

# *Schistidium halinae* (Grimmiaceae, Bryopsida), a new moss species from the Antarctic

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*Received 17 September 1998, accepted 6 November 1998*

*Schistidium halinae* Ochyra (Grimmiaceae, Bryopsida) is described as a new species based on ten collections from the maritime West Antarctic. It differs from the congeners in (1) its piliferous upper leaves giving the plants a hoary appearance, (2) sharply spinulose-denticulate, hyaline, broad, flattened and membranous hair-points, 0.2–1.0 mm long on the upper leaves, (3) narrowly recurved and partially bistratose margins in the upper half leaf, (4) presence of a large central strand, (5) short-rectangular and sinuose laminal cells in the lower middle, and (6) long-rectangular basal juxtacostal cells with straight incrassate walls and quadrate to short-rectangular basal marginal cells forming a band 4–6 cells wide. Additionally, the capsules are deeply immersed in the ovate perichaetial leaves with a plane or narrowly recurved margin on one side below the apex and terminated with a long, hyaline hair-point (0.6–1.4 mm). The exothecial cells are mostly isodiametric to oblong, thin-walled with distinct corner thickenings and the peristome teeth are erect, lanceolate, perforate to irregularly cracked. The new species is fully described and illustrated and its affinities are discussed. *Schistidium halinae* is currently known from King George and Livingston Islands in the South Shetland Islands and from Vega and James Ross Islands near Trinity Peninsula on the NE coast of the Antarctic Peninsula. The distribution is mapped.

Key words: Antarctica, Bryopsida, Grimmiaceae, *Schistidium*, taxonomy

## INTRODUCTION

During the IV Polish Antarctic Expedition, in January 1980, I discovered a puzzling species of *Schistidium* Brid. growing on exposed andesite rock near Ezcurra Inlet on the west side of Admiralty Bay, King George Island, South Shetland Islands. Two months later a large population of this moss was found on Puchalski Peak on the east side of

Admiralty Bay. Here, it was the only moss recorded amongst a number of crustose lichens. The moss is a very distinct taxon, easily distinguished from all congeners in Antarctica by its long spinulose-denticulate hyaline hair-points, giving the plants a hoary appearance.

Initially, I was unable to identify this taxon and consulted B. G. Bell, who was then completing the treatment of *Grimmia* Hedw. and *Schisti-*

*dium* for a synoptic moss flora of South Georgian mosses (Bell 1984). He named the plant, with considerable reservation, *S. hyalinocuspdatum* (C. Müll) B. G. Bell. The material from Puchalski Peak was subsequently distributed in *Bryophyta Antarctica Exsiccata* as No. 164 (Ochyra 1984, Ochyra *et al.* 1986) and it has remained unexamined since. During the course of a revision of *Schistidium* for a forthcoming illustrated moss flora of Antarctica (Ochyra *et al.* 1997, Lewis-Smith *et al.* 1998) further specimens of this moss have been discovered in collections made by Dr. R. I. Lewis-Smith on James Ross and Vega Islands. Additionally, the specimen reported by Schulz (1993) as *S. cf. amblyophyllum* (C. Müll.) Ochyra & Hertel from Livingston Island also proved to belong within this species. Having examined all relevant type collections of *Schistidium* species in the Southern Hemisphere I came to the conclusion that the Antarctic material does not fit the concept of any known species and accordingly it is described as a new species.

It is a great pleasure to me to dedicate this distinctive moss to my wife, Halina Bednarek-Ochyra, for her skilled illustrations of mosses, particularly for the forthcoming Antarctic Flora.

## DESCRIPTION

*Schistidium halinae* Ochyra, *sp. nov.* (Fig. 1)

*Species distinctissima foliis sicce imbricatis, spiralter quinquefariis, pilis planis spinuloso-denticulatis, 0.2–1.0 mm longis, marginibus superne irregulariter bistratosi, cellulis sinuosis in medio laminae, basi rectangularibus, parietibus laevissimis incrassatisque, costis in sectione transversali bistratosi, foliis perichatilibus capsula duplo longioribus, perpilosis, pilis 0.6–1.4 mm longis, capsulis profunde immersis, breviter oblongo-cylindricis, cellulis exothecii isodiametricis vel oblongis, leptodermis collenchymaticisque et dentibus peristomii aurantiacis, perforatis vel irregulariter rimosis ab omnibus congeneribus facillime dignoscenda.*

Type: Antarctica. South Shetland Islands, King George Island, Admiralty Bay, Puchalski Peak, lat. 62°10'S, long. 58°17'30"W, elev. 140 m, on dry, bare andesite rocks on a west-facing slope, 16.III.1980, *Ochyra 2711/80* (holotype KRAM; isotypes AAS, ALA, ALTA, B, BA, BM, BP, BR,

C, CANM, CHR, COLO, DUIS, DUKE, F, FH, FLAS, G, GJO, GL, H, HIRO, HO, HSC, IFP, JE, KRAM, L, M, MEXU, MICH, MIN, MO, NAM, NFLD, NIPR, NICH, NSW, NY, PC, PE, PRE, S, TENN, TNS, TRH, U, UBC, US. All isotypes were distributed in *Bryophyta Antarctica Exsiccata* No. 164 as *Schistidium cf. hyalinocuspdatum*).

*Plants* medium-sized, rarely smaller, in relatively large, compact cushions, dull, olivaceous to brown or yellow-brown above, brown below, rarely brown or blackish throughout. *Stems* (1.0–) 1.5–2.5(–3.0) cm long, erect, much branched, in cross-section with 1–2 layers of smaller, brown to orange-brown, moderately thick-walled, cortical cells surrounding 3–4 layers of large, hyaline, thicker-walled medullary cells with distinct collenchymatous thickenings; *central strand* large and conspicuous; *rhizoids* scattered in the lower part of the stem, brown and smooth, weakly branched; *axillary hairs* hyaline throughout, 5–7-celled, composed of short rectangular cells or with elongated upper cells. *Leaves* densely set in 5 distinct, spiral rows giving the stem a ridged appearance, straight, closely imbricate, erect when dry, erect-spreading when moist, (1.3–)1.5–1.8(–2.0) mm long, 0.4–0.7 mm wide at the widest part, lanceolate to ovate-lanceolate, gradually acuminate, variable on the same shoot as regards the presence and length of the hyaline hair-points, the lower ones acute to obtuse and mucous, the uppermost acute and pilose, sharply keeled in the upper half, obtusely keeled to canaliculate below; *hair-points* hyaline, 0.2–1.0 mm long, becoming progressively longer up the stem, rather stiff, flattened, membraneous, narrow above and becoming widened towards the insertion and embracing a small part of the upper lamina, not or shortly decurrent down the margins, finely and irregularly spinulose-denticulate with short narrow spicules; *margins* entire, plane in lower half or more of the leaf length on one side and in lower 1/4–1/3 on the other side, narrowly recurved above almost to the apex, at least on one side, irregularly bistratose in upper and central part for 1–2 rows of cells, in the lower half unistratose; *costa* longly excurrent, channelled above, strongly convex dorsally, 40–65 µm wide above, becoming narrower towards the base, smooth throughout on the dorsal surface, in cross-section hemispherical to subrectangular in outline, bistratose throughout, occasionally with tristratose spots below, composed of uniform, large cells; *laminal cells* unistratose through-

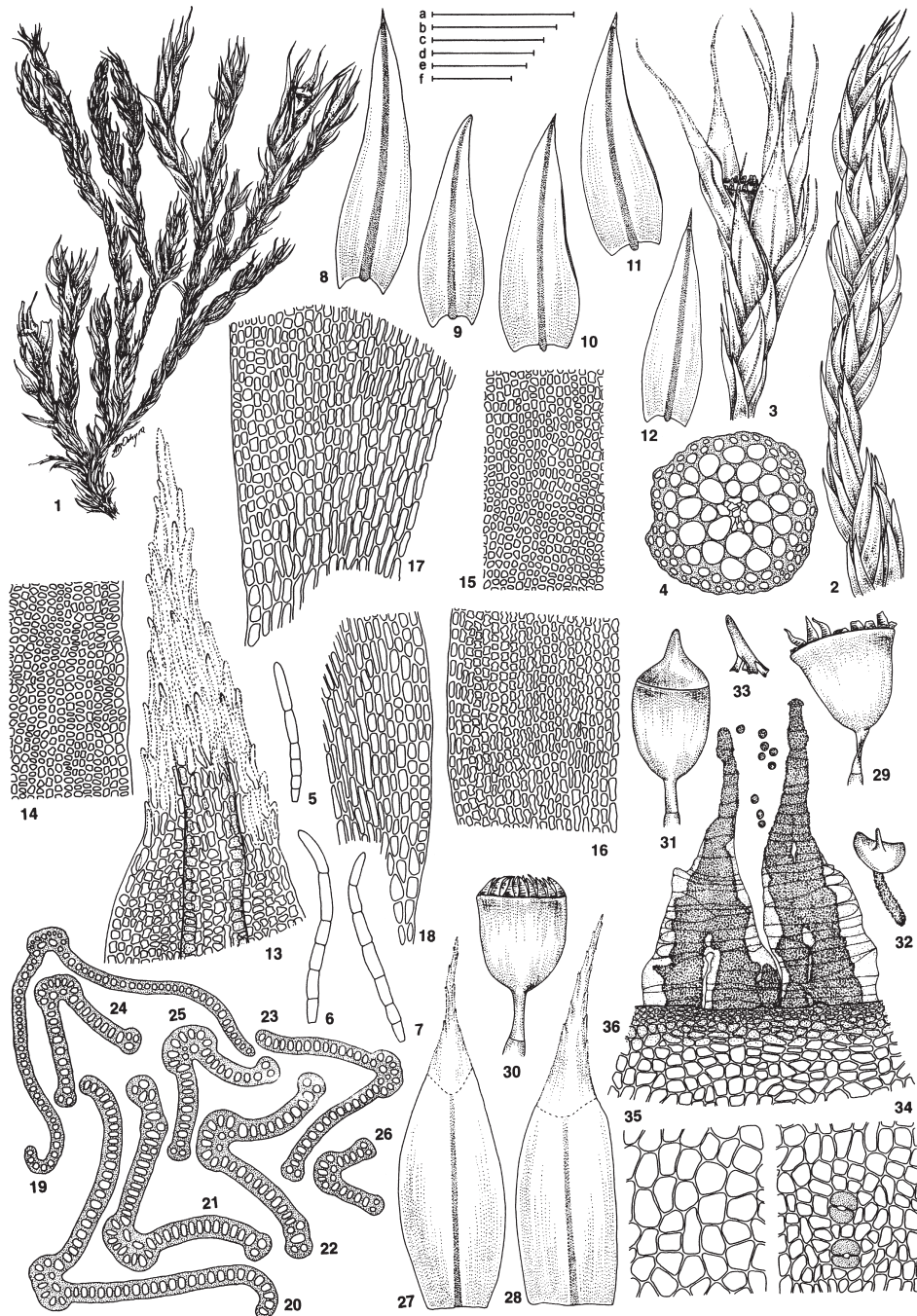


Fig. 1. *Schistidium halinae* Ochyra (drawn from the holotype (1, 4–10, 13–14, 16–17, 19–36) and *Ochyra* 937/80 (2–3, 11–12, 15, 18); both in KRAM). — 1. Habit. — 2. Portion of branch, dry. — 3. Perichaetium with deoperculate capsule. — 4. Cross-section of stem. — 5–7. Axillary hairs. — 8–12. Leaves. — 13. Leaf apex. — 14. Upper laminal cells at margin. — 15. Midleaf cells. — 16. Lower midleaf cells. — 17. Basal cells. — 18. Angular cells. — 19–26. Cross-sections of the leaves, a sequence from the base to the apex. — 27–28. Perichaetial leaves. — 29. Deoperculate capsule, dry. — 30. Deoperculate capsule, wet. — 31. Operculate capsule, wet. — 32. Operculum with attached columella, dry. — 33. Calyptra. — 34. Exothelial cells at the base of the urn and stomata. — 35. Exothelial cells in the middle of the urn. — 36. Peristome teeth, spores and the rim cells of the capsule. — Scale bars: a: 1 mm (8–12) and 100 µm (4–7). b: 100 µm (34–35). c: 1 mm (2) and 3 mm (1). d: 1 mm (29–33) and 100 µm (13–18). e: 1 mm (3, 27–28) and 100 µm (19–26). f: 100 µm (36).



out with occasional bistratose spots in the upper half, entirely smooth, thick-walled; *upper* and *median cells* rounded, rounded-quadrate to oblong, sometimes transversely short-rectangular, (4.5–) 6.0–10.0  $\mu\text{m}$  long, 6–8  $\mu\text{m}$  wide, straight-sided to slightly sinuose, becoming short rectangular in the lower midleaf, 10–14  $\mu\text{m}$  long, 7–8  $\mu\text{m}$  wide; *basal cells* chlorophyllose to subhyaline, forming a large juxtacostal band of short- to long-rectangular cells with straight and strongly incrassate longitudinal walls, 20–50  $\mu\text{m}$  long, 2.5–4.5 (–5.0)  $\mu\text{m}$  wide; *basal marginal cells* thick-walled with transverse walls thicker than longitudinal walls, 7–8  $\mu\text{m}$  wide, 6–20  $\mu\text{m}$  long, forming a group of 4–6 rows of cells wide, imperceptibly merging into the juxtacostal group. *Autoicous*. *Gynoecia* and *androecia* terminal, but appearing lateral due to subfloral innovations stretching to nearly the same direction as that of the preceding stem. *Perichaetial leaves* yellowish- to olive-green, about twice as long as sporophytes, 2.0–2.5 (–3.0) mm long, 1.1–1.3 mm wide, concave, sometimes faintly plicate, ovate, gradually acuminate, ending with a very long, 0.6–1.4 mm, hyaline, flat, spinulose-denticulate hair-point, non-decurrent down the margins but down the dorsal side of the costa resulting in a U- or V-shaped hyaline portion of the upper part of the perichaetial leaves; *margins* plane throughout or narrowly recurved on one side in the upper half; *upper cells* quadrate to short-rectangular, thick-walled, sinuose; *lower cells* long-rectangular, thin-walled, lax in the innermost leaves. *Setae* short, 0.5–0.6 mm long, straight, centrally attached; *vaginula* very short, with thin and smooth epidermal cells; *capsules* deeply immersed in perichaetial leaves, pale brown, shortly oblong-cylindrical, thin-walled, 0.9–1.0 mm long, 0.7–0.8 mm wide at mouth; *operculum* conic, with a straight beak, orange-brown; *columella* attached to the operculum after dehiscence, 0.7–0.8 mm long; *exothecial cells* mostly isodiametric, rounded-quadrate to short-oblong, 20–35  $\mu\text{m}$  long, 20–30  $\mu\text{m}$  wide, thin-walled, with clear corner thickenings, becoming transversely rectangular below the mouth, those at the urn rim markedly smaller, 8–15  $\mu\text{m}$  wide, thick-walled, orange-brown, in 2–3 tiers; *stomata* 7–10 at the extreme base of the urn, bicellular, superficial, round-pored, variously oriented; *peristome teeth* 280–350  $\mu\text{m}$  long, orange, erect, straight, lanceolate, acute to obtuse,

irregularly perforated, often with irregular cracks, usually eroded at margins, densely papillose. *Spores* spherical, pale brown, smooth to very finely papillose, 10–12  $\mu\text{m}$  wide. *Calyptrae* conical, smooth, mitriform, lobed at base, not extending to the urn.

*Other specimens seen (paratypes).* — **South Shetland Islands.** King George Island. Admiralty Bay, Ezurra Inlet, ridge called Cytadela between Monsimet Cove and Zaleski Glacier, lat. 62°11'S, long. 58°35'W, elev. 20 m, on dry strongly insolated andesite boulders on northern slope of the ridge, 20.I.1980, *Ochyra 937/80* (KRAM); same locality, elev. 80 m, on dry and exposed andesite rocks on NW-facing slope, 20.I.1980, *Ochyra 947/80* (KRAM). Livingston Island. South Bay, Hurd Peninsula near Juan Carlos I Station, lat. 62°37'S, long. 60°30'W, 6.II.1992, *Schulz 97* (KRAM). **East Antarctic Peninsula.** Vega Island. W side of Pastorizo Bay, elev. 50 m, lat. 63°54'S, long. 57°18'W, moist gravelly soil and rocks below late snow beds, 4.II.1989, *Lewis-Smith 7855* (AAS, KRAM, TRH). James Ross Island. S of Abernethy Flats (5 km SSE from SW corner of Brandy Bay), near Monolith Lake, elev. 100 m, lat. 63°52'S, long. 57°54'W, on blocks of breccia, 30.I.1989, *Lewis-Smith 7635* (AAS, KRAM, TRH); Fortress Hill, elev. 150 m, lat. 63°56'S, long. 57°31'W, seepage area below snow patch on plateau, 18.I.1989, *Lewis-Smith 7777* (AAS, KRAM, TRH) & *7781C* (AAS, KRAM); in valley S of St. Martha Cove, elev. 35 m, lat. 63°56'S, long. 57°49'W, dry soil among large stones at margin of soil stripe, 26.I.1989, *Lewis-Smith 7455A* (AAS, KRAM, TRH); same locality, elev. 50 m, dry soil and gravel on stony col, 26.I.1989 (AAS, KRAM); same locality, elev. 80 m, on dry rocks, 23. I. 1989, *Lewis-Smith 7648* (AAS, KRAM); hill top to S side of St. Martha Cove, elev. 150 m, lat. 63°56'S, long. 57°49'W, pocket of soil amongst large block boulder, 6.II.1989, *Lewis-Smith 7541A* (AAS, KRAM).

## DISCUSSION

Species of *Schistidium* are one of the most important constituents of the impoverished terrestrial vegetation in the Antarctic biome, both in terms of frequency and cover. Also, the genus is still under-investigated taxonomically both in this area as well as in the Southern Hemisphere in general. The only available revision of the genus (Bremer 1980a, 1980b, 1981) is, in practice, not particularly useful because of the exceedingly broad concept of *S. apocarpum* (Hedw.) Bruch & Schimp. with which many distinct and well defined species have been lumped. My revision of *Schistidium* for a forthcoming moss flora of Antarctica has revealed that no fewer than ten species are present

in this region, making it the richest genus in this biome. A survey of the Antarctic species will be presented in a separate treatment, but this note provides a description of this distinct new species which was kept misnamed in the herbarium for nearly twenty years.

*Schistidium halinae* can be easily recognized in field by its hoary appearance because of the long, hyaline hair-points on the uppermost vegetative and perichaetial leaves which seem to be the key character of the species, not only in the south, but also in the Northern Hemisphere. They are broad, flattened and membranous and tend to be very long and pronounced in the upper vegetative leaves, reaching to 1.4 mm in the perichaetial leaves and it is peculiar that the cell wall remnants are clearly visible in them. Such hair-points seem to have evolved in several species growing in dry, often sunny and exposed habitats and they occur in partly in remotely related species such as *S. flaccidum* (De Not.) Ochyra, *S. frisvollianum* Blom, *S. bryhnii* I. Hag., *S. venetum* Blom and *S. scandicum* Blom. However, the hair-point in *S. halinae* is much stiffer because of the strong and long-excurrent costa and does not tend to be flexuose as in the aforementioned species. In fact it could slightly remind the hyaline awn is some species of *Grimmia*, for example *G. anodon* Bruch & Schimp.

Additionally, the species is recognized by the combination of the following characters: (1) upper and median laminal cells rounded to rounded-quadrate becoming short-rectangular and sinuose in the lower midleaf; (2) long-rectangular and straight-walled basal juxtacostal cells and quadrate to short-rectangular basal marginal cells forming a broad band; (3) central strand present; (4) setae 0.5–0.6 mm long; (5) capsules shortly oblong-cylindric; (6) exothecial cells thin-walled, isodiametric to short-oblong; (7) spores 10–12  $\mu\text{m}$  wide, smooth to minutely roughened.

The only other Antarctic species with long-pilose leaves is *Schistidium urnulaceum* (C. Müll.) B. G. Bell, endemic to South Georgia (Bell 1984) and King George Island (Ochyra 1990, Chen *et al.* 1995). It is easily recognized microscopically by a set of characters as follows: laminal cells rectangular and strongly nodulose throughout the leaf except for the extreme base; central strand lacking; very short setae, 0.2–0.3 mm long; glo-

bose capsules; exothecial cells with strongly incrassate walls; and smooth, small spores, 7–9  $\mu\text{m}$  in diameter.

Originally, the first collections of *Schistidium halinae* were compared to *S. hyalinocrepidatum*. It is considered a South Georgian endemic (Bell 1984) and very closely related to — and probably conspecific with — *S. amblyophyllum*, a subantarctic-andean species (Ochyra & Hertel 1990). These species differ from *S. halinae* in their leaf areolation of elongate and strongly sinuose laminal cells extending nearly to the base, epilose leaves and the lack of central strand.

All other Antarctic species have short hyaline hair-points and differ additionally in other structural characters. Some populations of the endemic *Schistidium antarctici* (Card.) L. I. Savicz & Smirnova have occasionally leaves with well developed hyaline awns and additionally the leaves are distinctly 5-ranked. However, the peristome teeth are reduced in this species, mostly truncate and rudimentary, the basal juxtacostal cells are short-rectangular and the supra-basal cells are only weakly sinuose. Likewise, *S. occultum* (C. Müll) Ochyra & Matteri has sometimes a short hyaline hair-point, usually less than 0.1 mm long, but it is distinct in its tristratose costa in transverse section.

Antarctica seems to be a centre of endemism in *Schistidium*. Apart from *S. halinae* and *S. antarctici*, a third species, *S. steerei* Ochyra, is known only from two localities on King George Island (Ochyra 1987). However, it is likely that these species occur elsewhere in southern South America or in Subantarctica as floristic exploration is extended in these biomes, but examination of the relevant type collections showed that they have not been described elsewhere under different names. Until new records of these species from more northerly latitudes are available, the hypothesis that they have evolved in the Antarctic must be accepted.

Because the genus *Schistidium* is still poorly known taxonomically, it is difficult to suggest the relatives of *S. halinae*, but it seems to show the closest relationship to the above-mentioned Antarctic species, and to *S. frigidum* Blom and *S. cryptocarpum* Blom. & Mogensen (and possibly *S. venetum*) from the Northern Hemisphere. The northern species may be similar to *S. halinae* in habit, but the hair-points, if not incrusted by calcareous

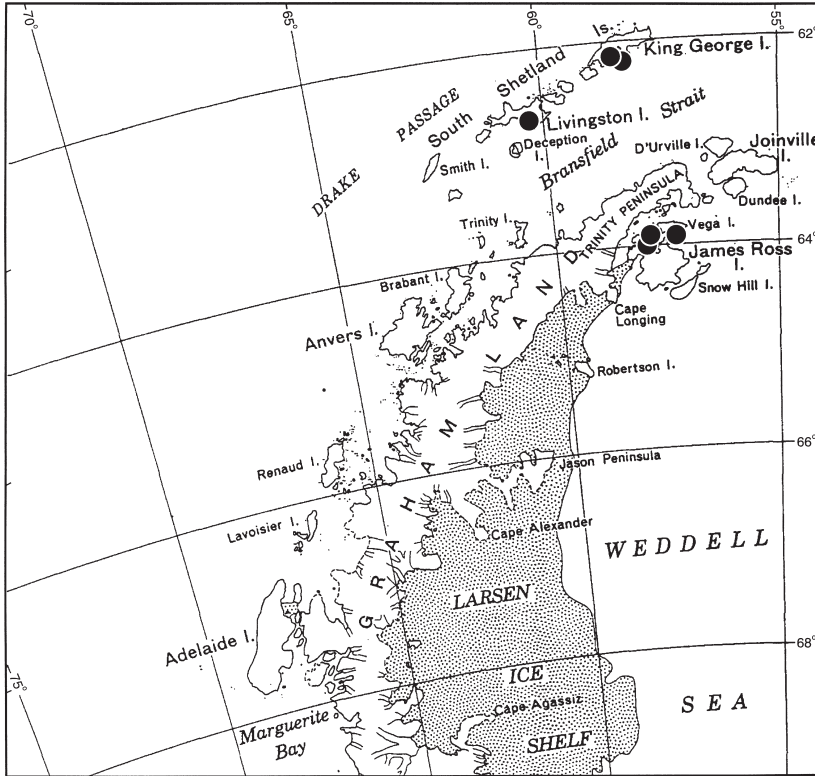


Fig. 2. Distribution map of *Schistidium halinae* Ochyra.

matter, are much softer. *Schistidium halinae* bears also some similarity to the Scandinavian *S. scandicum* Blom, a species recently described (Blom 1996) from Norway and Sweden. Both species share long-piliferous leaves, the presence of a distinct central strand and areolation in the leaf base, but the Scandinavian species seems to be distinct in its shallowly immersed capsules, red, patent to squarrose peristome teeth, narrowly recurved margins of the perichaetial leaves in the upper half, larger laminal cells and granulose to verucose, somewhat larger spores.

At present *Schistidium halinae* is known from two widely separate centres in the northern West Antarctic (Fig. 2). It occurs on King George and Livingston Islands in the South Shetland Islands archipelago, and on Vega and James Ross Islands near the Trinity Peninsula on the East Antarctic Peninsula. It does not seem to have been collected elsewhere in the maritime Antarctic, and a survey of large collections in the herbarium of the British Antarctic Survey (AAS) has not revealed other specimens of this distinctive moss. *Schistidium halinae* grows in exposed places on stones and

gravelly ground, mostly in dry situations, although on James Ross Island it was recorded in a moist site below a late snow patch. These are typical habitats of most *Schistidium* species in Antarctica, which are either saxicolous or epigeal plants in this biome.

*Acknowledgements:* Special thanks are due to Dr Hans H. Blom, Trondheim, for his valuable comment on the new species. I am grateful to Drs Helen J. Peat and Ronald I. Lewis-Smith, Cambridge, for kindly allowing me to study the specimens of Antarctic mosses deposited in the herbarium of the British Antarctic Survey (AAS), and to Dr Florian Schulz, University of Kiel, for making available for study the specimen from Livingston Island. Special thanks are also due to Dr R. I. Lewis-Smith for his comment on the manuscript and correcting the English. I am also indebted to my wife, Halina Bednarek-Ochyra, for her illustrations and to Mrs Katarzyna Biłtyk for the distribution map.

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