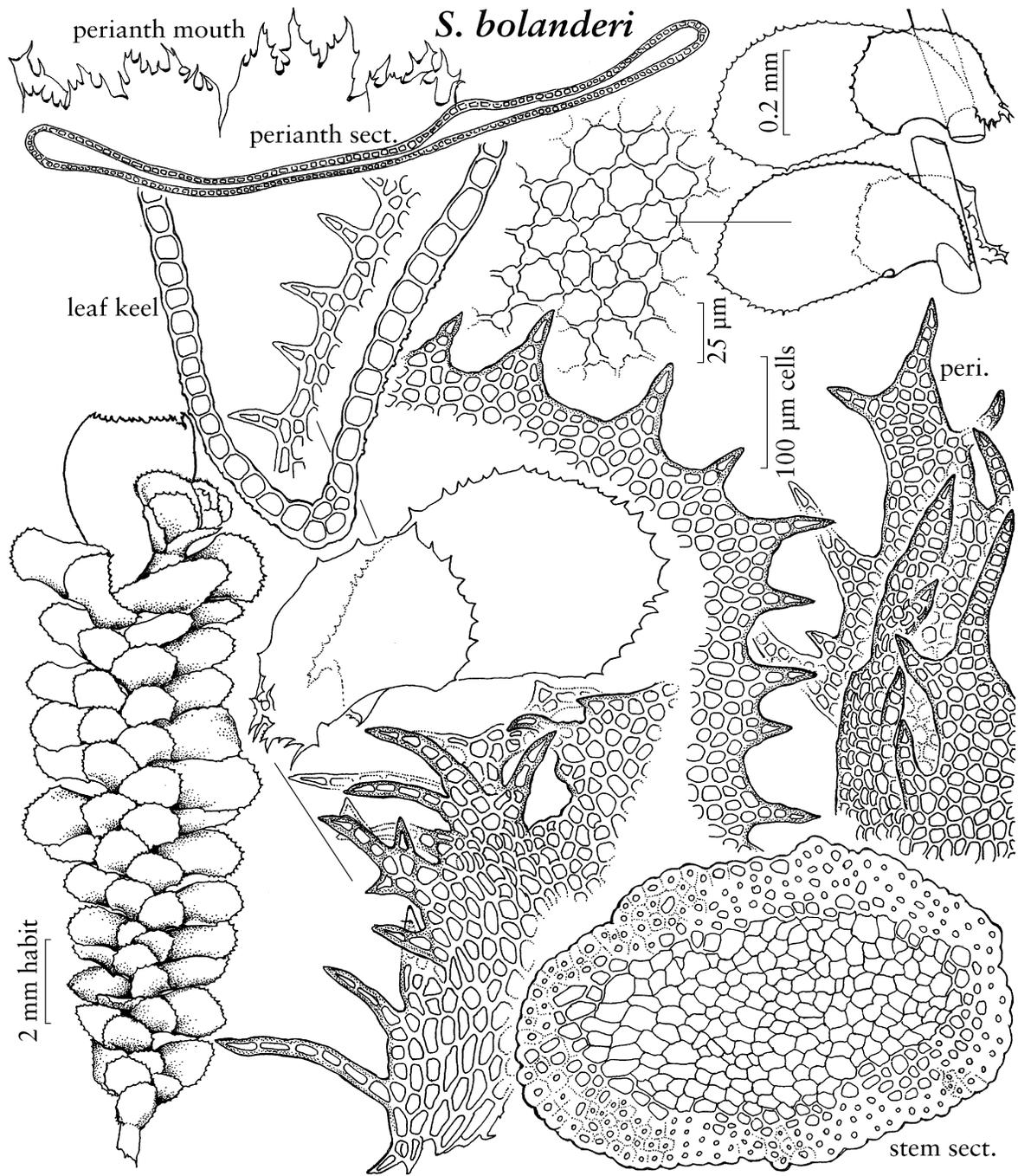
Moist rocks, rock detritus, soil; 0--1600 m; Greenland; B.C., N.W.T.; Alaska; Europe (Finland, Norway, n Russia, Sweden); Asia (n Russia).

*Scapania kaurinii*, when sterile, may be confused with *S. hyperborea* var. *hyperborea*. It differs from the latter in usually having a distinct narrow keel wing (vs. no distinct wing), small acute to moderate slightly bulging trigones, and sharply defined, often 2--3-stratose (vs. weakly defined, mostly 1--2-stratose) cortex. The leaves of *S. kaurinii* are mostly upturned and incurved.

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