

SPHAGNUM IMBRICATUM COMPLEX (SPHAGNACEAE, BRYOPHYTA)
IN RUSSIA

КОМПЛЕКС SPHAGNUM IMBRICATUM (SPHAGNACEAE, BRYOPHYTA)
В РОССИИ

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Abstract

The complex *Sphagnum imbricatum* in Russia is revised basing on the narrow species concept suggested by K.I. Flatberg. According to this approach, *S. austinii* and *S. affine* occur only in European Russia, *S. steerei* is mainly arctic species, distributed from West Siberian Arctic to Yakutia and Chukotka, and *S. imbricatum* s.str. is presently known in the southern part of Russian Far East, northern part of Transbaikalia, South Yakutia and along the Lena River up to 67°N. Species descriptions and illustrations are provided and distribution in Russia is mapped.

Резюме

Проведена критическая ревизия видов комплекса *Sphagnum imbricatum* в России в соответствии с современным пониманием объема видов. Показано, что *S. austinii* и *S. affine* встречаются только в европейской части России, *S. steerei* – преимущественно в арктических районах Западной Сибири, Якутии и Дальнего Востока, а *S. imbricatum* s.str. – на юге Дальнего Востока, в северном Забайкалье, бассейне р. Лены от южной Якутии до Жиганска, ~67°с.ш. Даны описания видов, иллюстрации, карты распространения на территории России.

Sphagnum imbricatum and related species belong to *Sphagnum* sect. *Sphagnum*, where they form a distinct group characterized by: 1) presence of comb-fibrils in hyalocysts of branch leaves and branch hyalodermis; 2) chlorocysts of branch leaves equilateral triangular and broader to ventral leaf surface.

Flatberg (1984) revised *Sphagnum imbricatum* in a worldwide scope, recognizing two species, *S. portoricense* Hampe and *S. imbricatum* Hornsch. ex Russow. In addition, he demonstrated that the latter includes 5 infraspecific taxa: *S. imbricatum* Hornsch. ex Russow ssp. *imbricatum*, *S. imbricatum* ssp. *affine* (Renauld & Cardot) Flatberg with var. *affine* and var. *flagellare* (Röll) Cardot, *S. imbricatum* ssp. *austinii* (Sull.) Flatberg with var. *austinii* and var. *arcticum* Flatberg. Later Andrus

(1987) raised the status of suggested subspecies and of var. *arcticum* Flatberg to the species of their own: *S. imbricatum* Hornsch ex Russow, *S. affine* Renauld & Cardot, *S. austinii* Sull., *S. steerei* R.E. Andrus (the latter being a new name for var. *arcticum* Flatberg), respectively.

The species independence of these taxa was subsequently supported by molecular and genetic markers (Shaw, 2000; Thingsgaard, 2002) and accepted by american (McQueen, 1998; Anderson & Allen, 2001) and european authors (Hill et al., 2006).

In Russia, up to the recent past (e.g. Ignatov & Afonina, 1992), *S. imbricatum* was treated in a broad sense, but in recent years the narrow species concept was accepted, and results of the present revision were partly published in the recent check-

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list (Ignatov, Afonina, Ignatova et al., 2006).

The present revision is based on all the material from Russia in H, IRK, LE, MHA, MW, PTZ, and SASY, and also on personal field studies in European North and in Yakutia.

According to Flatberg (1984), the important diagnostic characters in the group are (1) the comb-fibrils in stem and branch hyalodermis where they are situated on the inner surface of wall (i.e. adjacent to sclerodermis); 2) the leaf size; 3) the presence of the comb-fibrils in hyalocysts; 4) the presence and the degree of development of comb-fibrils along the length of branch leaves; 5) number of pendent branches per fascicle.

Comb-fibrils in branch hyalodermis can be seen in light microscope after leaf detachment: they are arranged in perpendicular or slightly oblique to branch length, whereas spiral fibrils are arranged in various directions. Comb-fibrils in branch hyalodermis occur in all species of *Sphagnum imbricatum*-complex, but well-seen only in *S. affine* and *S. austinii*. In *Sphagnum imbricatum* they are less developed and in *S. steerei* can not be seen without special preparation.

Comb-fibrils in stem hyalodermis are more difficult to observe. This needs a separation of pieces of stem by thin forceps, placement them in water with some glicerol on slide glass, and look at the places where outer layers of hyalodermis were removed.

KEY FOR SPECIES OF *SPHAGNUM IMBRICATUM*-COMPLEX IN RUSSIA

1. Hyalocysts of stem leaves with apparent comb-fibrils; pendent branches 1 per fascicle
..... *S. austinii*
- Hyalocysts of stem leaves without comb-fibrils (rarely present in hemiisophyllous plants of *S. steerei*); pendent branches 1-3 per fascicle 2
2. Inner cells of stem hyalodermis next to sclerodermis with apparent comb-fibrils; branch leaves with or without comb-fibrils; pendent branches 2(-3) per fascicle *S. affine*
- Inner cells of stem hyalodermis without comb-fibrils; branch leaves with comb-fibrils; pendent branches 1-2 per fascicle 3
3. Stem leaves 1.2-1.5(-1.6) mm; branch leaves relatively narrow, with width to length ratio

0.6-0.7(-0.8); comb-fibrils well developed throughout branch leaf; inner cell wall of branch hyalodermis adjacent to sclerodermis without comb-fibrils *S. steerei*

— Stem leaves 0.8-1.1(-1.2) mm; branch leaves relatively broad with width to length ratio 0.7-0.9; comb-fibrils well developed only in proximal part of branch leaf; inner cell wall of branch hyalodermis adjacent to sclerodermis with comb-fibrils; stems yellow-brownish or occasionally yellow-green *S. imbricatum*

Sphagnum affine Renault & Cardot, Rev. Bryol. 12: 44. 1885. — *S. affine* var. *flagellare* (Schlieph. ex Röll) L. Söderstr. & Hedenäs, Annales Botanici Fennici 29: 121. 1992. — *S. imbricatum* ssp. *affine* (Renault & Cardot) Flatberg, K. Norske Vidensk. Selsk. Skr. 3: 47. 1984; *S. imbricatum* var. *affine* (Renault & Cardot) Warnst.; *S. imbricatum* var. *laeve* Warnst.

Figs. 1, 5.

Plants of loose tufts, yellow-brown or more rarely yellowish-green or green, not glossy. Stem usually stout, but slender in more wet habitats. Stem hyalodermis 4-5-stratose, outer cells subquadrate to short rectangular, with (1-)2-4 pores and numerous fibrils; inner cells usually with well-developed comb-fibrils. Sclerodermis yellow to fuscous. Stem leaves short rectangular, 1.1-1.5(-1.6) mm long, with width to length ratio 0.7-0.9; distally broadly bordered by decomposed cell remains; hyalocysts above by 2-4(-6) per loop, without comb-fibrils. Branches 4 per fascicle, 2(-3) branches pendent. Branch leaves moderately to loosely imbricate, 1.4-2.2 mm long, with width to length ratio (0.6-)0.7-0.9, broadly ovate to ovate-elliptic; hyalocysts with numerous round and ovate pores on dorsal surface distally; on ventral surface distally with one round pore in distal end of each cell, near margin with 2-4 round pores, in mid leaf on ventral surface without pores; chlorocysts in transverse section triangular, broader to ventral surface; cell walls of hyalocysts at join with chlorocysts with more or less developed comb-fibrils, usually apparent in proximal part of leaf, more rarely only at leaf base to very rarely totally absent. Sporophytes not known in Russia [Spores (27-)28-29(-31) µm].

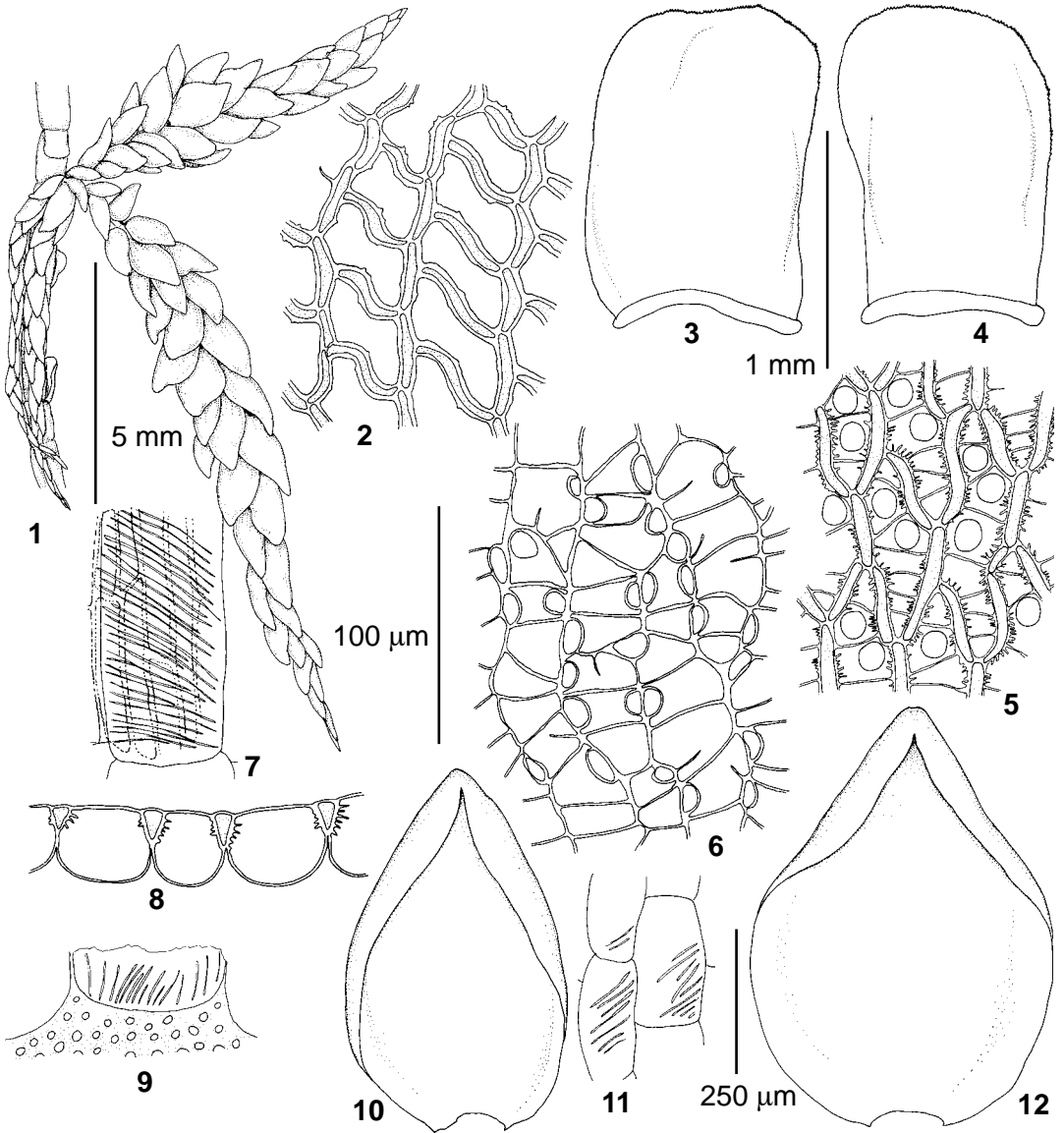


Fig. 1. *Sphagnum affine* Renault & Cardot (from Karelia, Bolshakovo 1.IX.1963 Yurkovskaya, PTZ): 1 – fascicle of branches; 2 – stem leaf cells from adaxial side; 3–4 – stem leaves; 5 – branch leaf cells from adaxial side near leaf margin; 6 – branch leaf cells from abaxial side; 7 – branch hyalodermis; 8 – transverse section of branch leaf; 9, 11 – stem hyalodermis; 10,12 – branch leaves. Scale bars: 5 mm for 1, 1 mm for 3-4, 10,12; 250 µm for 11; 100 µm for 2, 5-9.

Differentiation. *Sphagnum affine* has 2(-3) pendent branches per fascicles, i.e. more than other species of the *S. imbricatum*-complex in Russia. Stem leaves are short and relatively broad, usually with broad border of several rows of decomposed cells and hyalocysts are sometimes several per loop of chlorocysts. Also, *S. affine* is unique in having apparent comb-fibrils in the inner cells of stem hyalodermis adjacent to sclerodermis.

SPECIMENS EXAMINED: **Karelia:** Kyappyaselka, 14.VII.1899 *Alexeenko* (LE); Olonetskiy Distr., Bolshakovo (Il'inskoye) 1.IX.1963 *Yurkovskaya* (LE, PTZ); Suojarvi Distr., Hiisjarvi, Koitajarvi Lake, Pitkyaniemi Cape, 11.VII.1998 *Maksimov* #4-375; same 4.VII.2002 *O.L.Kuznetsov* #14 (PTZ); Hiisjarvi Lake, 2.IX.2007 *Maksimova & Maksimov* (PTZ).

Ecology. Low hummocks and flat covers in mesotrophic sedge-*Sphagnum* mires and sandy

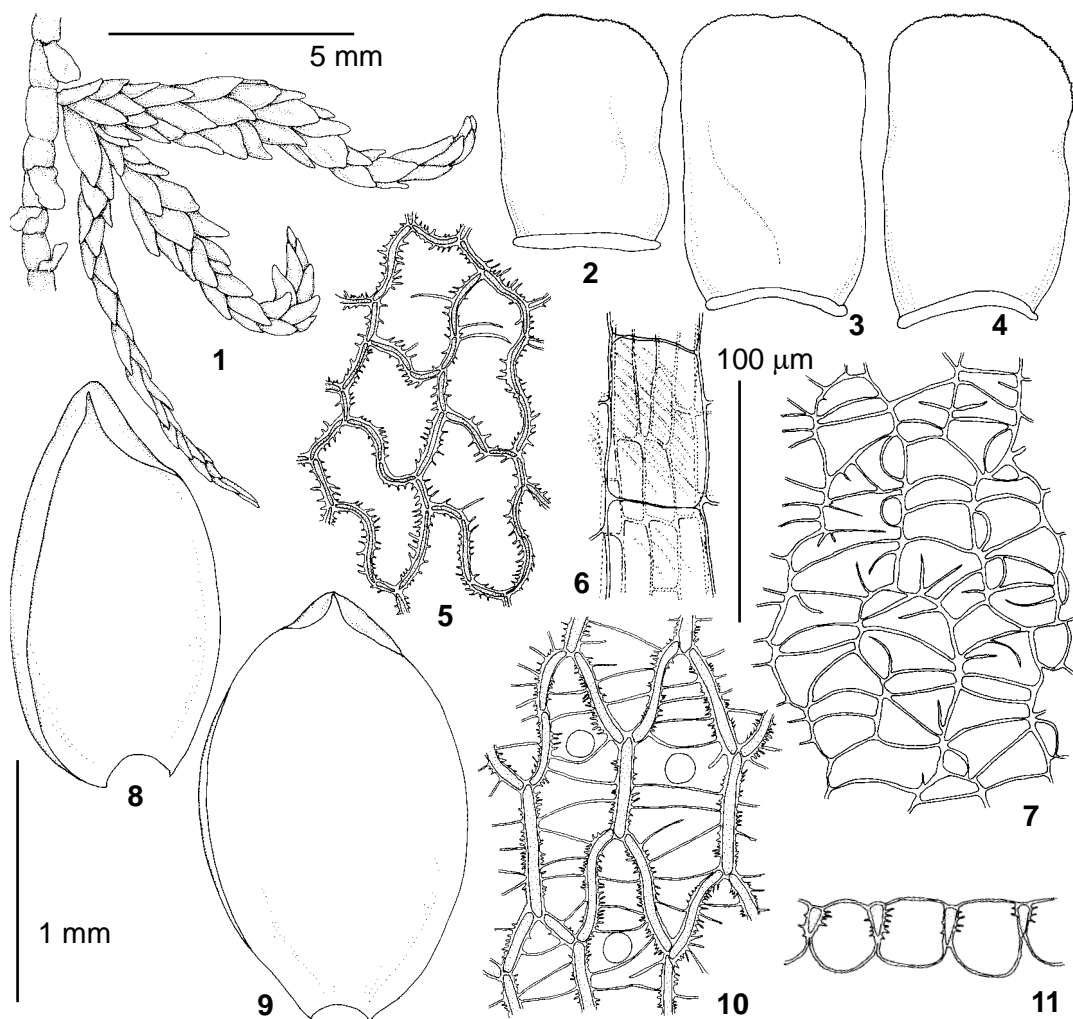


Fig. 2. *Sphagnum austinii* Sull. (from Kaliningrad Prov., Kozie Bog, 13.X.1996 Napreenko # 553, PTZ): 1 – fascicle of branches; 2-4 – stem leaves; 5 – stem leaf cells from adaxial side; 6 – branch hyalodermis; 7 – branch leaf cells from abaxial side; 8-9 – branch leaves; 10 – branch leaf cells from adaxial side near leaf margin; 11 – transverse section of branch leaf. Scale bars: 5 mm for 1, 1 mm for 2-4, 8-9; 100 µm for 5-7, 10-11.

banks of lakes where it grows in small cushions seeping by waves.

Distribution. Atlantic and Central Europe, Atlantic North America, Central America, West Indies (Cuba).

Savicz (1936) revealed this species (as *S. imbricatum*) in collections of Alexeenko of 1899, and after that for a long time this species was not collected, despite of extensive studies in the area. Second record was done much later, by Yurkovskaya in 1963 (Yurkovskaya, 1967) and then it was found in Hiisjarvi (Maksimov & Maksimova, 2006).

The species was never recorded during sub-

fossil peat analysis, which also supports its status of a rare species.

***Sphagnum austinii* Sull.**, Musci Appalachiani: tickets of specimens of mosses collected mostly in the eastern part of North America 2 [3]. 1870. – *S. cymbifolium* subsp. *austinii* (Sull.) Cardot, Bull. Soc. Roy. Bot. Belgique 25((1): 50. 1886. – *S. imbricatum* subsp. *austinii* (Sull.) Flatberg, K. Norske Vidensk. Selsk. Skr. 3: 44. 1984.

Figs. 2, 5.

Plants in dense tufts, ferruginous-brownish, glossy. Stem usually stout and rigid. Stem hyalodermis 4-5-stratose, outer cells rectangular, with

(1-)2-4 (-5) pores and abundant fibrils; inner cells without comb-fibrils. Sclerodermis ferruginous-brownish. Stem leaves rectangular, 1.0-1.4(-1.5) mm long, with width to length ratio 0.6-0.7; distally narrowly to moderately broadly bordered by decomposed cell remains; hyalocysts above by 1(-2) per loop, usually with simple fibrils and comb-fibrils. Branches 3 per fascicle, 1 branch pendent; divergent branches usually curved, tapered to apex. Branch hyalodermis with clear comb-fibrils that sometimes lacking at places. Branch leaves of divergent branches closely imbricate, ovate-elliptic to elliptic, 1.5-2.1 mm long, with width to length ratio 0.6-0.7; upper leaf obviously scabrous dorsally. Hyalocysts of branch leaves dorsally with numerous pores, above with numerous round or ovate pores and pseudopores, ventrally with 1-2 round pores in distal and middle part of leaf, near margin with 2-4 round pores; in basal part pores restricted to 1-2 rows of cells near margin; in inner cell walls adjacent to chlorocysts with clear and numerous comb-fibrils in all parts of leaf. Chlorocysts in transverse section equilaterally triangular. Sporophytes unknown in Russia [Spores (23-)24-27(-28) μm].

Differentiation. *Sphagnum austinii* can be easily recognized both by habit as well as by microscopic characters. It has dense reddish-ferruginous tufts, horn-like curved and densely imbricate divergent branches and 1 pendent branch per fascicle. Microscopically it differs from other species by distinct comb-fibrils in stem leaves, sparse round pores on adaxial surface in central part of branch leaves (that can be absent in wet habitats). Comb-fibrils in branch leaves are the most abundant among other related species, being present also in upper part of leaf.

SPECIMEN EXAMINED: Kaliningrad Province: Slavskiy Distr., Kozie Bog (eastern part), 13.X.1996 Napreenko # 553 (PTZ). This specimen was reported as *Sphagnum imbricatum* by Napreenko & Razgulyaeva (1999).

Ecology. Hummocks in ombrotrophic bog, with *Calluna vulgaris*.

Distribution. Atlantic Europe, northern Atlantic North America and northern Pacific North America.

Sphagnum imbricatum Hornsch. ex Russow, Arch. Naturkunde Liv-Ehst-Kurlands 2. Ser. 7: 21. 1865. (Beitrage zur Kenntniss der Torfmoose 99. 1865.). Fig. 3, 5.

Plants in loose mats or cushions, yellowish-brown, often somewhat pinkish when dry. Stem rather short and delicate. Stem hyalodermis 4-5-stratose, outer cells mostly rectangular, with (1-)2-4 pores and numerous fibrils; inner cells without or with indistinct comb-fibrils. Sclerodermis yellowish-fuscous. Branch hyalodermis with clear comb-fibrils in inner cell walls. Stem leaves 0.8-1.1(-1.2) mm long, short-rectangular, with width to length ratio 0.7-0.9; marginal cells in upper half decomposed in a narrow belt, hyalocysts in distal part of leaf near margin 1 or rarely 2 per loop of chlorocysts, without pores and fibrils or with thin fibrils, and always without comb-fibrils; hyalocysts at the adaxial surface intact. Branches 3-4 per fascicle, (1-)2 branches pendent. Branch leaves of divergent branches moderately to loosely imbricate, ovate to round-ovate, 1.1-1.6 mm long, width to length ratio 0.7-0.8(-0.9). Chlorocysts in transverse section equilateral triangular; hyalocysts in median part of branch leaf on adaxial surface without pores; near margin with large pores almost as broad as hyalocysts; on abaxial surface with numerous elliptic pores near borders with chlorocysts and solitary round pores in upper cell ends; comb-fibrils are clearly seen only in proximal part of leaves. Sporophytes rare. [Spores (22-)24-27(-28) μm].

Differentiation. *Sphagnum imbricatum* differs from *S. steerei* in relatively small and delicate plants (vs. robust, rigid with somewhat erect branches), yellowish-brown and somewhat pinkish (vs. brownish), loosely imbricate branches (vs. densely imbricate) and in 2 (vs. 1 in *S. steerei*) pendent branches. Microscopically, *S. imbricatum* differs from *S. steerei* by the presence of comb-fibrils in branch hyalodermis, smaller stem leaves and more weakly developed comb-fibrils in upper parts of branch leaves.

Variation. According to Flatberg (1984), *Sphagnum imbricatum* is a very homogeneous morphologically throughout its range, from Himalays to Siberia. The specimen from Zhigansk in northern Yakutia fits well to this range of variation, except leaves that are slightly shorter. The lectotype of *S. imbricatum*, however, has more compact plants and more closely imbricate shoots comparatively with the more widespread phenotypes of *S. imbricatum*; by these characters the

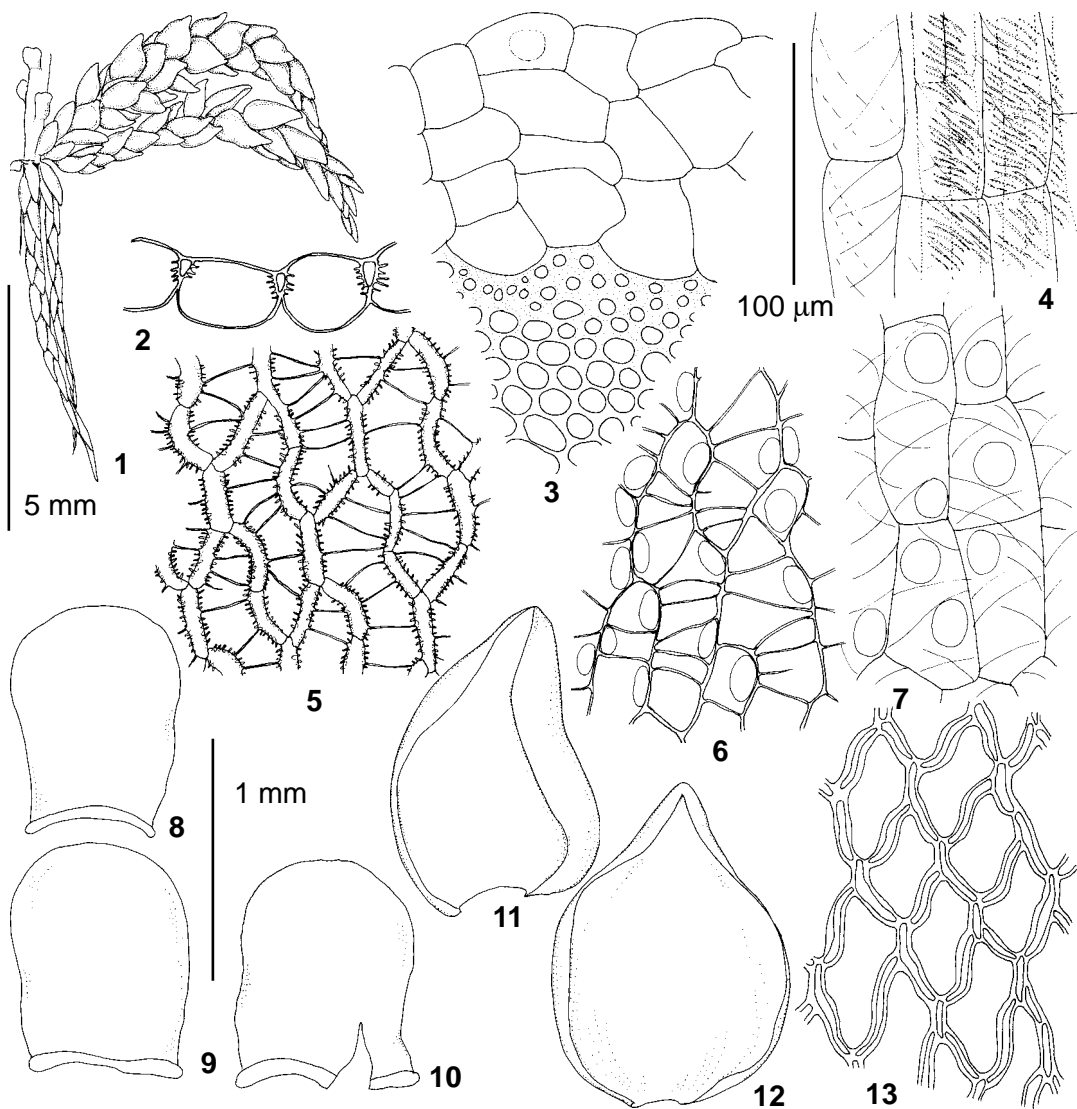


Fig. 3. *Sphagnum imbricatum* Hornsch. ex Russow (from Amurskaya Prov., Belaya River, 9.IX.1958 *Lipatova*, Hepaticae et Musci URSS exiccati, Dec. XIV (1962), # 132, LE): 1 – fascicle of branches; 2 – transverse section of branch leaf; 3 – stem transverse section, showing hyalodermis with pores; 4 – branch hyalodermis; 5 – branch leaf cells from adaxial side; 6 – branch leaf cells from abaxial side in leaf middle part; 7 – stem hyalodermis; 8-10 – stem leaves; 11-12 – branch leaves; 13 – branch leaf cells from adaxial side. Scale bars: 5 mm for 1, 1 mm for 8-12; 100 µm for 2-7, 13.

lectotype is closer to *S. steerei*. However, the relatively short and broad leaves, lacking of comb-fibrils in upper part of branch leaves and their total absence in the stem leaves, as well as the presence of comb-fibrils on inner walls in branch hyalodermis, make sure that the lectotype fits the current concept of *S. imbricatum*. In addition, fascicles in lectotype have 2 pendent branches, that agrees with *S. imbricatum* and contradicts with *S. steerei* that has 1 pendent branch per fascicle.

SPECIMENS EXAMINED: EAST SIBERIA:
Chita Prov.: Stanovoye Upland, 1963 *Mikheev* (IRK).
YAKUTIA: Middle Lena, vicinity of Zhigansk, on Zhiganka River (66°46'N, 123°E), 7.VIII.1901 *Cajander* (H); Tompo Distr., Bryungoda River 5 km downstream from mouth of Pelkosyg Creek, 9.VIII.1956 *Kildyushevsky* (LE); Olekminsk, Tungir River, mouth of Dzyadachi Creek, 29.VI.1910 *Sukachev & Poplavskaya* # 146 (H, dupl. PTZ); Suktarsky Distr., Vilyuj River, 213 km downstream from Ulokhoosh-Vova, 9.VIII.1958 *Kildyushevsky* (LE, SASY); Olekminsk Distr., Nema-

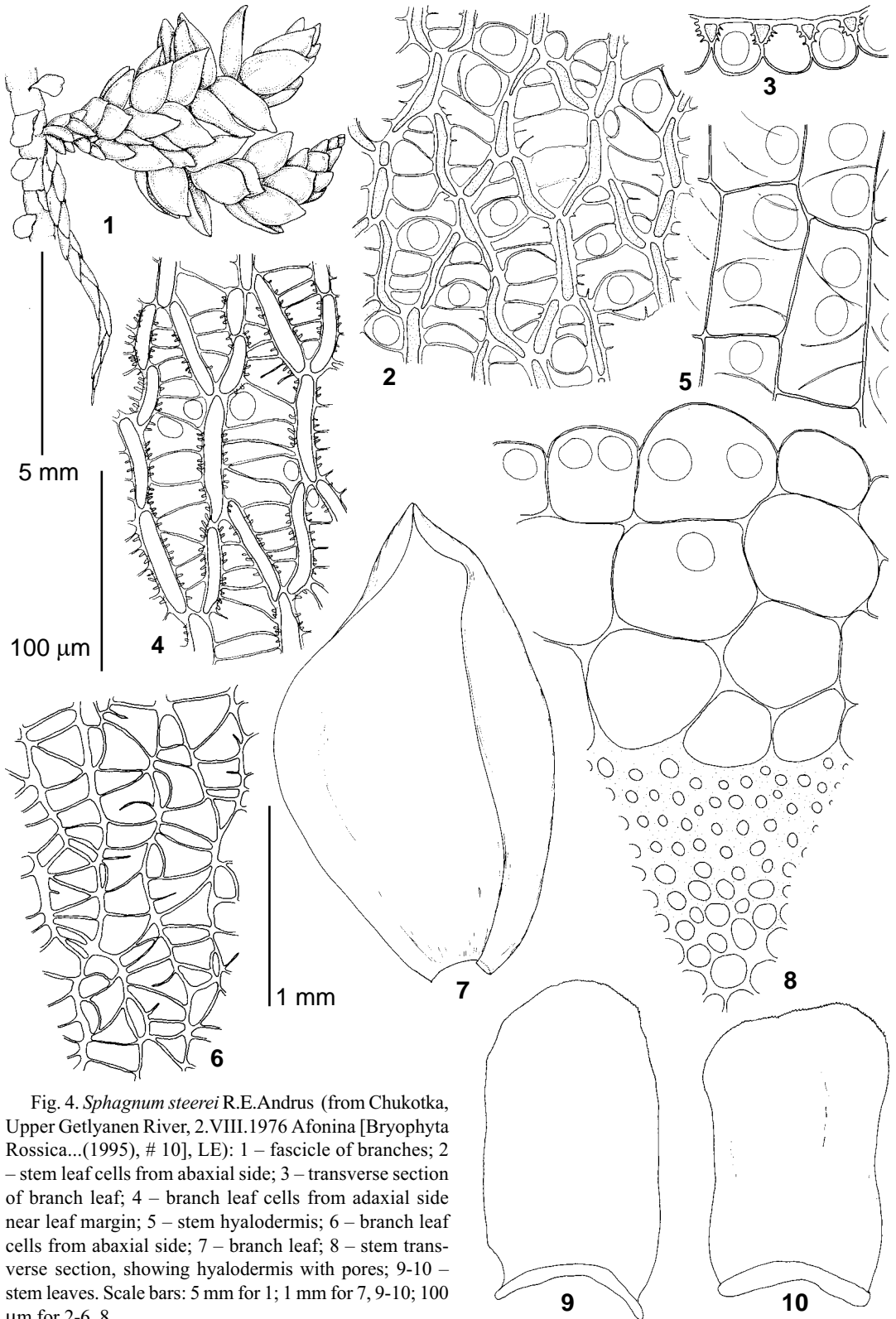


Fig. 4. *Sphagnum steerei* R.E. Andrus (from Chukotka, Upper Getlyanen River, 2.VIII.1976 Afonina [Bryophyta Rossica... (1995), # 10], LE): 1 – fascicle of branches; 2 – stem leaf cells from abaxial side; 3 – transverse section of branch leaf; 4 – branch leaf cells from adaxial side near leaf margin; 5 – stem hyalodermis; 6 – branch leaf cells from abaxial side; 7 – branch leaf; 8 – stem transverse section, showing hyalodermis with pores; 9-10 – stem leaves. Scale bars: 5 mm for 1; 1 mm for 7, 9-10; 100 μm for 2-6, 8.

ny River 2.5 km from Arylakh, 11.IX.1952 *Kuvaev* #124 (SASY). **FAR EAST: Amurskaya Prov.:** Birma Creek, left tributary of Zeya River, 29.VII.1926 *Krasnoruzkaya* (LE); Upper course of Tom Creek, tributary of Zeya River, 10.VIII.1926 *Kuzeneva* #32a (c.fr!) (LE); Belaya River, tributary of Zeya River, 9.IX.1958 *Lipatova*, Hepaticae et Musci URSS exsiccati, Dec. XIV (1962), # 132 (LE); **Evreiskaya Autonomous Prov.:** Bira River, 6.VIII.1913 *Prokhorov & Kuzeneva* (LE); **Primorsky Territory:** Sikhote-Alin Nature Reserve, Chingouza Bay, 4.IX.1936 *Kolesnikov* (LE); Ussuri area, 1913 *Komarov* (LE); Vladivostok, Lyanchiche Creek, 20.VII.1954 *Vasilieva* (LE); Khasan Distr., Ryazanovka, 14.IX.1985 *Ignatov* # 82 (MHA); Vladivostok, Lyanchiche, 10.X.1950 *Woroschilov* # 5629 (MHA).

Ecology: Low hummocks and carpets in mesotrophic, sedge–*Sphagnum*, *Betula*–sedge–*Sphagnum* and spring mires, in very wet mires around lakes, and boggy open *Larix* forest in permafrost areas (“mar”-type).

Distribution. Outside Russia, this species occurs in China, Korea, Nepal, Japan. In Russia it is known in southern part of Far East, southern part of Eastern Siberia and along Lena River up to Zhigansk (~67°N). Numerous reports from the Arctic (Abramova, 1956; Afonina & Czernyadjeva, 1995; Afonina, 2004; Czernyadjeva, 1994, 2001; Ignatov & Afonina, 1992; Ivanova et al., 2005; Savicz-Ljubitskaya, 1952; Savicz-Ljubitskaya & Smirnova, 1968; Stepanova, 1986; Tyuremnov, 1963, etc.) belong in fact to *S. steerei*.

Sphagnum steerei R.E. Andrus, Bryologist 91 (2): 137. 1988. – *S. imbricatum* ssp. *austinii* var. *arcticum* Flatberg, K. Norske Vidensk. Selsk. Skr. 3: 46. 1984. Figs. 4, 5.

Plants in dense tufts or, more rarely, loose carpets, brownish, with distinct glaucous tones when dry. Stem stout and rigid. Stem hyalodermis 3–4-stratose, outer cells quadrate to rectangular, with 1–2(–3) pores and numerous fibrils; inner cells without comb-fibrils. Sclerodermis dark-brown to yellowish-fuscos. Stem leaves quadrangular to spatulate-quadangular, or in hemiisophyllous forms broadly ovate-spatulate, 1.2–1.5(–1.6) mm long; with width to length ratio 0.55–0.7(–0.8); margin near leaf apex incurved, and narrowly to moderately narrowly bordered by decomposed cells; hyalocysts by 1 per loop of chlorocysts, only rarely by 2, with delicate fibrils or without them, without comb-fibrils or with indistinct ones;

hyalocysts on adaxial surface with solitary round pores in upper and middle parts of leaves, sometimes (in hemiisophyllous forms) pores like in branch leaves. Branches 3 per fascicle, 1(–2) branches pendent; divergent branches rigid, spreading, curved to erect, somewhat obtuse at apex. Branch hyalodermis usually without comb-fibrils. Leaves of divergent branches imbricate, ovate-elliptic to ovate, 1.6–2.2 mm long, width to length ratio 0.55–0.7; chlorocysts in transverse section equilateral-triangular; hyalocysts on adaxial surface in middle part of leaf without pores, near margin with round pores in centres of hyalocysts; on abaxial surface in middle part of leaf with numerous elliptic pores near borders with chlorocysts; comb-fibrils more or less distinct throughout leaf. Sporophytes unknown in Russia.

Differentiation. *Sphagnum steerei* is similar to *S. austinii*, but differs in (1) the presence of peculiar glaucous tones of the overwise brownish shoots (glaucous color is absent or indistinct in *S. austinii*); (2) divergent branches are rigid, more or less erect and distally obtuse (vs. flexuose and distally acute in *S. austinii*); (3) branch leaves are more loosely arranged, not distinctly imbricate (vs. densely imbricate) and in general are longer than in *S. austinii*; (4) pores on the adaxial (concave) surface of branch leaves in middle part are absent. Comb-fibrils in stem leaves are absent or weakly developed. Comb-fibrils in inner surface of branch hyalodermis are rare and indistinct (vs. well-developed and easily seen in *S. austinii*).

SPECIMENS EXAMINED: WEST SIBERIA:

Yamal Peninsula: Left shore of Obskaya Guba, 30 km N of Novyj Port, 17.VII.1938 *N.Ya. & S.V. Katz* (LE); Middle course of Saebiyakhe River (69°37'32" N, 69°27'40" E), 27.VII.1992 *Czernyadjeva* (LE); **Gydan Peninsula:** Lower course of Chugor-Yakha River (69°07'N, 74°40'E), 26.VII.1991 *Czernyadjeva* (LE). **YAKUTIA:** Anabar Distr., Yuele River 40 km from Kumakh-Yuryakh River, 2.VII.1974 *Perfilieva* (SASY); Tiksi, Sogo River, 6.IX.1956 *Katenin* # 73 (LE); Tiksi, behind observatorium, 18.VIII.1982 *Perfilieva* (SASY); Tiksi Bay, 1962, Mezhenyj (SASY); Tiksi, 1.5 km SE of Polar Station (71°41'N, 129°E), 27.VII.1955 *Kildyushevsky* (LE); Ust-Yana Distr., Omchikanda, 27.VII.1991 *Perfilieva* (SASY); Aldan Distr., Tommot Peak, 17.X.1969 *Trufanova* (SASY); Tompo Distr., Verkhoyansk Range, upper course of Tompo River, 25.VII.1956 *V.Ivanova* (SASY); Vato-

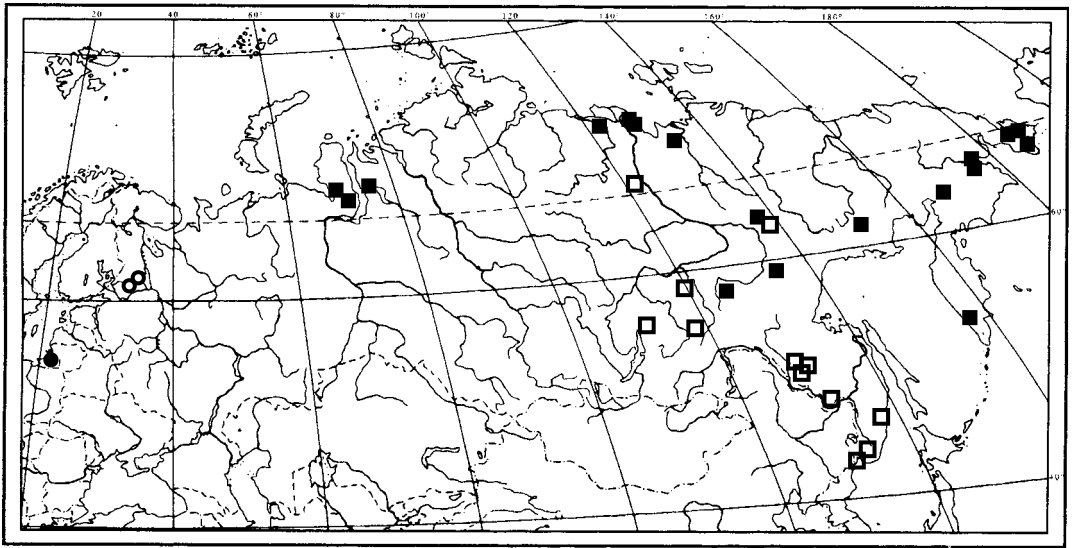


Fig. 5. Distribution of *Sphagnum affine* (○), *S. austinii* (●), *S. imbricatum* (□), *S. steerei* (■) in Russia.

ma River (tributary of Maya River), 20.VII.1912 *O.V. Sokolov* (PTZ). **FAR EAST: Chukotka:** Upper course of Keiyuveem River, 15 km SW of Kukunei Mt. (69°-70°N, 172°-174° E), 30.VIII.1951 *Gruzdev* (LE); Arakamchechen Island, south coast of Senyavina Bay, 18.VIII.1976 *Afonina*, (LE); Ioni Lake, Ioni Mt., 28.VI.1977 *Afonina* (LE); Provideniya Bay, 20.VII. 1975 *Afonina* (LE); Belaya Creek, left tributary of Anadyr River, 18.VIII.1929 *Sochava* (LE); Hot springs Gil'mimleveem, 15 km S of Ioni Lake, 3.VII.1977 *Afonina* (LE); Egvekinot (in Kresta Bay), 17.VIII.1977 *Afonina* (LE); Anadyr, near airport, 6.VIII.1950 *Andreev* (LE); Upper Getlyanen River, 2.VIII.1976 *Afonina* [Bryophyta Rossica...(1995), # 10] (LE); upper course of Anadyr River, Karval'yanskaya Creek, 21.VII.1982 *Afonina* (LE); Provedeniya Distr., Chaplinsiye Hot Springs, 30.VIII.1958 *V. Gavriljuk* (LE); same, 15.VII.1969 *Afonina* (LE); **Koryaksky Autonomous District:** Penzhina Distr., 8.VII.1930 *Saverkin* (LE). **Magadan Prov.:** Tenkinsky Distr., Sibityaellakh, «Aborigen» station, 14.VII.1976 *Blago-*

datskikh (LE); Ola Distr., middle course of Chelomzha River. zoological station, 10.VII.1982 *Blagodatskikh* (LE); Kamchatskaya Prov.: Opalikhinskoe bog, VIII.1958 *Koreneva* (MW).

Ecology. Hummock tundra with *Eriophorum*; sedge-*Sphagnum* mires in flood plains, shrubby sedge-moss tundras, hummocky shrubby tundras with *Eriophorum*, sedgy mountain tundras and boggy slopes in alpine areas.

Distribution. Arctic Siberia, Yakutia, north of Russian Far East including Kamchatka, North America (Alaska and Canada).

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