

typically curved, typically stout and blunt ended; strongly 5-ranked, leaves not much elongate at distal end. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** green but often reddish at proximal end, with cortex enlarged with conspicuous retort cells. **Branch leaves** ovate to ovate-lanceolate, 1.4–1.8 mm; straight to often subsecund; weakly undulate and slightly recurved; hyaline cells on convex surface with 1 pore per cell at apical end of cell, on concave surface with round wall thinnings in the cells ends and angles; chlorophyllous cells triangular to triangular-ovate in transverse section, very well-enclosed within concave surface. **Sexual condition** dioicous. **Spores** 25–28 μm ; roughly papillous on both surfaces; proximal laesura more than 0.5 the length of the spore.

Abundant in poor fens and raised bogs, forming dense carpets at water level, especially on floating mats; low to moderate elevations; Man., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., Que.; Alaska, Conn., Ind., Maine, Mass., Mich., Minn., N.H., N.J., N.Y., Wis., W.Va.; Europe.

Sporophytes are uncommon in *Sphagnum pulchrum*. With its distinctive broad and strongly 5-ranked branch leaves, It is one of our most easily recognized species.

43. *Sphagnum recurvum* P. Beauvois, Prodr. Aethéogam., 88. 1805



Sphagnum pentastichon Bridel;
S. pulchricoma Müller Hal.;
S. riparioides Warnstorf

Plants moderate-sized to robust, moderately stiff-stemmed, \pm lax, but not compact; green to pale yellow to yellowish brown; capitulum typically strongly convex in open grown forms, but flat and \pm 5-radiate in shade forms. **Stem** pale green to yellowish; superficial cortex of 2 layers of enlarged, thin-walled and well differentiated cells. **Stem leaves** triangular, triangular-lingulate to lingulate, more than 0.8 mm, appressed, apex obtuse to broadly obtuse, erose to fimbriate; hyaline cells efibrillose and nonseptate. **Branches** straight and often tapering, often 5-ranked, leaves not much elongate at distal end of branches. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** green, cortex enlarged with conspicuous retort cells. **Branch leaves** ovate-lanceolate, 1.4–2 mm, straight; slightly undulate and sharply recurved; margins entire; hyaline cells on convex surface with 1 pore per cell at cell apex, concave surface with round wall thinnings in the cell ends and angles; chlorophyllous cells triangular in transverse section and well-enclosed on concave surface. **Sexual condition** dioicous. **Spores** 22–28 μm ; papillose on both surfaces; proximal laesura more than 0.5 spore radius.

Capsules mature late summer to early fall. Forming carpets in a variety of very poor to poor fen habitats, including sedge fens, pocosins, bay swamps; low to moderate elevations; Nfld. and Labr. (Nfld.), N.S.; Ala., Ark., Conn., Del., Fla., Ga., Ill., Ind., Ky., La., Maine, Md., Mass., Miss., Mo., N.H., N.J., N.Y., N.C., Ohio, Pa., S.C., Tenn., Tex., Vt., Va., W.Va.; South America.

Sporophytes in *Sphagnum recurvum* are uncommon. This species is found exclusively in the New World. It has several strong characters that distinguish it from *S. flexuosum*, and the opinion of H. A. Crum (1997) that the two species are synonymous is rejected. See discussion under 30. *S. flexuosum*.

44. *Sphagnum riparium* Ångström, Öfvers. Kongl. Vetensk.-Akad. Förh. 21: 198. 1864



Plants stiff and upright, large; green to pale green to brownish, capitulum large and flat, with a conspicuous terminal bud. **Stems** pale green, superficial cortex of 3–4 layers of weakly differentiated cells. **Stem leaves** triangular-lingulate, 1.2–1.4 mm; apex with a deep lacerate split; hyaline cells

aporous, efibrillose and often septate. **Branches** unranked to rarely 5-ranked, branch leaves only weakly undulate, but sharply recurved at the apex, leaves not much elongated at distal end. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stem** green, cortex enlarged with retort cells. **Branch leaves** ovate-lanceolate; 2–2.6 mm; straight; weakly undulate but strongly recurved, hyaline cells on convex surface with very large irregular pores (formed from the confluence of several smaller pores) at the cell apex, concave surface with large round wall thinnings in the cell angles; chlorophyllous cells triangular to trapezoidal in transverse section, apex normally slightly exposed on concave surface. **Sexual condition** dioicous. **Spores** 22–28 μm ; proximal surface noticeably papillose, distal surface smooth or with fewer papillae; proximal laesura more than 0.5 the length of the radius.

Forming often extensive carpets in weakly minerotrophic mires; low to moderate elevations; Greenland; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.W.T., N.S., Ont., P.E.I., Que., Sask., Yukon; Alaska, Conn., Ind., Maine, Mass., Mich., Minn., Mont., N.H., N.J., N.Y., Ohio, Pa., Vt., Wash.; Eurasia.

Sporophytes are uncommon in *Sphagnum riparium*. This species is typically very easily recognized in the field with its pale green color, strong terminal bud, and unranked branch leaves.

45. *Sphagnum rubroflexuosum* R. E. Andrus,
Bryologist 91: 364, figs. 1–8. 1988 [E]



Plants small, soft, fairly weak-stemmed; pale green to pale yellow brown; capitulum not 5-radiate or only weakly so, may be tinged with red; loose to somewhat compact. **Stems** pale green to pink; superficial cortex of undifferentiated. **Stem leaves** 0.7–1 mm (to 1.2 mm in

hemiisophyllous forms) elongate-triangular to triangular-lingulate, apex obtuse-erose, to apiculate; usually fibrillose at least apically; in hemiisophyllous forms spreading and in anisophyllous forms appressed; hyaline cells often septate at base. **Branches** moderately long and tapering, unranked to weakly 5-ranked, leaves not much elongated at distal end. **Branch fascicles** with 2 spreading and 2–3 pendent branches. **Branch stem** cortex enlarged and with conspicuous retort cells. **Branch leaves** 1–1.7 mm, ovate-lanceolate, undulate and recurved when dry; hyaline cells on convex surface with 3–10 round pores per cell in the cell angles and free, on concave surface with round wall thinnings in the ends and angles. **Sexual condition** unknown. **Spores** not seen.

Forming carpets in weakly minerotrophic fens; moderate elevations; Md., Pa.

Sporophytes are unknown in *Sphagnum rubroflexuosum*. Compared to the closely related *S. flexuosum*, this species is paler and may have a reddish stem. Otherwise, identification must be made microscopically on the basis of branch leaf porosity. Although we have not seen this species in the field, it should be separable from *S. majus*, the only other large, aquatic species of sect. *Cuspidata*, in its range by traits of stem leaves and its color. *Sphagnum majus* is also typically a much darker brown.

46. *Sphagnum splendens* Maass, Bryologist 70: 193,
figs. 1–4. 1967 [E]



Plants moderate-sized, pale brown and shiny, capitulum well defined. **Stems** yellowish, superficial cortex of moderately well differentiated. **Stem leaves** triangular, 0.7–0.9 mm, appressed to stem; apex apiculate; hyaline cells efibrillose and nonseptate. **Branches** moderately tapering, leaves only

moderately larger at branch tips. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** green; cortex enlarged with conspicuous retort cells. **Branch leaves** ovate-lanceolate, 1–1.4 mm; straight; stiff, not undulate and slightly recurved; margins entire; hyaline cells efibrillose, convex surface with 1 pore per cell at

cell apex, on concave surface with round wall thinnings in the cell ends and angles; chlorophyllous cells triangular in transverse section and well enclosed to just reaching concave surface. **Sexual condition** unknown. **Spores** unknown.

Moderate elevations; known only from the type locality; Que.

Sporophytes of *Sphagnum splendens* are unknown. The lack of any fibrils in the branch leaf hyaline cells gives it an unusually glossy appearance that should make it readily identifiable in the field. The facts that it differs from *S. fallax* in only one character and that it is known only from the type locality make *S. splendens* questionably distinct to some observers. More investigation is needed.

47. *Sphagnum tenellum* (Bridel) Bory, Voy. Îles Afrique.
3: 107. 1804



Sphagnum cymbifolium var.
tenellum Bridel, Musc. Recent. 2(1):
24. 1798; *S. molluscum* Bruch

Plants small, slender and weak-stemmed; pale yellow to golden brown, rarely tinged with red; capitulum not especially distinct. **Stems** pale green to pale brown; superficial cortex of 2–3 layers of

enlarged thin-walled cells. **Stem leaves** ovate-lingulate; 1–1.3 mm, apex broadly rounded; hyaline cells nonseptate, aporse and fibrillose in at least distal half of leaf. **Branches** 2–3 spreading and 2 pendent leaves not much elongated at distal end. **Branch stems** green; cortex enlarged, with conspicuously long-necked retort cells. **Branch leaves** ovate, 1–1.5 mm; straight; not or weakly undulate or recurved when dry; margins entire; hyaline cells short and wide, convex surface with 1–3 small pores per cell and on concave surface with large round wall thinnings in the cell angles; chlorophyllous cells equilateral-triangular in transverse section, broadly exposed on convex surface and just reaching to well-enclosed on concave surface. **Sexual condition** monoicous. **Spores** 27–42 µm; both surfaces smooth, proximal surface with distinct bifurcated Y-mark sculpture surrounded by distinct circular border, distal surface with distinct raised border around margins; proximal laesura usually less than 0.4 spore radius.

Capsules mature early to mid summer. Wet depressions in a variety of ombrotrophic and weakly minerotrophic habitats; low to high elevations; Greenland; B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.S.; Alaska, Maine, N.J., N.Y., N.C.; Eurasia.

Sporophytes are common in *Sphagnum tenellum*. The delicate appearance created by the ovate and concave branch leaves as well as the large concave stem leaves make this a usually unmistakable species.

48. *Sphagnum torreyanum* Sullivant, Mem. Amer.

Acad. Arts, n. s. 4: 174. 1849 [E]



Sphagnum cuspidatum var. *torreyi* Braithwaite; *S. cuspidatum* var. *miquelonense* (Röll) Renaud & Cardot; *S. kearneyi* Warnstorff; *S. laxifolium* var. *miquelonense* Röll

Plants robust and weak-stemmed; green to golden yellow; capitulum ± rounded in emergent forms, flat in submersed forms; lacking distinct terminal bud. **Stems** green to brown; superficial cortex of 2 layers of thin-walled and enlarged cells. **Stem leaves** triangular, 1–1.7 mm, apex acute to slightly obtuse; leaves usually appressed; margins entire; hyaline cells fibrillose and usually septate at base and sides. **Branches** unranked, long and tapering, leaves greatly elongated at distal end. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** green; cortex enlarged with conspicuous retort cells. **Branch leaves** ovate-lanceolate to lanceolate, 3–5.5 mm; straight but sometimes slightly falcate-secund; weakly undulate and recurved when dry; margins entire; hyaline cells on convex surface with 0–1 pore per cell, on concave surface with round wall thinnings on the apices and angles; chlorophyllous cells narrowly triangular in transverse section and just enclosed on the concave surface. **Sexual condition** dioicous. **Spores** 26–29 μm; both surfaces distinctly papillose, appearing pustulate to irregularly pustulate; proximal laesura mostly less than 0.5 spore radius.

Forming wet often floating carpets in weakly minerotrophic mires; low to moderate elevations; St. Pierre and Miquelon (Miquelon); N.B., Nfld. and Labr. (Nfld.), N.S., Que.; Ala., Conn., Del., Fla., Ga., La., Maine, Md., Mass., Miss., N.H., N.J., N.Y., N.C., Pa., R.I., S.C., Vt., Va.

Sporophytes are uncommon in *Sphagnum torreyanum*. See discussion under 24. *S. atlanticum* for taxonomic distinctions.

49. *Sphagnum trinitense* Müller Hal., Syn. Musc. Frond. 1: 102. 1848

Sphagnum cuspidatum var. *serratum* (Austin) Austin; *S. cuspidatum* var. *serrulatum* (Schliephacke) Schliephacke; *S. helleri* Warnstorff; *S. laxifolium* var. *serrulatum* Schliephacke; *S. serratum* Austin

Plants moderate-sized, slender and weak-stemmed, green to pale yellow; flaccid and plumose in aquatic forms to more compact and sprawling in emergent forms; green to pale yellow; capitulum not

especially enlarged and differentiated. **Stems** green; superficial cortex of undifferentiated or slightly differentiated cells. **Stem leaves** ovate-triangular to triangular, 1–1.6 mm; appressed to spreading; apex acute to slightly obtuse; hyaline cells often fibrillose and often 1-septate. **Branches** straight and unranked, in capitulum tapering at distal end to a point, leaves greatly elongated at distal end. **Branch stems** green, cortex enlarged with conspicuous retort cells. **Branch leaves** ovate-lanceolate to lanceolate, 2–3.5 mm; straight, undulate and slightly recurved when dry; margin serrulate; hyaline cells on convex surface with 0–1 small pores at cell apex on concave surface with round wall thinnings in cell angles (often indistinct or lacking); chlorophyllous cells trapezoidal in transverse section and exposed more broadly on the convex surface. **Sexual condition** monoicous. **Spores** 26–40 μm; ± roughly to densely granulose.

Capsules mature early to mid summer. Submersed or stranded at edge of shallow, acidic pond, lakes, and roadside ditches, mostly in sandy areas of the Atlantic coastal plain; low to moderate elevations; Del., Fla., Ga., Ill., Kans., La., Md., Mass., N.J., N.Y., N.C., Pa., S.C., Va.; South America.

Sporophytes are common in *Sphagnum trinitense*, which can often be distinguished from *S. cuspidatum* in the field by the appearance of its branches when wet. In this state the branches of *S. trinitense* just below the capitulum resemble a fine paintbrush drawn out to a pointed tip. See also discussion under 29. *S. fitzgeraldii* and 39. *S. mississippiense*. Spore features are taken from H. A. Crum (1984).

50. *Sphagnum viride* Flatberg, Kongel. Norske Vidensk. Selsk. Skr. (Trondheim) 1: 9, figs. 1988

Plants slender and weak-stemmed, moderate-sized, flaccid and plumose when submerged and stiffer and more compact when emergent; green to yellow, usually not tinged with brown or red; capitulum well defined, flat in submersed forms and more rounded in emergent forms. **Stems**

green; superficial cortex of 2–3 layers of enlarged thin-walled cells. **Stem leaves** long triangular-ovate, 1–2 mm; usually appressed; apex acute to apiculate, hyaline cells only rarely septate or aporse but often fibrillose in apical region. **Branches** unranked, straight to slightly curved, leaves somewhat elongated at distal end. **Branch fascicles** with 2 spreading and 2–3 pendent branches. **Branch stems** green, cortex enlarged with conspicuous retort cells. **Branch leaves** 1.5–2.7 mm, ovate-lanceolate to lanceolate; straight to falcate toward branch tips; when dry often undulate and lightly recurved, margins entire to rarely

weakly toothed along the margins in flaccid aquatic forms, hyaline cells on convex surface with 0–1 small round pores at apex, on concave surface with faint round wall thinnings in cell apices and angles; chlorophyllous cells triangular to trapezoidal in transverse section, broadly exposed on the convex surface and exposed slightly to broadly on the concave surface. **Sexual condition** dioicous. **Spores** 30–43 µm; the superficial surface coarsely papillose to papillose reticulate.

Widespread, forming wet carpets in weakly minerotrophic mires; low to moderate elevations; Nfld. and Labr. (Nfld.), N.S.; Ala., Conn., Del., Fla., Ind., Maine, Mass., Mich., Minn., N.H., N.J., N.Y., N.C., Ohio, Pa., S.C., Tenn., Vt., Va.; Europe.

The sporophytes of *Sphagnum viride* are uncommon. See discussion under 27. *S. cuspidatum* for taxonomic distinctions. Spore characters are taken from Flatberg's description.

1g. SPHAGNUM sect. SUBSECUNDA (Lindberg) Schimper, Syn. Musc. Eur. ed. 2, 2: 843. 1876

Sphagnum [unranked] *Subsecunda* Lindberg, Öfvers. Kongl. Vetensk.-Akad. Förh. 19: 1862;
Sphagnum [unranked] *Cavifolia* C. E. O. Jensen; *Sphagnum* [unranked] *Comatosphagnum* Müller
 Hal.; *Sphagnum* [unranked] *Cyclophylla* Lesquereux & James; *Sphagnum* sect. *Hemitheca*
 Braithwaite

Plants erect to prostrate, extremely variable, capitulum rarely well developed; green, yellowish, light brown, golden brown, reddish brown to dark brown. **Stem** green to dark brown, superficial cortex of 0–3 layers of efibrillose, non-ornamented, enlarged, thin-walled cells; cells in outer layer aporse or with single round to elliptical wall thinning adjacent to the distal cell wall, visible only with heavy staining. **Stem leaves** varying from smaller than to larger than branch leaves; triangular, ovate to lingulate; with rounded and sometimes erose apex; border entire; hyaline cells rhomboid to S-shaped, non-ornamented, efibrillose to fibrillose, aporse to sometimes porose, non- to multiply septate; neither surface resorbed. **Branches** not always clearly dimorphic, spreading and pendent branches very similar. **Branch fascicles** 1–3 spreading and 0–2(–4) pendent. **Branch stems** green, surrounded by 1 layer of efibrillose, non-ornamented, thin-walled, inflated cells, with solitary short-necked retort cells or with conspicuously necked retort cells, interspersed with primarily aporse rectangular-shaped cells. **Branch leaves** oval, ovate or ovate-lanceolate; hyaline cells fibrillose, non-ornamented; convex surface mostly with numerous elliptical to round pores (8–24 per cell) in rows along commissures on convex surface, concave surface with fewer or no pores; chlorophyllous cells elliptical in transverse section, ± equally exposed on both surfaces or slightly more on convex surface, end walls not thickened. **Sexual condition** dioicous. **Capsule** with few pseudostomata. **Spores** 22–41 µm, with or without raised surface sculpture on distal surface; proximal laesura more than 0.5 spore radius.

Species 99 (13 in the flora): worldwide except Antarctica.

1. Stem cortex undifferentiated, superficial layer composed of small thick-walled cells 57. *Sphagnum microcarpum*
1. Stem cortex differentiated with one or more superficial layers of enlarged thin-walled cells.
 2. Stem cortex of more than 1 superficial layer of enlarged, thin-walled cells.
 3. Stem leaves broadly ovate and completely fibrillose, fascicles of 3 branches; terminal bud large, round 61. *Sphagnum platyphyllum*
 3. Stem leaves lingulate and fibrillose apically; fascicles most 4 or more branches; terminal bud, if any, small.
 4. Stem leaf hyaline cells without parallel septations, usually non-septate; branch leaves 1.2–2 mm. 52. *Sphagnum contortum*
 4. Stem cortex partly one and partly two layers of enlarged thin-walled cells.

5. Branch leaf convex surface commissural pores equal to or less than 1 μm 59. *Sphagnum orientale*
5. Branch leaf convex surface commissural pores 3 μm or more.
6. At least some stem leaf hyaline cells with 2 or more parallel septations; branch leaves 2.2 mm or longer 51. *Sphagnum carolinianum*
6. Stem leaf hyaline cells without parallel septations, leaves less than 2.2 mm 54. *Sphagnum inexpectatum*
- [2. Shifted to left margin.—Ed.]
2. Stem cortex 1 superficial layer of enlarged, thin-walled cells.
7. Stem simple without branches.
8. Hyaline cells of stem and branch leaves with numerous minute, rounded pores on free surface, stem and branch leaves similar and very long (3.5–4 mm), some stem cortical cells with a single wall thinning at the distal end of the cell . . . 53. *Sphagnum cyclophyllum*
8. Hyaline cells of stem and branch leaves without pores on superficial surface or with 1–3 small pores in apical ends and angles of cells, stem leaves longer (1.5–2.5 mm) than branch leaves (0.9–1.2 mm), stem cortical cells aporose 62. *Sphagnum pylaesii* (in part)
7. Stems with branches arranged in fascicles.
9. Hyaline cells of branch leaves without pores on convex surface or with 1–3 small pores in cell apical ends and angles, hyaline cells of branch leaves with thick fibrils that nearly divide the cells into a series of squarish segments 62. *Sphagnum pylaesii* (in part)
9. Hyaline cells of branch leaves with rows of commissural pores or with 1–5 pores per cell free from the commissures on the convex surface, hyaline cells with thin fibrils.
10. Stem leaves greater than 1.2 mm, lingulate to ovate-lingulate, generally fibrillose for more than $\frac{1}{3}$ their length 56. *Sphagnum lescurii*
10. Stem leaves equal to or less than 1.2 mm, triangular to triangular-lingulate, generally fibrillose for $\frac{1}{3}$ or less their length.
11. Branch leaf hyaline cells lacking pores along the commissures but up to 5 small pores free from the commissures on convex surface 58. *Sphagnum oregonense*
11. Branch leaf hyaline cells with continuous rows of pores along the commissures and sometimes with few to numerous pores free from the commissures on convex surface.
12. Branch leaf hyaline cell pores less than or equal to 3 μm , often with 1–2 rows of pores free from the commissures 60. *Sphagnum perfoliatum*
12. Branch leaf hyaline cell pores more than 3 μm , lacking pores free from the commissures.
13. Stem leaves longer than 0.7 mm; branch leaves equal to or greater than 1.2 mm, mostly straight 55. *Sphagnum inundatum*
13. Stem leaves less than 0.7 mm; branch leaves less than 1.2 mm, often subsecund 63. *Sphagnum subsecundum*

51. *Sphagnum carolinianum* R. E. Andrus, Bryologist
86: 257, figs. 1983 [E]



Sphagnum subsecundum var.
carolinianum (R. E. Andrus) H. A.
Crum

Plants moderate to large, erect to floating, green to dark brown; capitulum large, well defined and flat-topped. **Stems** typically light green but grading to dark brown; superficial cortex of 2–3 layers of

enlarged, thin-walled cells. **Stem leaves** lingulate to lingulate-triangular, 0.7–1.5 mm (to 3 mm in isophyllous forms), apex erose; hyaline cells mostly 1-septate but in

a few cells with 2–3 parallel septations, efibrillose to fibrillose throughout, pores present in hemiisophyllous and isophyllous forms. **Branches** straight to somewhat curved, with spreading leaves. **Branch fascicles** with 2 spreading and 2 pendent in emergent forms, these reduced in aquatic forms to 2 per fascicle. **Branch leaves** variable, broadly ovate to ovate-lanceolate, 1.3–5 mm; straight, hyaline cells on the convex surface with 4–8 μm round to elliptic pores in nearly continuous rows along the commissures, the concave surface aporose or with some porosity as on the convex surface. **Sexual condition** unknown. **Capsule** not seen. **Spores** not seen.

Forming wet often floating carpets in pools in weakly minerotrophic mires; low to moderate elevations; Nfld.