

2. *Sphagnum alaskense* R. E. Andrus & Janssens, Bryologist 106: 435, figs. 1, 3. 2003 [E]



**Plants** moderate-sized to robust, ± weak-stemmed and compact, capitulum conspicuously large and flat-topped; pinkish brown to red-brown; compact low hummocks and hummock sides. **Stems** brown, superficial cortical layer with spiral reinforcing fibrils lacking or faint, usually 2 or more pores per cell, comb-fibrils lacking on interior wall. **Stem leaves** to  $1.7 \times 1.2$  mm; rarely hemiisophyllous; hyaline cells nonseptate to occasionally septate, comb-lamellae absent. **Branches** long and tapering. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** with hyaline cells non-ornamented, no or weak funnel-like projections on the interior end walls, often with large round pores on the superficial wall. **Branch leaves** broadly ovate, to  $3 \times 2.3$  mm; hyaline cells on proximal half of convex surface with elliptical pores along the commissures, often with ridges running parallel to long leaf axis on hyaline cell surface overlying chlorophyllous cells; chlorophyllous cells elliptical and just enclosed on both surfaces in transverse section; end walls not thickened. **Sexual condition** dioicous. **Capsule** not seen. **Spores** unknown.

Poor to medium fens and mineral edges of ombrotrophic mires; low to moderate elevations; B.C.; Alaska, Wash.

*Sphagnum alaskense* most resembles *S. magellanicum* and *S. centrale* in its chlorophyll cell cross section. The cross section characteristic is most similar to that of *S. centrale* but *S. alaskense* lacks thickened walls. *Sphagnum alaskense* also apparently does not have any range overlap with *S. centrale*, the latter being more of a boreal forest species. *Sphagnum alaskense* occurs in more open and less mineral rich sites near the coast. *Sphagnum magellanicum* has more well-enclosed chlorophyll cells and usually has some purplish coloration, whereas *S. alaskense* often has a quite distinctive pinkish brown color which, along with its often large flattened capitula, can give it a distinctive look in the field.

3. *Sphagnum austinii* Sullivant in C. F. Austin, Musci Appalach., 2. 1870 (as austini) [F]



*Sphagnum cymbifolium* subsp. *austinii* (Sullivant) J. Cardot; *S. cymbifolium* var. *austinii* (Sullivant) Warnstorff; *S. imbricatum* subsp. *austinii* (Sullivant) Flatberg

**Plants** moderate-sized to large, usually quite compact; reddish brown and often yellow flecked with red-brown; in dense stands forming large and tall hummocks. **Stems** brown,

superficial cortical cells with spiral reinforcing fibrils clearly visible, usually 2 or more pores per cell, comb-fibrils lacking on interior wall. **Stem leaves**  $1.2\text{--}1.6 \times 1$  mm; rarely hemiisophyllous; hyaline cells nonseptate or more typically mostly septate, comb-lamellae present on interior wall. **Branches** clavate, tapering to short point, tightly imbricate at proximal end to somewhat spreading at distal end in less compact forms. **Branch fascicles** with 2 spreading and 1 pendent branch. **Branch stems** with cortical cell comb-lamellae visible on interior wall, conspicuous funnel-like projection on interior end walls extending to next cell less than one half its length, pores in superficial wall restricted to leaf bases. **Branch leaves** ovate-elliptical to elliptical,  $1.5\text{--}2.1 \times 0.8\text{--}1.4$  mm; hyaline cells on convex surface with numerous moderate-sized round pores along the commissures, comb-lamellae present throughout most of leaf; chlorophyllous cells broadly triangular in transverse section and well-enclosed on the convex surface, end wall not thickened. **Sexual condition** dioicous. **Capsule** with scattered pseudostomata. **Spores**  $23\text{--}28$   $\mu\text{m}$ ; coarsely granulate on both surfaces; proximal laesura more than 0.50 spore radius.

Capsules common, mature mid summer. Ombrotrophic mires and large hummocks in blanket mires; low to moderate elevations; B.C., N.B., Nfld. and Labr. (Nfld.), N.S.; Alaska, Maine, Mass., N.J., Vt., Wash.; Europe.

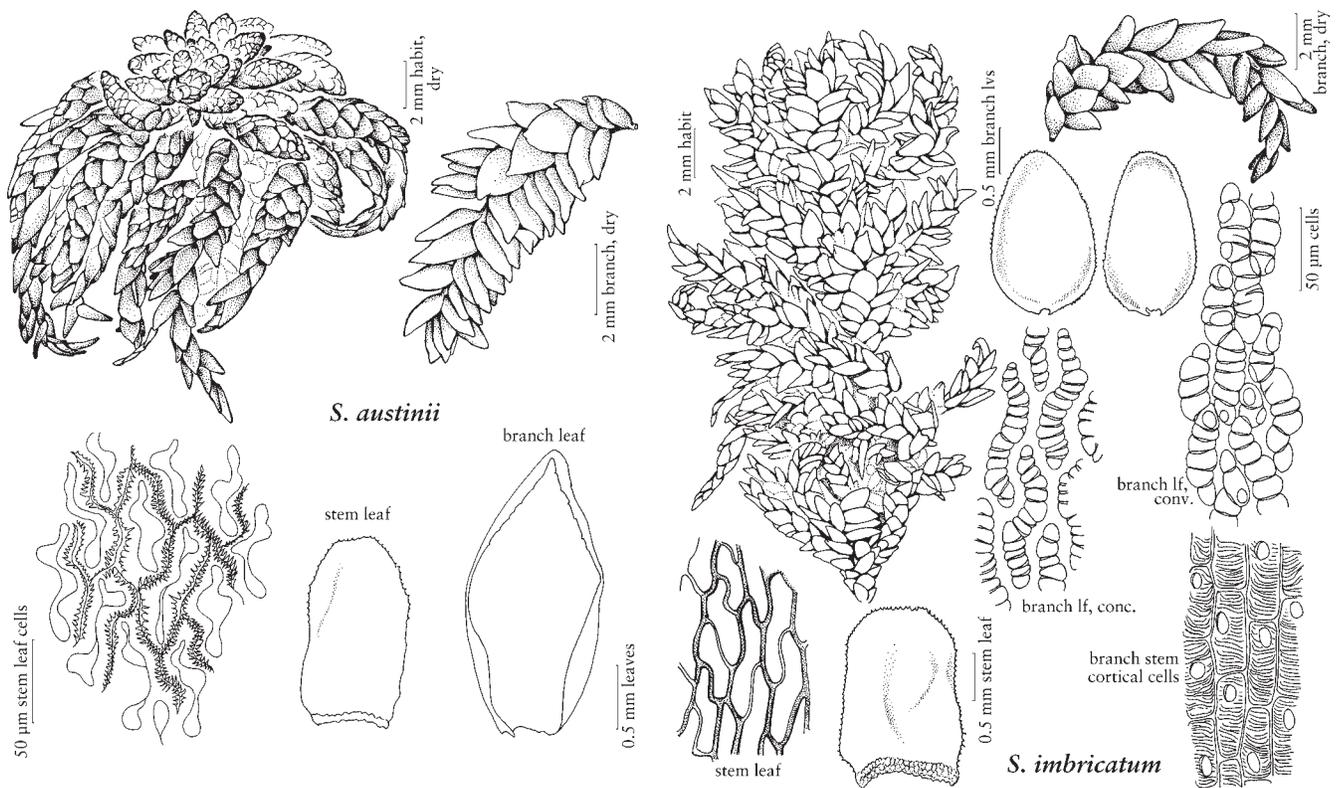
*Sphagnum austinii* is usually easily recognized in the field by its strongly imbricate and clavate branches. It forms very dense and often tall hummocks with a distinct deep golden brown color. In contrast to the view stated by H. A. Crum (1997), this species has an ecology and distribution quite distinct from those of *S. affine*. *Sphagnum affine* is a minerotrophic species that does not even occur in the Pacific coast region, where *S. austinii* is quite prominent.

4. *Sphagnum centrale* C. E. O. Jensen, Bih. Kongl. Svenska. Vetensk.-Akad. Handl. 21(10): 34. 1896



*Sphagnum palustre* subsp. *intermedium* Russow; *S. subbicolor* Hampe

**Plants** moderate-sized to robust, capitulum compact and well rounded in open-grown forms, lax to somewhat compact; green in shade forms to golden yellow to golden brown in open-grown forms, occasionally with a pinkish tinge; lawns, loose low hummocks to larger, ± firm hummocks. **Stems** pale brown to brown, superficial cortical cells with spiral reinforcing fibrils clearly visible, 2 pores or more per cell, comb-fibrils lacking on interior wall. **Stem leaves** to  $1.2\text{--}2.2 \times 0.8\text{--}1$  mm; rarely hemiisophyllous; hyaline cells



SPHAGNUM

non-ornamented, rarely septate, comb-lamellae absent. **Branches** tapering, leaves spreading to somewhat imbricate. **Branch fascicles** with 2 spreading and 1–2 pendent branches. **Branch stems** with cortical cells non-ornamented, no or weak funnel-like projections on the interior end walls, often with large round pores on the superficial walls. **Branch leaves** broadly ovate, to  $1.7 \times 1.5$  mm; hyaline cells non-ornamented, convex surface with elliptic to rarely round pores along the commissures; chlorophyllous cells lenticular to narrowly elliptical in transverse section, narrowly exposed on both ends, but more so on concave surface, end walls thickened at both ends. **Sexual condition** dioicous. **Capsule** with inconspicuous pseudostomata. **Spores** 23–30 μm; surface finely roughened to smooth; laesura on proximal surface more than 0.5 spore radius.

Capsules uncommon, mature late summer. Medium to rich fens, especially prominent in coniferous fens and sedge fens; low to high elevations; Greenland; Alta., B.C., Nfld. and Labr. (Nfld.), N.W.T., N.S., Ont., P.E.I., Que., Sask.; Conn., Idaho, Ill., Ind., Iowa, Maine, Mass., Mich., Minn., Mont., N.H., N.J., N.Y., Ohio, Pa., Vt., Wash., Wis.; Eurasia.

*Sphagnum centrale* is most similar to *S. alaskense* but seems to have no range overlap with that species and is also considerably more minerotrophic. In the field it lacks the often reddish tinge of *S. palustre* and is larger than

*S. affine*. See also discussion under 2. *S. alaskense* and 9. *S. papillosum*.

5. *Sphagnum henryense* Warnstorf, Hedwigia 39: 107. 1900



*Sphagnum henryense* var. *bartlettii*  
Warnstorf

**Plants** moderate-sized to robust, capitulum typically flat, ± 5-radiate and with terminal bud slightly visible; green, pale green, to pale pinkish brown tinged with brown to reddish brown; forming carpets or low hummocks. **Stems**

pale green to brown; superficial cortical layer with spiral reinforcing fibrils clearly visible, usually 4 or more pores per cell, comb-fibrils lacking on anterior wall. **Stem leaves** to  $1.9 \times 1$  mm; rarely hemiisophyllous; hyaline cells non-ornamented, nonseptate or septate. **Branches** ± tapering to a point, leaves spreading to moderately imbricate. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** with hyaline cells non-ornamented; funnel-like projections absent from interior end walls, large round pores on superficial walls. **Branch leaves** ovate, to  $2.7 \times 1$  mm; hyaline cells on convex surface with numerous small round pores along the commissures, cell walls overlying chlorophyll cells often with a network of

irregular worm like ridges although they may be lacking; chlorophyllous cells isosceles-triangular to narrowly ovate triangular in transverse section and just enclosed on convex surface, end wall not thickened. **Sexual condition** dioicous. **Capsule** with numerous pseudostomata. **Spores** 24–29  $\mu\text{m}$ ; surface finely papillose to nearly smooth.

Poor to medium fens, common in wooded fens and pond margins; low to moderate elevations; B.C., Nfld. and Labr. (Nfld.), N.S., P.E.I.; Ala., Alaska, Ark., Calif., Conn., Del., D.C., Fla., Ga., Ill., Ind., La., Maine, Md., Mass., Mich., Miss., Mo., N.H., N.J., N.Y., N.C., Ohio, Okla., Oreg., S.C., Tenn., Tex., Vt., Va., W.Va., Wis.; Asia.

The typical form of *Sphagnum henryense* is a large plant with a quite flat capitulum with a small terminal bud. Microscopically, typical material has distinct ridges on the branch leaf hyaline cells and relatively small and round pores on the branch leaf hyaline cell convex surface. *Sphagnum palustre*, which has the same branch leaf chlorophyll cell cross section, typically has smooth hyaline cell walls and hyaline cell pores that are larger and more elliptical in shape. However, *Sphagnum* species are plastic phenotypically and it is common to find plants that cannot be reliably assigned to either *S. henryense* or *S. palustre*. For example, some species of *Sphagnum* that are relatively easy to distinguish on other characteristics, such as *S. papillosum*, *S. alaskense* and *S. affine*, may occasionally completely lack any hyaline cell ornamentation or display it in reduced form. Since these can be distinguished on other characters, the species are still readily identifiable, but when *S. henryense* lacks the ornamentation, there is no other solid character to distinguish it from *S. palustre*. Thus, although we can find material from both North American coasts that has good ornamentation (R. E. Andrus 1980), there is much other material that looks in other respects like *S. henryense* but lacks the ornamentation. Barring taxonomy beyond microscopic examination, many collections of *henryense/palustre* will of necessity not be absolutely identifiable. Where their ranges overlap, mixed stands may often be found. We believe that the species are still good, but accurate delimitation of their distinctive ecologies and ranges will be very problematic.

#### 6. *Sphagnum imbricatum* Russow, Beitr. Torfm., 99.

1865 [E] [F]



**Plants** moderate-sized, weak-stemmed, lax; yellowish to golden brown; forming loose carpets; branches loosely imbricate. **Stems** yellow to brown, superficial cortical layer with spiral reinforcing fibrils visible, 1 or more pores/cell, comb-fibrils on interior wall. **Stem leaves** short-

rectangular, 0.8–1.1 mm, hyaline cells mostly non-septate and absent comb-fibrils. **Branch fascicles** with 2

spreading and 1–2 hanging branches. **Branch stems** with hyaline cells non-ornamented, no or weak funnel-like projections on the end walls of cortical cells, cortical cell walls usually with large round pores. **Branch leaves** ovate to ovate-elliptic, 1.4–1.8 mm; hyaline cells on convex surface with numerous pores along the commissures; comb-lamellae obvious only in proximal 1/2 of leaf; chlorophyllous cells broadly triangular in transverse section and well-enclosed on the convex surface. **Sexual condition** dioecious. **Spores** (22) 24–27(–28)  $\mu\text{m}$ , surface granulate.

Ecology poorly known; moderate elevations; Alaska.

K. I. Flatberg (1984) considered *Sphagnum imbricatum* to be East Asian in distribution but a recent collection in Selawik National Wildlife Refuge places it in the North American flora. It will undoubtedly be found elsewhere. *Sphagnum imbricatum* is closest in morphological detail to *S. steerei*, but the latter is a very dark colored and densely branched species whereas *S. imbricatum* is quite light in color and not particularly dense.

#### 7. *Sphagnum magellanicum* Bridel, Muscol. Recent.

2(1): 24. 1798



**Plants** moderate-sized to robust, somewhat lax in shade forms to quite compact and stiff in open grown forms; green to pinkish green to reddish purple; forms lawns in shaded habitats and low to moderately tall, dense hummocks in open habitats.

**Stems** green to purplish red, superficial cortical cells with spiral reinforcing fibrils clearly visible, usually 1 or 2 pores per cell, comb-fibrils lacking on interior wall. **Stem leaves** to 2 × 0.7 mm; rarely hemiisophyllous; hyaline cells non-ornamented, mostly nonseptate. **Branches** long and tapering to short and pointed, leaves loosely imbricate. **Branch fascicles** with 2–3 spreading and 2–3 pendent branches. **Branch stems** with hyaline cells non-ornamented; no or weak funnel-like projections on the interior end walls, large round pores on superficial cell walls. **Branch leaves** broadly ovate, to 2 × 1 mm or more wide, broadly ovate, hyaline cells non-ornamented, convex surface with round to elliptic pores along the commissures; chlorophyllous cells short-elliptic in transverse section and well-enclosed on both surfaces. **Sexual condition** dioicous. **Capsule** with numerous pseudostomata. **Spores** 22–30  $\mu\text{m}$ ; roughly papillose to nearly smooth, with distinct Y-mark sculpture on distal surface; proximal laesura 0.5–0.8 spore radius.

Capsules mature mid summer. Ecological amplitude very wide, ombrotrophic to rich fen peatlands, forested and open mires; low to high elevations; Alta., B.C., Man., N.B., Nfld. and Labr. (Nfld.), N.W.T., N.S., Ont., P.E.I.,

Que., Sask., Yukon; Ala., Alaska, Ark., Calif., Conn., Del., Fla., Ga., Idaho, Ill., Ind., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Mont., N.H., N.J., N.Y., N.C., Ohio, Oreg., Pa., S.C., Tenn., Tex., Vt., Va., Wash., W.Va., Wis.; South America; Eurasia.

As the only boreal species of the section with a reddish purple color, *Sphagnum magellanicum* is usually easy to identify. The branch leaf chlorophyll cells are capable of being confused only with those of *S. alaskense*, which are less enclosed on both surfaces, and *S. centrale*, which has thickened end walls on the chlorophyll cells that give them a narrow exposure on the concave surface.

8. *Sphagnum palustre* Linnaeus, Sp. Pl. 2: 1106. 1753



*Sphagnum cymbifolium* (Ehrhart)  
R. Hedwig

**Plants** moderate-sized to robust, strong-stemmed, lax to somewhat compact, capitulum somewhat flattened to more typically compact and rounded; green to golden brown to pale brown with often a pinkish tinge; carpets to

more or less compact, low to moderate sized hummocks. **Stems** brown, superficial cortical cells with spiral reinforcing fibrils visible, usually 2–4 pores per cell, comb-fibrils lacking on interior wall. **Stem leaves** to  $1.7 \times 1$  mm, occasionally longer; rarely hemisophyllous; hyaline cells non-ornamented, nonseptate. **Branches** long and tapering, leaves  $\pm$  imbricate to spreading in shade forms. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** with hyaline cells non-ornamented; no or weak funnel-like projections on the interior end walls, often with 1 large pore per cell on superficial cell walls. **Branch leaves** broadly ovate,  $2.2 \times 1.3$  mm, hyaline cells non-ornamented, convex surface with elliptic pores along the commissures, chlorophyllous cells isosceles-triangular to ovate-triangular in transverse section and just enclosed to just exposed on the convex surface; end wall not thickened. **Sexual condition** dioicous. **Capsule** with numerous pseudostomata. **Spores** 24–33  $\mu$ m, surface finely papillose to smooth, distal surface with distinct bifurcated Y-mark sculpture; proximal laesura more than 0.6 spore radius.

Capsules mature mid to late summer. Widespread in forested fens and poor to rich sedge fens; low to moderate elevations; B.C., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que.; Ala., Ark., Calif., Conn., Del., Fla., Ga., Ill., Ind., Iowa, Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., N.H., N.J., N.Y., N.C., Ohio, Okla., Oreg., Pa., S.C., Tenn., Tex., Vt., Va., Wash., W.Va., Wis.; Europe; Pacific Islands.

*Sphagnum palustre* may occur elsewhere than listed above, but the taxonomy is unclear. In some open-grown situations, it may have a reddish tinge and seem similar

to *S. magellanicum*, but this is a pinkish red color rather than the purplish red of the latter. See discussions under 5. *S. henryense* and 9. *S. papillosum* for distinction from those species.

9. *Sphagnum papillosum* Lindberg, Acta Soc. Sci. Fenn. 10: 280. 1872



*Sphagnum cymbifolium* var. *papillosum* Schimper; *S. papillosum* var. *laeve* Warnstorff; *S. papillosum* var. *sublaeve* Röhl; *Sphagnum waghornei* Warnstorff

**Plants** moderate-sized to fairly robust; strong-stemmed and generally compact, capitulum usually not much enlarged;

greenish brown to deep golden brown; forming compact carpets in floating mats and depressions as well as dense stands on hummock sides and low hummocks. **Stems** brown, superficial cortical layer with spiral reinforcing fibrils visible; usually 1–2 pores per cell, comb-fibrils lacking on interior wall. **Stem leaves** to  $1.3 \times 0.7$  mm; rarely hemisophyllous; hyaline cells non-ornamented, mostly septate. **Branches** generally short and blunt, leaves spreading. **Branch fascicles** with 2 spreading and 2–3 pendent branches. **Branch stems** with hyaline cells non-ornamented, no or weak funnel-like projections on the interior end walls, mostly with 1 pore per cell on superficial cell wall. **Branch leaves** broadly ovate,  $1.7 \times 1$  mm; hyaline cells on convex surface with round to elliptic pores along the commissures, hyaline cell walls covered with papillae where overlying chlorophyllous cells; chlorophyllous cells trapezoidal to truncate-elliptic in transverse section, equally exposed on both surfaces or less exposed on convex surface, end walls thickened. **Sexual condition** dioicous. **Capsule** with numerous pseudostomata. **Spores** 26–36  $\mu$ m; more roughly papillose on distal surface than proximal surface, distinct raised, bifurcated-Y mark sculpture on distal surface; proximal laesura 0.5 spore radius or more.

Capsules mature mid to late summer. Very common in very poor to poor fen mire habitats where it is often a major peat former, but scarce to absent in truly ombrotrophic peatlands sites; low to moderate elevations; B.C., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que., Yukon; Alaska, Calif., Conn., Del., Ill., Ind., Maine, Md., Mich., Minn., N.H., N.J., N.Y., N.C., Ohio, Oreg., Pa., S.C., Vt., Wash., W.Va., Wis.; Eurasia.

*Sphagnum papillosum* is often easily field-identifiable by its rich golden brown to dark brown color and short, blunt branches. Nearly all specimens have the papillae on the branch leaf chlorophyll cells but a few smooth forms have been found. Such forms will have stem leaves with divided hyaline cells whereas in the confusable species *S. palustre* and *S. centrale* such cells are rare or absent.

10. *Sphagnum perichaetiale* Hampe, *Linnaea* 20: 66.  
1847



*Sphagnum brevicaulle* Warnstorff;  
*S. cymbifolium* var. *ludovicianum*  
Cardot; *S. harperi* Warnstorff;  
*S. ludovicianum* (Cardot) Warnstorff

**Plants** ± moderate-sized, compact and stiff-stemmed; forming dense to somewhat loose low cushions in often seasonally dry depressions.

**Stems** brown; superficial cortical layer with spiral reinforcing fibrils faint to obvious, 1–3 pores per cell, comb-fibrils lacking on interior wall. **Stem leaves** to 1.1 × 0.7 mm, commonly hemiisophyllous; hyaline cells non-ornamented, mostly 1–2-septate. **Branches** short and blunt at distal end, leaves loosely spreading. **Branch fascicles** with 2 spreading and 1–2 pendent branches. **Branch stems** with hyaline cells non-ornamented, no or weak funnel-like projection of end walls of cortical cells, cortical cells with one large pore per cell on superficial wall. **Branch leaves** ovate, to 2.2 × 1.1 mm; ovate, hyaline cells non-ornamented, on proximal half of convex surface with small ringed pores or pseudopores in groups of three where the corners join and pseudopores along the commissures; chlorophyllous cells narrowly rectangular, lenticular to narrowly trapezoidal in transverse section; exposed equally on both surfaces or more broadly on concave surface; end walls not thickened. **Sexual condition** dioicous. **Capsule** with numerous pseudostomata. **Spores** 25–39 μm; surface smooth to irregularly and finely papillose; indistinct Y-mark on distal surface; proximal laesura more than 0.6 spore radius.

Capsules common, mature late spring to early summer. Mostly ruderal, wet depressions in sandy substrates, often in areas recently burned, also low to moderate-sized hummocks in *Chamaecyparis* swamps; low to high elevations; Ala., Del., Fla., Ga., La., Md., Miss., N.J., N.C., S.C., Tex., Va.; South America; se Asia; s Africa; Pacific Islands (New Zealand).

The compact growth form in thin but dense mats and occurrence in often desiccation-prone sites distinguishes *Sphagnum perichaetiale* from any other species of sect. *Sphagnum*. The often quite stiffly spreading branch leaves give it a strong resemblance to *S. compactum*, but the latter's small triangular stem leaves will readily distinguish that species. The branch leaf hyaline cells of *S. perichaetiale* have only a few pores on their convex surface, and they are typically small, thickened, and grouped in 3s where the cell corners meet. Similar species in sect. *Sphagnum* have more pores along the commissures, and they are more elliptical and not thickened. The often hemiisophyllous stem leaves are also diagnostic of *S. perichaetiale* within the section.

11. *Sphagnum portoricense* Hampe, *Linnaea* 25: 359.  
1852



*Sphagnum sullivantianum* Austin

**Plants** moderate-sized to often quite robust, ± weak-stemmed, lax; green, bluish green, green and brown to dark golden brown, often speckled in appearance; found submerged in shallow water, stranded along shore lines in loose carpets. **Stems** brown,

superficial cortical layer with spiral reinforcing fibrils clearly visible, usually many pores per cell (1–6), comb-fibrils on interior wall. **Stem leaves** 1.1 × 1 mm; rarely hemiisophyllous; hyaline cells non-ornamented, frequently septate. **Branches** clavate and rounded at distal end. **Branch fascicles** with 2 spreading and 2 pendent branches. **Branch stems** with hyaline cell comb-lamellae visible on interior cortex wall, cortical cell end walls with conspicuous funnel projections more than 1/2 length of cell, superficial cortical wall aporose. **Branch leaves** broadly ovate, 2.4 × 1.7 mm; hyaline cells on convex surface with numerous round pores along the commissures, comb-lamellae on hyaline cell walls where overlying chlorophyllous cells; chlorophyllous cells broadly triangular in transverse section and well-enclosed on the convex surface. **Sexual condition** dioicous. **Capsule** with pseudostomata. **Spores** 22–29 μm; finely papillose on both surfaces; indistinct triradiate ridge on distal surface; proximal laesura 0.5–0.6 spore radius.

Stream channels, shallow ponds, coniferous and hardwood swamps and pocosins; low to moderate elevations; Ala., Fla., La., N.J., N.Y., N.C., S.C., Tex.; Mexico; West Indies; South America.

*Sphagnum portoricense* is normally very easily distinguished because of its wet growing habit and strongly clavate branches.

12. *Sphagnum steerei* R. E. Andrus, *Bryologist* 90: 218.  
1987 [F]



*Sphagnum imbricatum* var. *arcticum*  
Flatberg, *Kongel. Norske Vidensk.*  
*Selsk. Skr. (Trondheim)* 3: 46. 1984

**Plants** moderate-sized to large, compact and stiff-stemmed with upswept branches; dark green and brown, dark chesnut brown, brown to blackish brown, often with bluish tinge when dry; forming dense low to moderately tall hummocks. **Stems** dark brown, superficial cortical layer with spiral reinforcing fibrils visible, usually 2 or more pores per cell, comb-fibrils lacking on interior wall. **Stem leaves** to 1.2 × 0.8 mm; rarely hemiisophyllous; hyaline cells mostly