

A SYNOPTIC FLORA OF SOUTH GEORGIAN MOSSES: *GRIMMIA* AND *SCHISTIDIUM*

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ABSTRACT. The species from South Georgia belonging to the genera *Grimmia* and *Schistidium* are described, a combined key for both genera, and short historical notes on the taxonomy of all species, being provided. Habitat and distribution data for all species together with full lists of all specimens examined are also given. *S. falcatum* (Hook. f. et Wils.) B. Bremer, *S. rivulare* (Brid.) Podp., and *Grimmia incrassicapsulis* B. G. Bell, a new species based on a hom. illeg., *G. inaequalis* Dix. et Sainsb., described from New Zealand, are reported for the first time from the island. *Grimmia hyalino-cuspidata* C. Muell., *G. syntrichiacea* C. Muell., *G. urnulacea* C. Muell. and *G. celata* Card. are transferred to *Schistidium*. *Grimmia nordenskjoeldii* Card. and *G. kerguelensis* Card. are reduced to synonymy with *G. immerso-leucophaea* (C. Muell.) Kindb. and *G. asperitricha* Dix. et Sainsb., a New Zealand species, is reduced to synonymy with *G. grisea* Card.

INTRODUCTION

Species of *Grimmia* and *Schistidium* are important constituents of the South Georgian bryoflora, occupying a wide range of habitats, including submerged rocks in streams and lakes and exposed, high-altitude rock surfaces. Recognition of plants as members of these genera is not difficult, the non-exserted singly peristomate capsules, the frequently sinuose nature of the leaf cell walls and the absence of cell papillae normally enabling separation from those cushion-forming species of *Andreaea*, *Racomitrium* and *Willia* with which some confusion may arise. Further distinguishing features are provided where appropriate in the species notes following the species descriptions.

Distinction between *Schistidium* and *Grimmia* is sometimes difficult. When erecting the genus *Schistidium* Bridel (1819) and later Bruch and Schimper (1845), in their more detailed reappraisal of its diagnostic characters, provided an extensive list of features but they included many variable characters which are, in fact, common to representatives of both genera. This has caused some taxonomic confusion but the generic diagnoses provided by recent authors (e.g. Smith, 1978) invariably include the monoecious condition, a tufted growth form, immersed capsules with columella falling attached to the lid (i.e. a dehiscent columella), as characteristic of *Schistidium* compared with monoecism or dioecism, a more compact cushion growth form, emergent or exserted capsules and a columella persisting within the capsule for *Grimmia*. In the following account those species with a dehiscent columella are referred to *Schistidium* and those with a persistent columella to *Grimmia* although, in all species, the nature of at least one and usually two additional features (i.e. sexual habit, growth form or capsule position) supports the generic distinction. To avoid confusion between species of *Grimmia* and *Schistidium* the key provided includes both genera.

To ascertain whether or not a columella is persistent, capsules where the operculum has almost separated but has not been totally dislodged, should be selected for close scrutiny. After soaking in water for at least 24 hours, the rostellum should be gently pulled while the capsule is being observed under a dissecting microscope. It has been found that there is a striking difference in the effort required

to remove the operculum in the two conditions. Where the columella is persistent, scarcely any effort is required to detach the operculum but where the columella remains attached to the operculum, a considerable tug is necessary to pull the columella through the peristome teeth. Further confirmation of the condition can be obtained by examining the contents of recently matured, fully dehisced capsules for the presence or absence of persistent columellae.

In this study the distinction between immersed and emergent capsules is often critical but never difficult to determine. In moist specimens, a capsule is said to be immersed if it is deeply enclosed in and surrounded by the bases of the perichaetial bracts whereas an emergent capsule is raised by its seta so that its rim remains level with the upper parts of the bracts but never reaches beyond their apices. In dry specimens showing the latter condition the bracts often curve away from the capsule leaving it apparently exerted, which can be confusing.

Two further points about the terminology used in this paper should be noted. Firstly there are three conditions where hyaline cells appear at the apex of vegetative leaves:

- (i) Where the tip of the leaf lamina is hyaline, e.g. as seen in *Schistidium apocarpum* (Fig. 7). This is described as a hyaline tip.
- (ii) Where a hyaline extension of the leaf is 'added on' to the green lamina, e.g. *S. syntrichiaceum* (Fig. 17), which is described as a hyaline hairpoint.
- (iii) Where an apical portion of the lamina is hyaline and the leaf also possesses an 'added on' hyaline portion, e.g. *Grimmia grisea* (Fig. 1), which is described as a hyaline hairpoint subtended by a hyaline apical margin.

The second point relates to measurements. In all cases, the leaf length measurements include the hairpoint when present. Leaf cells were measured in two positions. Those categorized as 'cells above' are located mid-way between nerve and margin and one-third of the total leaf length below the leaf apex while 'cells below' are located mid-way between nerve and margin immediately above the line of the leaf insertion.

The arrangement of the text, the description of the species and the citation of specimens and field records follows the format of earlier papers in this series (Greene, 1973; Newton, 1979). Most of the material examined is from the British Antarctic Survey bryophyte herbarium, presently housed at the Institute of Terrestrial Ecology's Bush Research Station, Penicuik, Midlothian, Scotland. The collections studied are those indicated by Bell and Greene (1975) with an additional collection made by G. Lawson in 1974-76.

Key to South Georgian species of *Grimmia* and *Schistidium*

1. Monoecious plants of very moist habitats forming loose cushions or mats, all leaves without a hairpoint 2
 Monoecious or dioecious plants of dry to moist habitats forming compact cushions or tufts, rarely loose, hairpoints present or apex hyaline at least on some upper leaves 3
2. Leaves triangular to oblong-lanceolate with a very wide diffuse nerve, plants invariably submerged in streams and lakes *Schistidium falcatum*
 Leaves widely ovate to ovate-lanceolate with a well-defined narrow nerve, plants rarely submerged but always growing near permanent water. *Schistidium rivulare*
3. Majority of leaves possessing a hairpoint which is often very long (>0.5 mm), cushions usually hoary, columella persistent 4

- Majority of leaves lacking a hairpoint which, if present, is short (<0.5 mm), cushions not or moderately hoary, columella dehiscent 6
4. Leaves oblong-lanceolate with longly-rectangular lax basal cells from nerve to margin, capsules with incrassate exothelial cells (walls 7–9 μ m thick)
Grimmia incrassicapsulis
- Leaves ovate- to oblong-lanceolate with quadrate to rectangular basal cells rarely lax and invariably incrassate towards margin, exothelial cells of capsule not incrassate 5
5. Capsules immersed (setal length usually <0.6 mm), small leaves at base of stem oblong-lanceolate, with cells at base near nerve shortly to longly rectangular (length:breadth ratio approx 4:1), upper margin frequently involute
Grimmia immerso-leucophaea
- Capsules emergent (setal length usually >1 mm), small leaves at base of stem ovate-lanceolate, majority of cells at base near nerve quadrate to shortly rectangular (length:breadth ratio approx. 2:1), upper margin rarely involute
Grimmia grisea
6. Majority of basal cells of leaf longly rectangular (>3:1 length:breadth ratio) rarely lax, normally merging into sinuose/nodulose cells immediately above or towards mid-leaf 7
- Majority of basal cells of leaf shortly rectangular (<3:1 length:breadth ratio) never lax, merging into straight-sided cells immediately above in most leaves 9
7. Majority of leaves with short hairpoint, exothelial cells of capsule with thickened walls (>7 μ m) *Schistidium urnulaeum*
- Majority of leaves mucous, exothelial cells of capsule not thickened (<3 μ m) ... 8
8. Leaves regularly ovate-lanceolate, lamina rarely inflexed on one side, basal cells sometimes lax, merging into shortly rectangular sinuose cells, cells above irregularly quadrate *Schistidium celatum*
- Leaves ovate- to oblong-lanceolate, lamina frequently inflexed on one side, basal cells never lax, merging into longly rectangular strongly nodulose cells, cells above irregularly quadrate to shortly rectangular *Schistidium hyalino-cuspidatum*
9. All vegetative leaves small, i.e. 0.7–1.5 mm long, often with short distinct hairpoint *Schistidium syntrichiaceum*
- Vegetative leaves usually larger, i.e. 1.5–2.0 mm long, becoming larger towards stem apex with short hyaline extension of lamina *Schistidium apocarpum*

GRIMMIACEAE

Grimmia

The three species of *Grimmia* known from South Georgia form short, compact cushions on rock surfaces and are moderately to strongly hoary. All are frequently found with capsules that are either immersed or emergent and possess persistent columellae.

Grimmia grisea Card.

Syn. *Grimmia asperitricha* Dix. et Sainsb.

Stems forming short moderately compact cushions 0.3–1.2 (–1.5) cm high, hoary, yellow-green above, brown below, regularly dichotomously branched, fastigiate, the leaves crowded, erect when dry, erect to erecto-patent when moist. Leaves (0.9–) 1.5–2.8 (–3.3) \times (0.1–) 0.2–0.5 (–0.6) mm, ovate- to oblong-lanceolate, small towards stem base with a \pm short hairpoint becoming larger towards apex with long

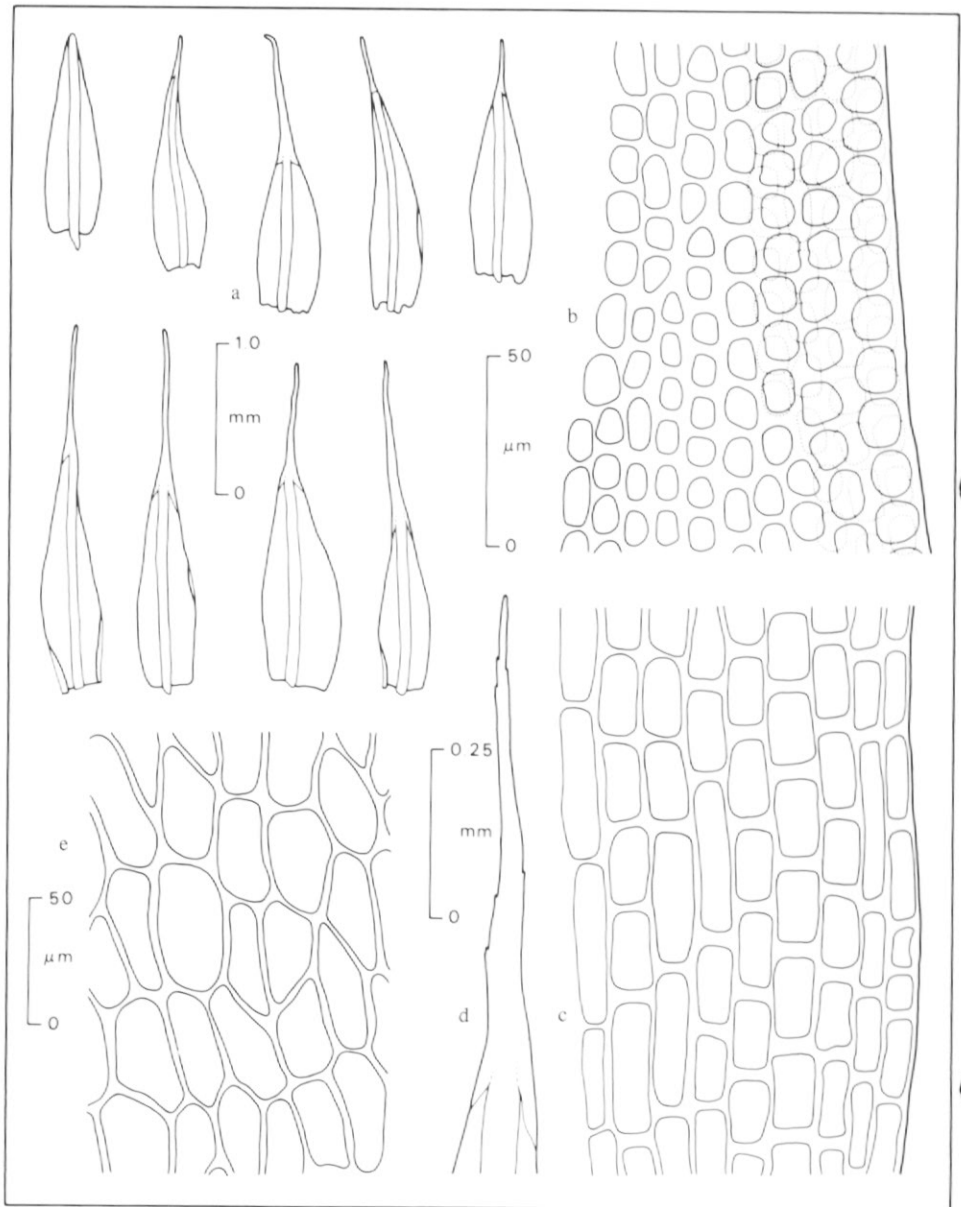


Fig. 1. *Grimmia grisea*. a. Leaves; b. Upper leaf cells and margin; c. Lower leaf cells and margin; d. Apex; e. Exothecial cells of capsule. Scales: upper left-hand for leaves; upper right-hand for leaf cells; lower left-hand for exothecial cells; lower right-hand for apex.

hyaline denticulate hairpoint, rarely weakly decurrent. Margin bi- or multistratose above, rarely involute towards apex, forming hyaline base of hairpoint. Nerve ceasing at base of hairpoint, usually strongly channelled from near base to apex. Cells above (3-) 5-8 (-11) \times (4-) 6-9 μm , irregularly quadrate, incrassate, in mid-leaf weakly to strongly sinuose, below (10-) 18-46 (-55) \times 8-15 (-18) μm , quadrate to shortly rectangular, rarely with longer cells adjacent to nerve, thickening

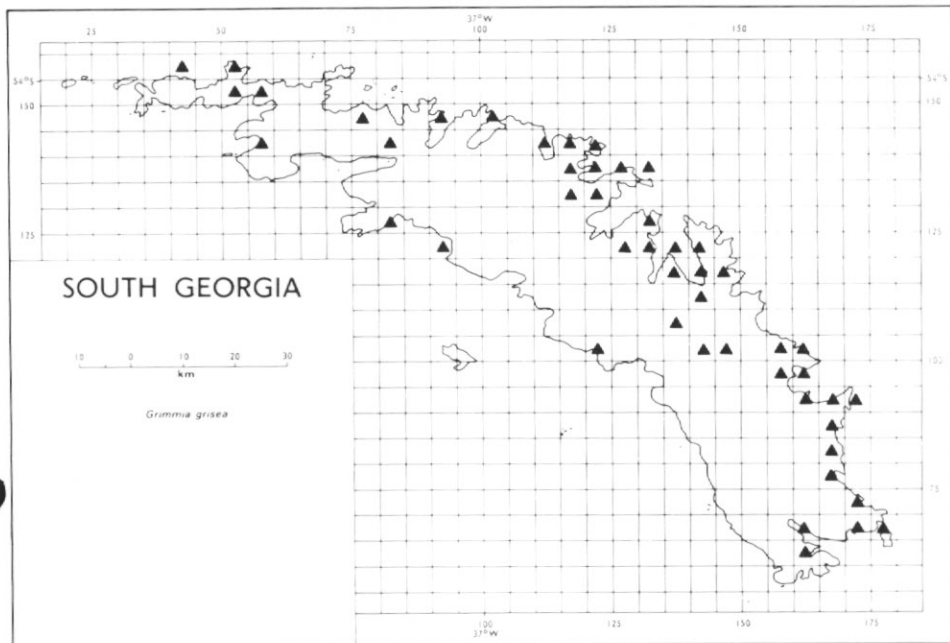


Fig. 2. The known distribution on South Georgia, by 5-km squares, of *Grimmia grisea* based on the specimens and field records given in the Appendix.

regular except at margin where transverse walls are thicker than longitudinal, rarely lax and thin-walled. Dioecious. Perichaetial bracts wider and longer than vegetative leaves with a very long hyaline denticulate hairpoint, small area of lamina at apex often hyaline. Seta 0.8–1.7 mm. Capsule 0.8–1.2 × 0.5–0.7 mm, emergent, erect, ovoid to obloid. Exothecial cells thin-walled i.e. < 3 µm thick. Operculum rostellate to rostrate. Columella persistent. (Fig. 1.)

Habitat and distribution (Fig. 2)

A widely distributed common species of dry or moist rock surfaces. Alt. 0–1000 m.

Notes

A variable species in its morphology and anatomy, *Grimmia grisea* is the only member of the genus on South Georgia with an emergent capsule and, although dioecious, is rarely found without sporophytes. Cushions without sporophytes may be confused with *G. incrassicapsulis* or *G. immerso-leucophaea*. Microscopic examination of the vegetative leaves should readily distinguish the former, as indicated in the notes for *G. incrassicapsulis*, but the distinction from *G. immerso-leucophaea* is more difficult as explained in the notes accompanying that species' description.

Taxonomy

Despite its variability, the very large number of specimens of this taxon in the collections from South Georgia with characteristic hoary appearance and emergent capsules suggested that there would be few problems in referral to a taxon previously described or reported from the island. However, neither Müller (1890) nor Cardot

(1906, 1908) describe a species of *Grimmia* with emergent capsules. Of the species they described with long hairpoints to the leaves, *Grimmia immerso-leucophaea* has immersed capsules (Müller, 1890) and *G. nordenskjöldii* has small leaves with long basal cells and a very compact growth form (Cardot, 1906), which indicates a very different taxon from the present species. Examination of the type specimen of the only other long hairpointed species described from the island (Syntype Skottsberg 307, PC, S, *Grimmia grisea* Card. sp. nova, South Georgia, Cumberland Bay, 21.5.1902. Det. J. Cardot, Svenska Sydpolarexpeditionen 1901–3), for which Cardot (1908) was unable to describe the sporophyte, indicates a species, the vegetative leaves of which are smaller and proportionately more widely oblong-lanceolate than most of the South Georgian specimens with emergent capsules and with some mucous leaves with broadly acute apices. The lower cells are also consistently quadrate to very shortly rectangular. Some of the specimens with emergent capsules exhibited this combination of characters but referral of all of the specimens to this species was originally considered unwise. However, examination of hoary species of *Grimmia* with emergent capsules from elsewhere in the world revealed only a single taxon that bore similarities to the combination of vegetative and sporophytic characters shown by the South Georgian specimens, i.e. *G. asperitricha* Dix. et Saisb. reported from New Zealand (Sainsbury, 1945). Syntypes of this species (Sainsbury 753, BM, *Grimmia asperitricha* Dix. et Sainsb. sp. n. Loc. Rocks near Hermitage, Mt Cook, N.Z. Coll. G. O. K. Sainsbury, 29 Jan. 1934. Herb. H. N. Dixon; Sainsbury 771, 772, BM, *Grimmia asperitricha* Dix. et Sainsb. sp. n. Loc. Malte Brun, Tasman Glacier, N.Z., on rock. Coll. G. O. K. Sainsbury, 22 Jan. 1934. Herb. H. N. Dixon; Sainsbury 756, BM, *Grimmia asperitricha* Dix et Sainsb. sp. n. Loc. Rock, Tasman Glacier, near De le Beche Hut, South I., N.Z. Coll. G. O. K. Sainsbury, 20 Jan. 1934. Herb. H. N. Dixon; Sainsbury 799, BM, *Grimmia asperitricha*, Mt Ruapehu, c. 6000 ft. On andesite rock. January 1930 probably) have been examined and several of the South Georgian specimens agree with them in all essential respects, particularly in possessing long ovate- to oblong-lanceolate hairpointed leaves with shortly rectangular cells at the base. There is, however, a large group of South Georgian specimens with emergent capsules that links *Grimmia grisea* to *Grimmia asperitricha* in having vegetative leaves intermediate in shape and size, the smaller leaves frequently lacking hairpoints, and the cells at the base sometimes quadrate, usually shortly rectangular. It therefore seems wise to group the two species together and, as *Grimmia grisea* has nomenclatural priority, *G. asperitricha* is reduced to synonymy. It is somewhat unfortunate that the species has to be typified by Skottsberg's specimen as it shows an extreme in vegetative leaf anatomy almost certainly due to habitat-related variation. Supportive evidence for grouping all of the specimens in a single taxon is provided by another Skottsberg specimen collected from South Georgia in 1909, as reported by Cardot and Brotherus (1923). This specimen (Skottsberg, 32, S, *Grimmia grisea* Card., Sydgeorgien, Cumberland Bay, Klipper in Morainfjorden. 18.4.1909. Det. Cardot. Carl Skottsberg 32. Expeditio suecica 1907–9) determined by Cardot has much narrower leaves than the type and possesses emergent capsules. Three specimens collected by Tröim and determined by Dixon (Tröim 10, BM, *Grimmia grisea* Card. Loc. Near sea level, Grytviken, South Georgia, Coll. T. Tröim, 5 Feb. 1929. Comm. O. A. Hoeg. Det. H.N.D. Herb. H. N. Dixon; Tröim 35, BM, *Grimmia grisea* Card. Loc. Cumberland Bay, South Georgia. Alt. 40 m. Coll. T. Tröim., Comm. O. A. Hoeg. Det. H.N.D. Herb. H. N. Dixon; Tröim 57, BM, *Grimmia grisea* Card. Loc. 'Dammen', Grytviken, S. Georgia. Alt. 100 m. Coll. T. Tröim, 4 April 1933. Comm. Herb. Mus. Nidaros. Det. H.N.D. Herb. H. N. Dixon) show that Dixon considered

the taxon as variable since none of this material shows the same combination of vegetative leaf characters as Cardot's type. Tröim 57 also possesses emergent capsules. The persistent columella confirms the inclusion of this taxon in *Grimmia* while the dioecious sexual habit, cushion growth form and emergent capsule provide supporting evidence.

Grimmia immerso-leucophaea (C. Muell.) Kindb.

Syn. *Grimmia bossieri* Card. et Ther.

Gumbelia immerso-leucophaea C. Muell.

Grimmia kerguelensis Card.

Grimmia nordenskjoeldii Card.

Stems forming compact to very compact cushions 0.5–2.5 (–3.0) cm high, moderately to strongly hoary, black below, dichotomously branched, fastigiate, the leaves crowded, erect when dry, erect to erecto-patent flexuose when moist. Leaves (1.2–) 1.4–2.3 (–2.6) × (0.1–) 0.2–0.5 mm, oblong- to ovate-lanceolate, small towards stem base with short hairpoint becoming larger towards apex with longer (>0.5 mm) denticulate hairpoint. Margin bi- or multi-stratose frequently weakly involute above (particularly in smaller leaves), rarely weakly revolute at the base of larger leaves. Nerve ceases at base of hairpoint, weakly channelled above. Cells above (5–) 6–10 × 5–8 μm, irregularly quadrate, incrassate, in midleaf weakly to strongly sinuose, at base 24–62 (–70) × 7–12 (–14) μm, variable, shortly to longly rectangular towards nerve with longitudinal walls more thickened than transverse, towards margin rarely long, with transverse walls at least as thick as longitudinal, rarely lax. Dioecious. Perichaetial bracts much larger than vegetative leaves, conspicuous, often extending above cushion surface, widely ovate-lanceolate with long hyaline denticulate hairpoint originating from a large area of long hyaline lamina cells at the apex. Seta 0.3–0.6 mm. Capsule 0.7–1.0 × 0.5–0.8 mm immersed, ovoid to obloid. Exothelial cells thin-walled i.e. <3 μm thick. Operculum rostellate to rostrate. Columella persistent. (Fig. 3.)

Habitat and distribution (Fig. 4)

A widely distributed, common species of dry or moist rock surfaces. Alt. 0–500 m.

Notes

Grimmia immerso-leucophaea is a variable species but the presence of a hairpoint on almost all vegetative leaves, imparting a moderately hoary appearance to the cushion, together with the generally small oblong- to ovate-lanceolate leaves with rarely weakly sinuose cells in mid-leaf, will distinguish it from all other species of *Grimmia* or *Schistidium* with the exception of *Grimmia grisea*. There should be no difficulty in recognizing the present species if the material is fruiting as the immersed capsules with a setal length 0.3–0.6 mm contrast with the emergent capsules on a seta 1.1–1.7 mm in length in *G. grisea*. When sporophytes are not present, careful microscopic examination of leaves is necessary to distinguish the two species, the smaller leaves at the base of the stems providing the most reliable differences. In *G. grisea* these leaves are more ovate- than oblong-lanceolate, the margin towards the base is rarely revolute, and the majority of the cells near the nerve at the base of the leaf are shortly rectangular, i.e. approximately twice as long as broad with undifferentiated thickening on longitudinal and transverse walls. In the present species, similarly situated leaves are more oblong- than ovate-lanceolate, the upper margin is frequently involute and the basal cells near the nerve are longer, i.e.

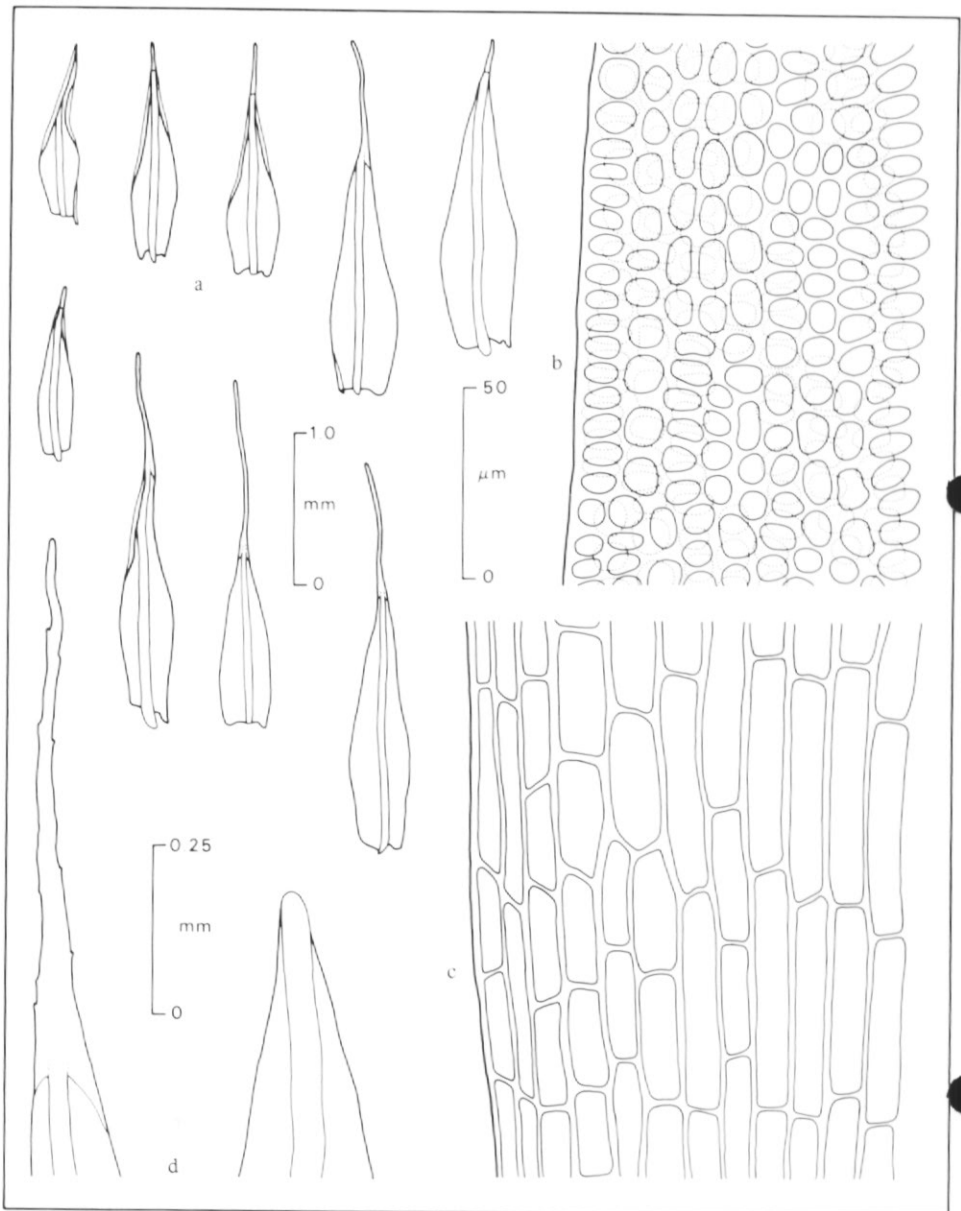


Fig. 3. *Grimmia immerso-leucophaea*. a. Leaves; b. Upper cells and margin; c. Lower cells and margin; d. Apices. Scales: upper left-hand for leaves; upper right-hand for cells; lower for apices.

approximately four times as long as broad, and often have thicker longitudinal walls. These characters generally remain true in larger leaves but the wide variation in the leaf areolation of both species can be extremely confusing. Cells at the basal margin can be shortly rectangular and thickened differentially, i.e. transverse walls appearing thicker than longitudinal, but they may be longly rectangular and relatively thin-walled in both species. Although sporophytes may be absent,

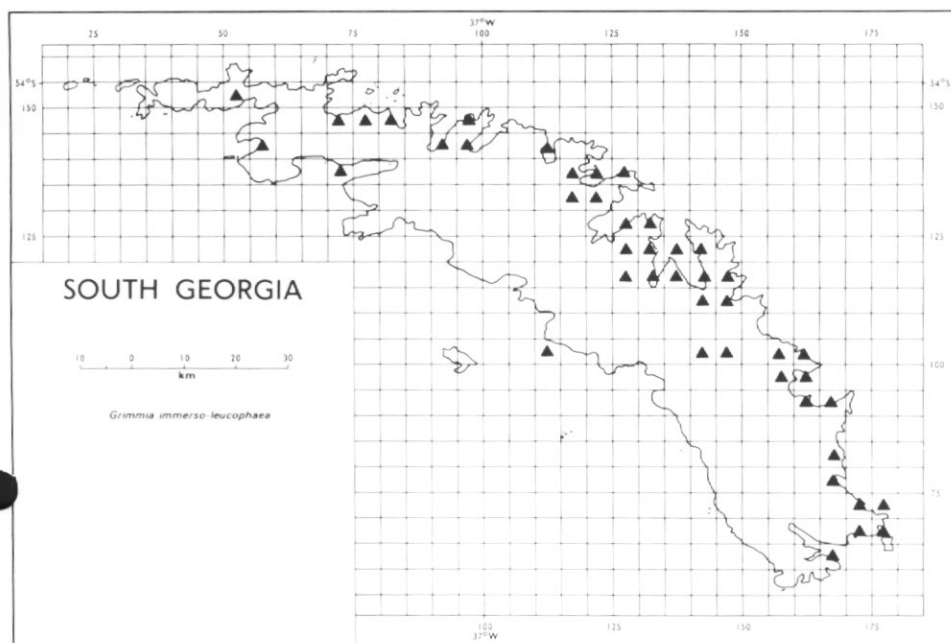


Fig. 4. The known distribution on South Georgia, by 5-km squares, of *Grimmia immerso-leucophaea* based on the specimens and field records given in the Appendix.

perichaetial bracts may be present and if so provide a useful discriminatory character in that they are twice as long as the vegetative leaves in *G. immerso-leucophaea* but only marginally longer than the largest vegetative leaf in *Grimmia grisea*.

Although the growth forms of *G. immerso-leucophaea* and *G. grisea* in dry exposed habitats are very similar, there should be no difficulty in distinguishing the two taxa since the cushion of the former is extremely compact, the leaves are small with a short often flexuose hairpoint and the cells at the base unusually long and incrassate: a thickened involute margin is rarely absent from any leaf.

Taxonomy

First described from South Georgia by Müller (1890) as *Gümbelia immerso-leucophaea* the species was later transferred to *Grimmia* by Kindberg (1891). The type specimen (Syntype Will 52, HBG, *Gümbelia immerso-leucophaea* [sic] C. Müll. n. sp, Fundort: Felsen am Ausgange des Brockenthal. Selten Süd-Georgien. 23.1.83. Südpolarexpedition; Syntype Will 52, HBG, *Gümbelia immerso-leucophaea* C. Müll. n. sp. Fundort: Koppenberg, an Felsen Süd-Georgien. 19.V.83. Südpolarexpedition) has been examined together with two further specimens determined by Müller (Will s.n., HBG, *Gümbelia immerso-leucophaea* C. Müll. Fundort: SW-Gletscherthal, Austro-Georgia. 9.V.83, Südpolarexpedition. Leg. Will; Will s.n. M, *Grimmiaceae* (*Gümbelia*) *immerso-leucophaea* C. Müller. Am Ross-Gletcher, Süd-Georgien, 9.V.83) and the many specimens represented in subsequent collection agree well with the material named by Müller particularly in the leaf shape, its involuted margins and areolation. However, there is considerably more variation in the growth form and leaf morphology and anatomy than suggested

by Müller's description (1890). The cushion may be less hoary and larger than described, the length of the hairpoint on the vegetative leaf is more variable than he indicated as is the areolation, particularly at the leaf base. Most of this variability is, in fact, present in the specimens he examined.

On initial examination, the species Cardot (1906) described as *Grimmia nordenskjoldii* Card., while showing some similarity to the present species, appears to constitute a well-defined taxon and several specimens from the South Georgian collections agree well with his type (Holotype Skottsberg s.n., PC, *Grimmia nordenskjoldii* Card. sp. nov. Georgie du Sud: Baie Royale, C. Skottsberg, 27.4.1902. Det. J. Cardot) and a further specimen he determined (Skottsberg 30, BM, *Grimmia nordenskjoldii* Card. South Georgia; Cumberland Bay, Moraine Fiord, 18.4.1909. Det. J. Cardot, *Expedition suecica 1907-1909*). However, the range of morphological and anatomical variation exhibited by specimens of *G. immerso-leucophaea* overlaps that shown by *G. nordenskjoldii* which has a very compact growth form, small leaves and proportionately long cells at the leaf base. Consequently it is considered that *G. nordenskjoldii* should be reduced to synonymy with the present species. There is little doubt that the variation in the degree of compactness of the cushions, the leaf size and pattern or areolation are habitat correlated.

Cardot (1906) also reported two species from Îles Kerguelen which should be considered synonymous with *G. immerso-leucophaea*. The first he named *Grimmia kerguelensis* Card. in an attempt to validate a species first illegitimately described by Brotherus (1906) as *G. austro-funalis* and the second *Grimmia bossierei* Card. et Ther. Unfortunately, the type specimen of *G. kerguelensis* Card. (as *G. austro-funalis* Broth. hom. illeg.) has not been traced during this study but van Zanten (1971), in his work on the bryoflora of Marion and Prince Edward Islands, examined it and considered that there were no differences between it and *G. bossierei* Card. et Ther. He accepted *G. kerguelensis* as a valid epithet although Cardot (1916) mentioned the name incidentally and reduced *G. bossierei* to synonymy with it. Some of the specimens van Zanten so named (Huntley 2045, AAS, *Grimmia kerguelensis* Card. Stoney Ridge, Marion I. Alt. 100 m. 24.2.1966. Det. B. O. van Zanten; Huntley 253, AAS, *Grimmia kerguelensis* Card. Fjaeldmark: 359, Marion I. 5.1.66. Det. B. O. van Zanten) have been examined together with the type of *G. bossierei* (Bossiere, 1913, Herbar I. Theriot) and they all show the same growth form and leaf anatomy of the small-leaved compact cushion form of the present species.

The persistent columella in this taxon indicates its inclusion in *Grimmia* while the dioecious sexual habit and cushion growth form provide supporting evidence.

Grimmia incrassicapsulis B. G. Bell

Syn. *Grimmia inaequalis* Dix. et Sainsb. Hom. Illeg. Sainsbury G. O. K., 1945, Trans. Roy. Soc. NZ. 75, p. 174. Type: Simpson and Thomson 811, Mt Watkin, Otago, New Zealand, 13 July 1935, BM

Stems forming short compact cushions 0.5–1.5 cm high, hoary, sparingly branched, fastigate, the leaves crowded, imbricate, erect when dry or moist. Leaves (1.4–) 2.0–2.7 (–3.0) × (0.2–) 0.3–0.4 (–0.5) mm, narrowly oblong-lanceolate with long smooth or denticulate hyaline hairpoint >5 mm long. Margin frequently bistratose from mid-leaf to apex. Nerve ceases at base of hairpoint, channelled above. Cells above (6–) 8–11 (–13) × 8–10 (–11) μm, irregularly quadrate to shortly rectangular, strongly incrassate, in mid-leaf sinuose, shortly rectangular, below

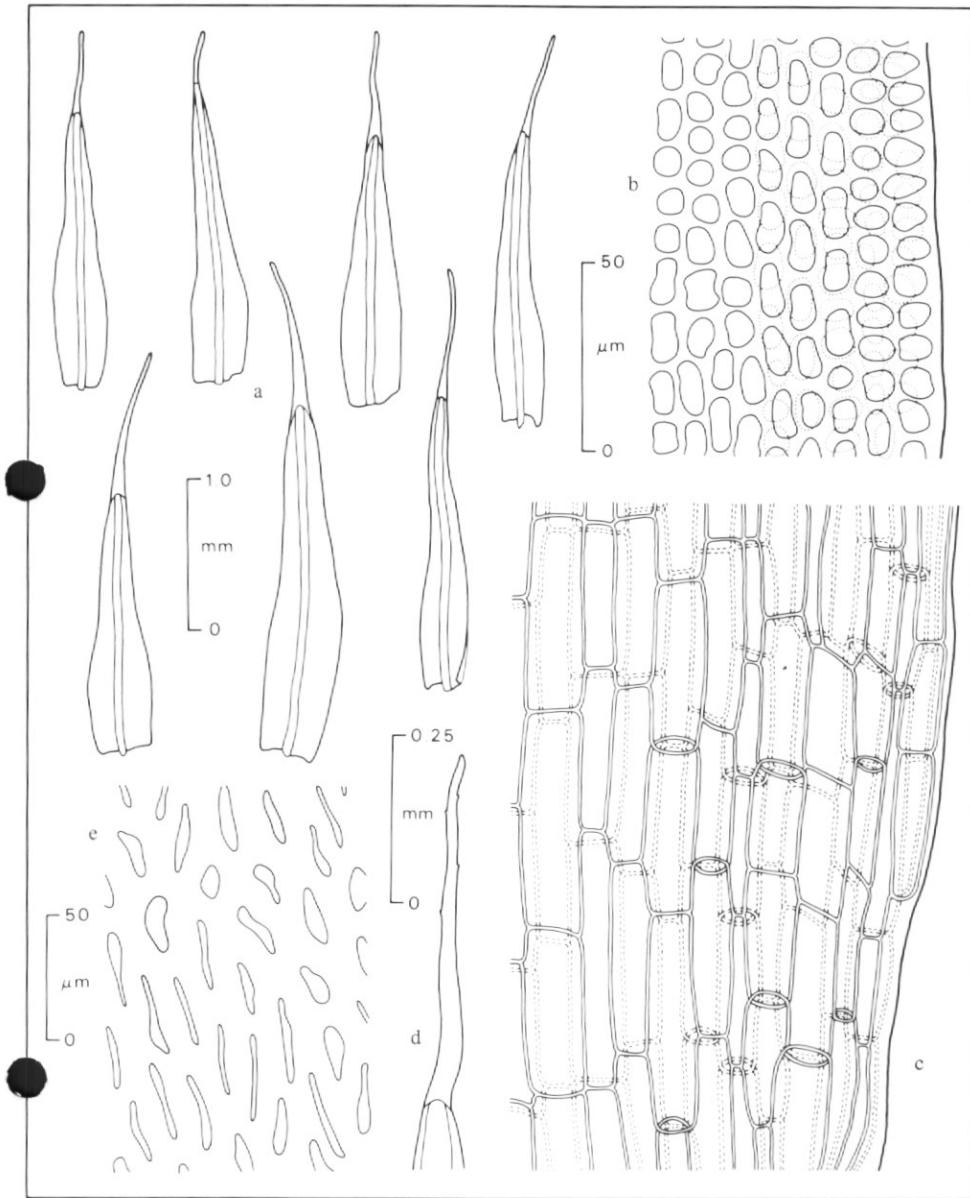


Fig. 5. *Grimmia incrassicapsulis*. a. Leaves; b. Upper leaf cells and margin; c. Lower leaf cells and margin; d. Apex; e. Exothelial cells of capsule. Scales: upper for leaf cells; median for leaves; lower left-hand for exothelial cells; lower right-hand for apex.

(24-) 39-71 (-90) \times 9-12 (-14) μm , longly rectangular, thin-walled, lax. Monoecious. Perichaetial bracts wider and larger than vegetative leaves, rarely weakly revolute towards apex. Seta 0.3-0.4 mm. Capsule 0.9-1.2 \times 0.8-0.9 mm, immersed, ovoid, slightly asymmetrically placed on seta, exothelial cells very incrassate with walls 7-9 μm thick. Columella persistent (Fig. 5.)

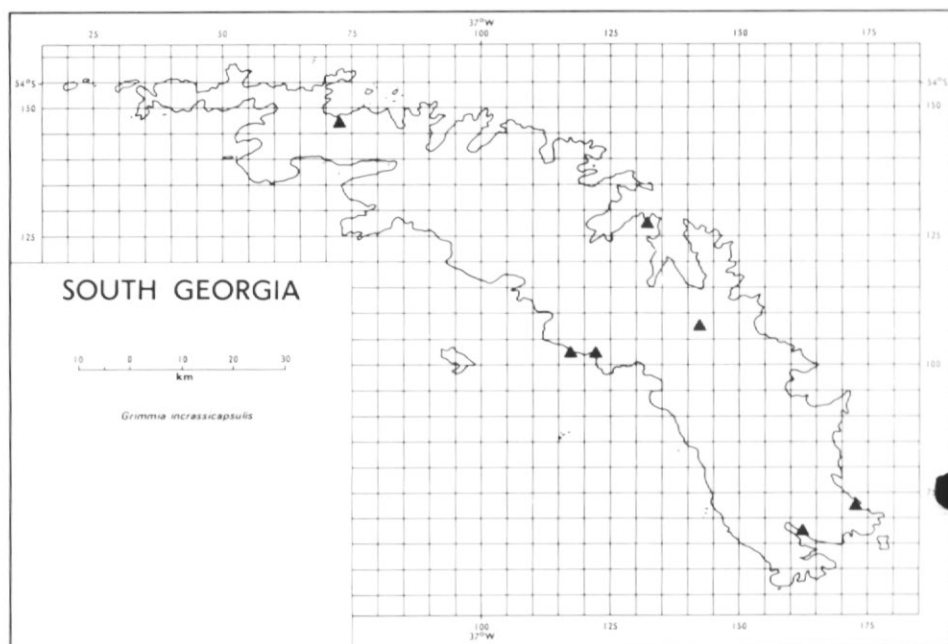


Fig. 6. The known distribution on South Georgia, by 5-km squares, of *Grimmia incrasscapsulis* based on the specimens and field records given in the Appendix.

Habitat and distribution (Fig. 6)

A very rare but widely distributed species of exposed rock surfaces. Alt. 200–530 m.

Notes

Although easily confused in the field with other hoary species of *Grimmia* the vegetative leaves of the present species are quite distinct under the microscope. The long narrow leaves with distinctive cell pattern, particularly the very long lax basal cells, are unique features as are the extremely thickened exothelial cell walls of the capsule.

Taxonomy

Sainsbury and Dixon (Sainsbury, 1945) described this taxon as *Grimmia inaequalis* Dix. et Sainsb. from New Zealand. However, this name is illegitimate, an error indicated by Van der Wijk and others (1962) as the epithet had been used previously by Stirton (1908) for another taxon. Three specimens of Sainsbury's New Zealand material have been traced, (Simpson & Thomson s.n., BM, *Grimmia inaequalis* Dix. et Sainsb. Rock, tufted, Mt Watkin, Otago, South Island, N.Z. 30 Nov. 1935. Coll. Simpson & Thomson, Det. G. O. K. Sainsbury; Simpson & Thomson 811, BM, *Grimmia inaequalis* Dix. & Sainsb. Mt Watkin, Otago, N.Z. Coll. Simpson & Thomson, 13 July 1935. Comm. G. O. K. Sainsbury, Herb. H. N. Dixon Type; 823 Ibidem, 30.11.35 Herb. H. N. Dixon). The third of the above-mentioned specimens is placed alongside that packet containing Simpson and Thomson's No. 811 on the same herbarium sheet and the scant information is in Dixon's hand. The details of the type specimen provided by Sainsbury and Dixon (Sainsbury, 1945) are: 'On rock, Mt

Watkin, near Waikauaiti, Otago, c. 1500 feet: coll. Simpson, Thomson, 30.11.1935, No. 823, type; same locality and collectors, 13.7.35, No. 811'. It is therefore reasonable to deduce from the similar collection dates provided for the unnumbered specimen and the third specimen indicated above that these are isotypes.

Only eleven specimens of this taxon have been collected from South Georgia but they agree in all essential respects with the New Zealand material particularly in the leaf shape, leaf areolation and in possessing immersed capsules with strongly incrassate exothecial cells. It is this last character which has been incorporated into the new specific epithet.

The persistent columella in this taxon indicate its inclusion in *Grimmia* while the cushion growth form provides supporting evidence.

Schistidium Brid.

The seven species of *Schistidium* known from South Georgia show a wide range of growth form and habitat, from short compact cushions on exposed rock surfaces to long straggling wefts submerged in streams and lakes. All are frequently found with capsules that are immersed and have dehiscent columellae.

Schistidium apocarpum (Hedw.) B.S.G.

Syn. *Grimmia occulta* C. Muell.

Grimmia abscondita Card.

Stems forming loose to compact cushions 0.6–2.5 cm high, yellow-brown above, brown below, irregularly branched, the leaves crowded, imbricate, erect when dry, erecto-patent when moist. Leaves (1.3–) 1.5–2.0 (–2.2) × (0.4–) 0.5–0.8 (–0.9) mm, the larger towards stem apex, widely ovate-lanceolate with narrow to broad acute apex, upper often with short toothed hyaline tip, rarely with a distinct short (<0.5 mm) hairpoint, weakly decurrent. Lamina rarely with a single plica towards base. Margin revolute for varying distances on both sides, irregularly bistratose. Nerve ceasing at or just below apex, strongly channelled above. Cells above 3–9 × 3–9 μm, irregularly quadrate, incrassate, below 6–20 (–28) × (3–) 5–9 (–11) μm, irregularly quadrate to shortly rectangular. Monoecious. Perichaetial bracts wider and longer than vegetative leaves with a hairpoint of variable length, strongly revolute on both sides particularly towards apex. Seta short 0.3–0.4 mm. Capsule 0.8–1.2 × 0.6–0.8 mm, immersed, obloid. Operculum rostrate. Columella dehiscent. (Fig. 7.)

Habitat and distribution (Fig. 8)

A widely distributed common species of moist rock surfaces, ledges and crevices. Alt. 0–300 m.

Notes

Although the morphology and anatomy of *Schistidium apocarpum* is variable and some forms may be confused with *S. celatum* or *S. syntrichiaceum*, microscopic examination of the vegetative leaves should provide adequate means of discrimination. The generally narrowly ovate-lanceolate leaves of *Schistidium celatum* possessing long cells (20–38 μm) at the base that become sinuose in mid-leaf, contrast with the widely ovate-lanceolate leaves of the present species with shorter basal cells which are only rarely sinuose. However, separation from *S. syntrichiaceum* is more difficult and requires a careful examination of all of the leaves from individual shoots. In *S. syntrichiaceum* the vegetative leaves are consistently

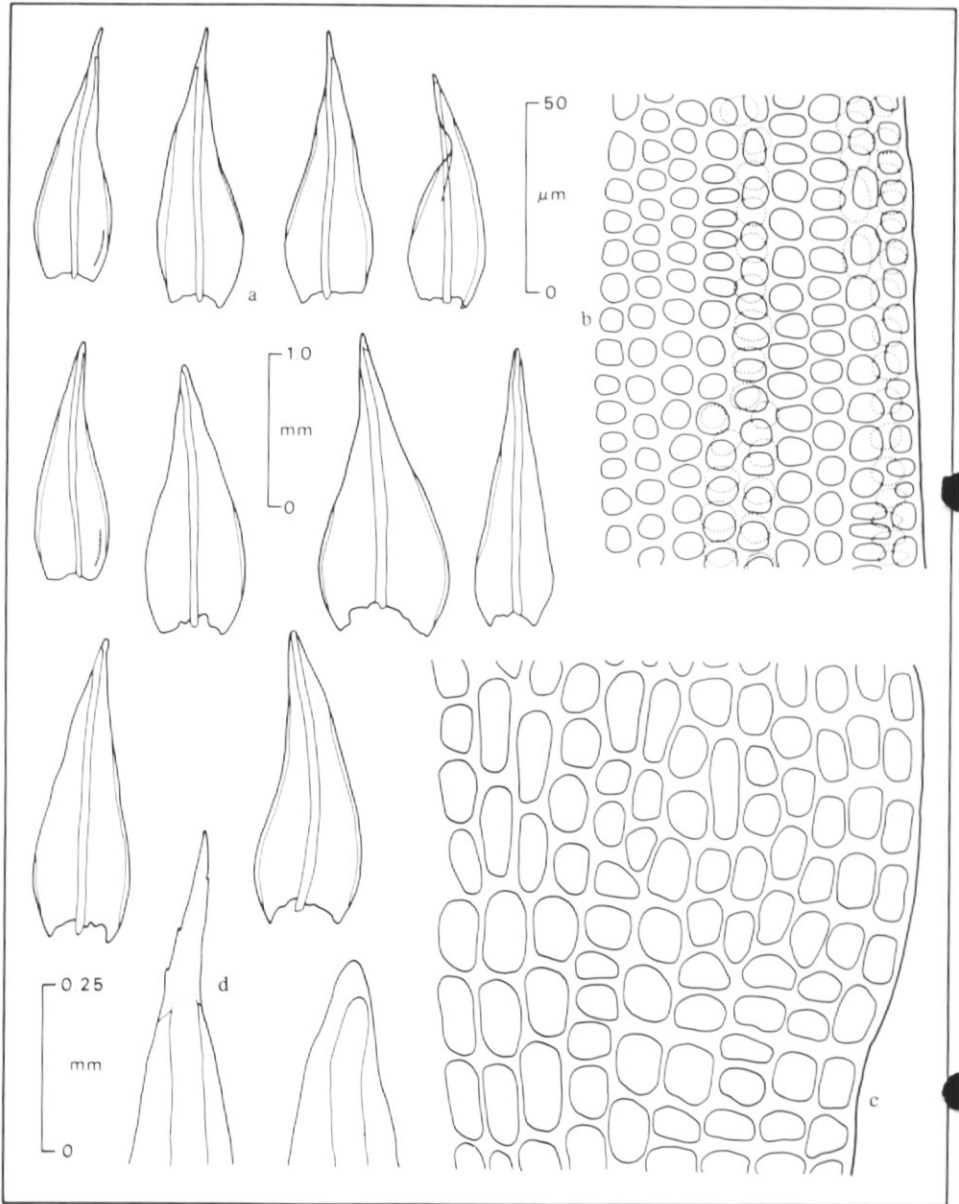


Fig. 7. *Schistidium apocarpum*. a. Leaves; b. Upper cells and margin; c. Lower cells and margin; d. Apices. Scales: upper for cells; median for leaves; lower for apices.

small ($0.7\text{--}1.5 \times 0.3\text{--}0.5$ mm) and, although a group of similar sized leaves is present at the base of the stem of *S. apocarpum*, the majority are much larger ($1.5\text{--}2.0 \times 0.5\text{--}0.8$ mm). A further useful discriminating character is the invariable presence of a single plica close to the basal margin in the leaves of *S. syntrichiaceum*, which is infrequent in the present species.

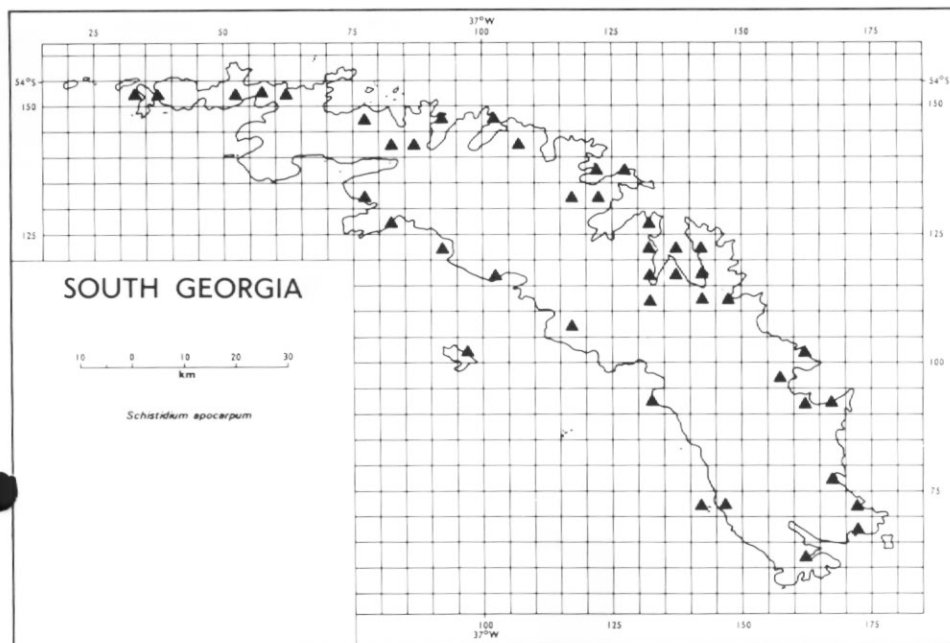


Fig. 8. The known distribution on South Georgia, by 5-km squares, of *Schistidium apocarpum* based on the specimens and field records given in the Appendix.

Taxonomy

Schistidium apocarpum was first described as *Grimmia apocarpa* Hedw. by Hedwig (1801) and later transferred by Bruch and Schimper (1845) to *Schistidium*. Hedwig's type description (1801) and Bruch and Schimper's (1845) more detailed consideration of the species indicate that the South Georgian specimens should be referred to this species. Although no type material has been examined, a large number of specimens both from Europe and the sub-Antarctic considered by eminent bryologists to belong to this taxon have been seen and, notwithstanding considerable variation, the South Georgian material readily falls within the limits of that described. It also agrees with the broad description provided by Bremer (1980b). The extremely complex nature of the variation in *S. apocarpum* noted by Bremer (1980b) precludes any attempt to assign the South Georgian material to an infra-specific taxon.

Perhaps the most significant material examined in this study was collected by J. D. Hooker from the Falkland Islands and Hermite Island during the *Erebus* and *Terror* Antarctic expedition of 1839–43 and from Tasmania. In their *Flora Antarctica*, Wilson and Hooker (1847) suggested that there were four varieties of the species – variety 1 from the Falkland Islands; varieties 2 and 3 from Îles Kerguelen and variety 4 from Hermite Island. It is apparent that there is no significant difference between the South Georgian material and their variety 1 (Hooker 2 {Wilson 195}, BM, *Grimmia apocarpa* Var. 1, Falkland Islands. Antart. [sic] Exp. 1839–1843. J.D.H. No. 195. Herbarium Hookerianum), one of the specimens labelled var. 3 (Hooker 42 {W.122}, BM, *Grimmia apocarpa* Lin. var. 3, Hermite Island, Cape Horn, Antart. [sic] Exp. 1839–1843. J.D.H. Herbarium Hookerianum), and material from Tasmania (Hooker s.n. {W.1309}, BM, *Schistidium apocarpa*, V.Ds. Ld. J.D.H. Herb. Musc. W. Wilson 1874). However, an unnumbered variety he has examined

from Îles Kerguelen (Hooker 730 {W24b}, BM, *Grimmia apocarpa* L. var. Kerguelen's Land. Antarct. Exp. 1839-1843. J.D.H.) is significantly different in possessing nodulose leaf cells and should be considered further when more material is available from that region. When examining Hooker's material collected from the Southern Hemisphere, Wilson often referred specimens to well-known European species conferring a varietal status where appropriate and there is little doubt that in some instances, he would have been better advised to describe new species. However, in this case *S. apocarpum* was a species well known to show considerable variation and this study confirms his interpretation of the taxon. This contention is supported by implication as he did describe two new species of *Schistidium* (as *Grimmia*), i.e. *G. tortuosa* and *G. falcata* at the same time (Hooker and Wilson, 1847).

There is no doubt that *G. occulta*, a species first described from South Georgia by Müller (1890), should be referred to the present species as Bremer (1980b) suggested. Syntypes (Will s.n., HBG, *Grimmia* {*Platystoma*} *occulta* C. Müll. n. sp. Drehkuppel. Zwischen Moor. Austro-Georgia, 6.II.83. Leg. Will. Sudpolar expedition; M, *Grimmia* {*Platystoma*} *occulta* C. Müller n. sp. Fundort: Drehkuppel. Zwischen Moor, Süd-Georgien, 83, Wil) have been examined and they show the characteristic ovate-lanceolate vegetative leaves with or without a short hyaline tip, revolute margins and small basal leaf cells that characterize *S. apocarpum*. A further species, *Grimmia abscondita*, described by Cardot (1908) from South America, has been examined (Type Dusen 5944, PC, *Grimmia abscondita* Card. sp. nova {*Grimmia pseudo-celata* Card.}. Patagonia australis, Lago San Martin, Rio Fosiles in saxis, c. 1000 m.s.m. Apr. 1905. P. Dusen, Herb. J. Cardot; Dusen s.n., *S. Grimmia abscondita* Card. {e specim. origin}. Patagonie australe: Lac San Martin; Rio Fosiles, rochers, Leg. P. Dusen, 1905, Herb. J. Cardot) and as Cardot (1908) suggested, this should be considered synonymous with *G. occulta*. Hence its reduction to synonymy with the present species, suggested by Bremer (1980b), is supported here.

The dehiscent columella in this taxon indicates its inclusion in *Schistidium* while the monoecious sexual habit and the occurrence of an immersed capsule provides supporting evidence.

Schistidium celatum (Card.) B. G. Bell

Syn. *Grimmia celata* Card. Cardot, J. 1906. Bull. Herb. Boiss. p. 7

Stems forming short compact cushions 0.8-1.9 cm high, yellow-green above, brown below, frequently dichotomously branched, fastigiate, the leaves crowded, closely imbricate, erect when dry, erecto-patent when moist. Leaves (0.9-) 1.2-2.1 (-2.6) × (0.2-) 0.3-0.6 (-0.8) mm, narrowly ovate-lanceolate to more widely ovate-to oblong-lanceolate with acute apex sometimes rounded at the tip, a few of the upper rarely with short (<0.5 mm) hyaline tip, lamina rarely inflexed on one side. Margin revolute on both sides for varying distances often bistratose particularly towards apex. Nerve percurrent or ceasing below tip, channelled above. Cells above 4-9 (-12) × (3-) 4-8 (-13) μm, irregularly quadrate rarely shortly rectangular, incrassate, below 20-38 (-40) × 5-11 (-13) μm, longly rectangular rarely thickened, sometimes lax, becoming weakly to strongly sinuose or nodulose immediately above base. Monoecious. Perichaetial bracts very large, up to twice size of vegetative leaves, widely ovate-lanceolate to ovate, acuminate. Seta short 0.2-0.4 mm. Capsule 0.7-0.9 × 0.7-0.9 mm, immersed, ovoid or obloid, wide mouthed. Exothecial cells thin-walled, i.e. <0.3 μm thick. Operculum rostellate to rostrate. Columella dehiscent. (Fig. 9.)

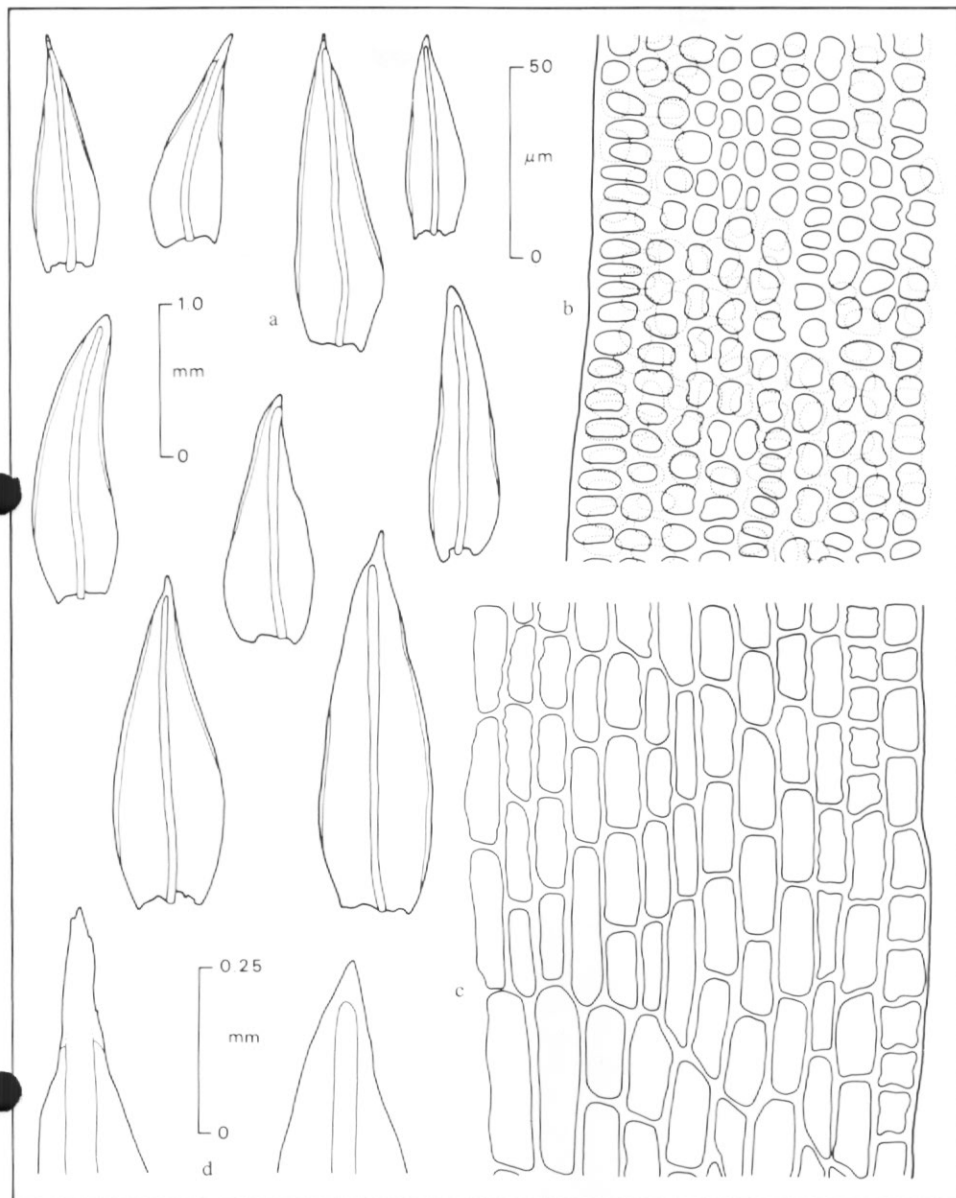


Fig. 9. *Schistidium celatum*. a. Leaves; b. Upper cells and margin; c. Lower cells and margin; d. Apices. Scales: upper for cells; median for leaves; lower for apices.

Habitat and distribution (Fig. 10)

An uncommon species of rock surfaces, crevices, etc., showing a preference for moist conditions. Alt. 0–120 m.

Notes

The short compact cushions of the present species are easily confused with forms of several other species particularly *Schistidium apocarpum*, *S. syntrichiaceum*,

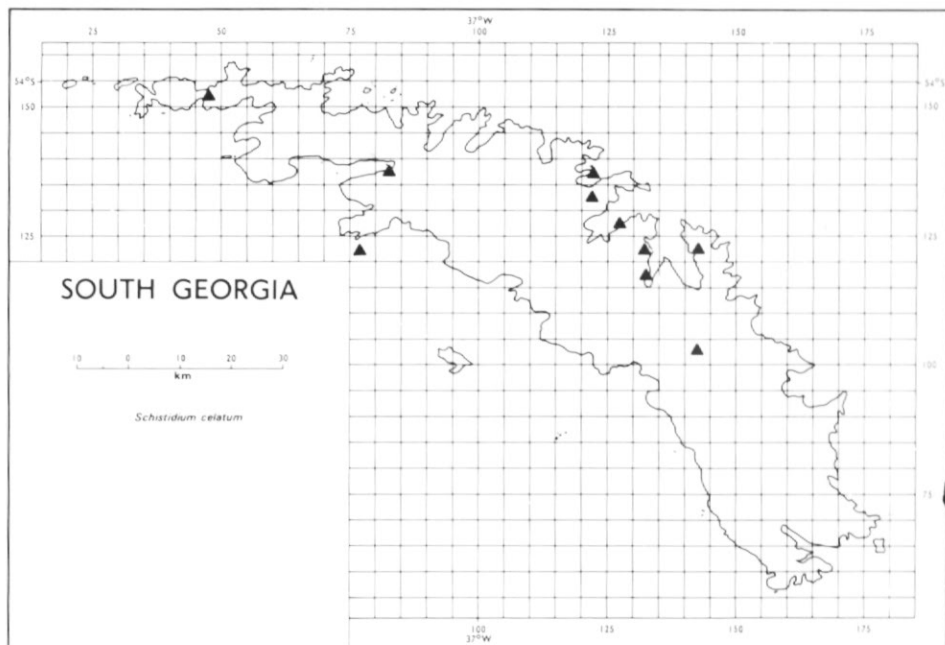


Fig. 10. The known distribution on South Georgia, by 5-km squares, of *Schistidium celatum* based on the specimens and field records given in the Appendix.

S. hyalino-cuspidatum and *S. urnulaceum*. The notes for *S. apocarpum* indicate reliable means of differentiation from that species while the larger vegetative leaves and longer basal cells together with the sinuosity of cells in mid-leaf should enable separation from *S. syntrichiaceum*. It is essential, however, that no one point of difference should be relied on for confirmation of identification due to areas of overlap in dimensions, etc. Thus separation from *S. hyalino-cuspidatum* is often very difficult and depends on close examination of all leaves on individual stems, discriminatory notes being given under that species.

The regularly hairpointed narrow leaves of *S. urnulaceum* are easily distinguished from those of *S. celatum* under the microscope and further confirmation of the former species can be obtained from an examination of the exothelial cells of its capsule which are strongly thickened, unlike the thin-walled cells of the capsule of the present species.

Taxonomy

This taxon was first described by Cardot (1906) as *Grimmia celata* Card. (Type Skottsberg 318 in parte, PC, *Grimmia celata* Card. sp. nova, Géorgie du Sud: baie Cumberland, vallée entre les fjords S. et O. 31.5.1902. Carl Skottsberg Ser. N:R 318 in parte. Det. J. Cardot. Herb. J. Cardot). Examination of this type material and a further specimen that Cardot determined as *G. celata* (Skottsberg 367, S, *Grimmia celata* Card. Rio Olivia prope Ushuaia, Fuegia. 14.3.1909. Det. J. Cardot. Leg. C. Skottsberg 367. Expeditio suecica 1907-09) indicate a species with which South Georgian specimens agree in essential respects. Unfortunately, the single specimen Cardot designated as type is not in complete accord with his type description nor is it in good condition, most of the vegetative leaves having suffered from decay. This

may have prompted his statement in the description that the upper leaf cells were 'cellulis . . . superioribus obscuris'. These cells are quite distinct in Skottsberg's specimen (No. 367) and in the remaining South Georgian material. He also describes the lower cells as 'haud sinuosis' but the type specimen clearly possesses leaves with strongly sinuose cells from just above the base to mid-leaf. Cardot (1908) considered *G. celata* to be similar to *G. occulta* C. Muell. and *G. abscondita* Card. and provides discriminatory features to clarify any confusion. Bremer (1980b) considered all three taxa to be synonymous with *S. apocarpum*; however, the clear differences in leaf shape and areolation indicate that *S. celatum* should be maintained as a distinct species. Cardot (1908) failed to appreciate the similarity of the present species to *Schistidium hyalino-cuspidatum*. The strongly sinuose leaf cells and leaf shape indicate the difficulty in separating the taxa but, as shown in the notes for *S. hyalino-cuspidatum*, there appears to be sufficient discriminatory features to warrant treating them as different species.

G. celata is transferred to *Schistidium* as the columella is dehiscent and the monoecious sexual habit and immersed capsule support this contention.

Schistidium falcatum (Hook f. et Wils.) B. Bremer

Stems forming loose cushions or mats 1–12 cm long, yellow towards apices, remainder brown-black, the leaves imbricate, erect when dry, flexuose, erect to erecto-patent when moist, falcato-secund towards apex. Leaves (1.3–) 2.5–3.6 (–4.1) × (0.4–) 0.6–0.9 (–1.0) mm, triangular to oblong-lanceolate, subulate, concave, lacking hairpoint, decurrent. Margin variably incurved or involute. Nerve broad, frequently approximately one third leaf base width, diffuse, ill-defined, percurrent or shortly excurrent. Cells above 5–12 (–16) × (4–) 6–12 μm, irregularly quadrate, below (6–) 10–28 (–34) × (5–) 6–12 (–14) μm, shortly rectangular, incassate. Monoecious. Perichaetial bracts a little larger and wider than vegetative leaves. Seta short, 0.3–0.5 cm long. Capsule 0.7–1.0 × 0.7–1.0 mm, immersed, obloid. Operculum rostrate. Columella dehiscent. (Fig. 11.)

Habitat and distribution (Fig. 12)

A locally common species growing on submerged rocks in streams and lakes or in splash areas near waterfalls. Alt. 0–130 m.

Notes

A species readily identified in the field by its growth form and confirmation is afforded under the microscope by the wide nerve of the vegetative leaves. Like many species growing in flowing water, the lamina of the older vegetative leaves is often eroded leaving only the nerve attached to the stem.

Taxonomy

Schistidium falcatum is here reported for the first time from South Georgia. It was first described from Îles Kerguelen by Hooker and Wilson (1844) as *Grimmia falcata* (Lectotype Hooker 738, *Grimmia* {*Scouleria*} *falcata* H. fil. et Wils., BM ex Kew, in the waterfall on the S-side of Christmas Harbour, Kerguelen's Land. May 1840. Antart. [sic] Exp. 1839–1843) and later invalidly transferred to *Schistidium* by Van Zanten (1971). Bremer (1980b) rectified this error by citing full details of the basionym. The specimen cited above has been selected as lectotype because although no type location was provided by Hooker and Wilson (1844) in their first report of the species, in their subsequent publication (Wilson and Hooker, 1847) a location was given as 'on rocks and stones near a small waterfall'. There is no doubt

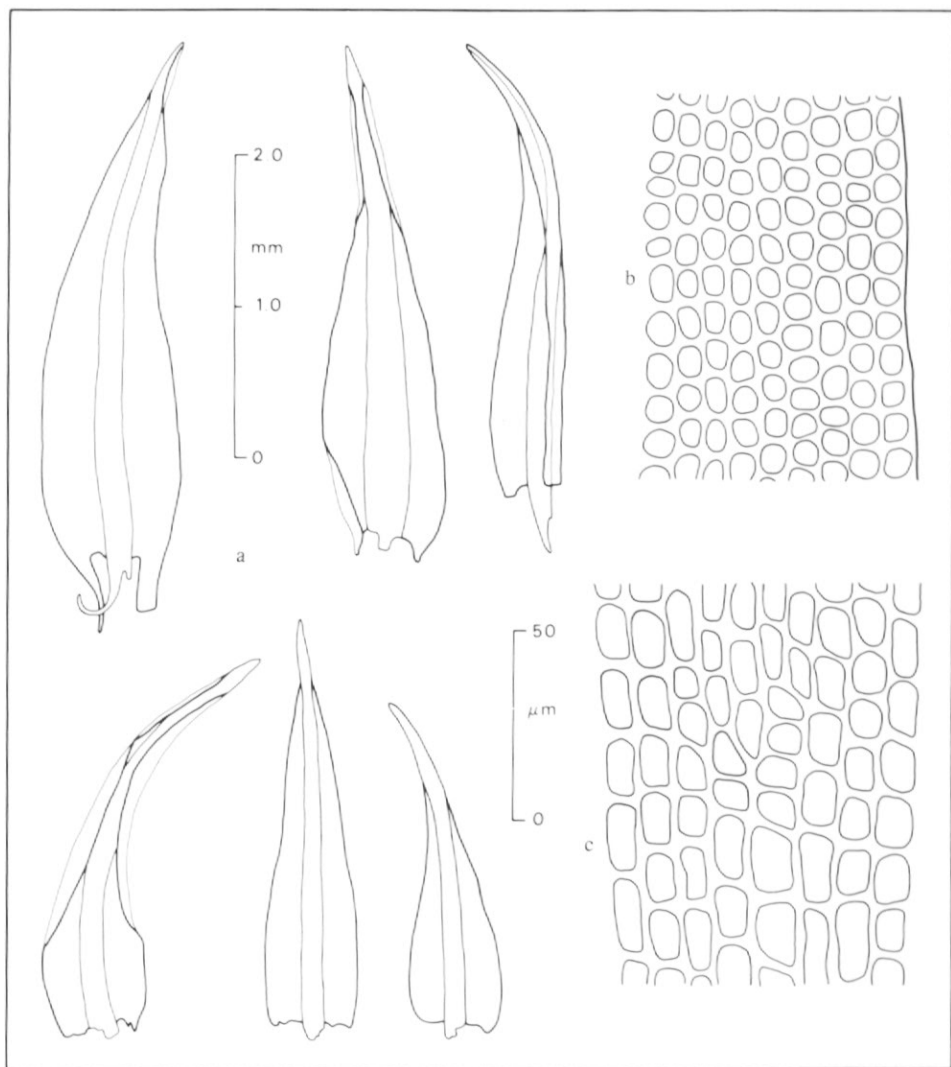


Fig. 11. *Schistidium falcatum*. a. Leaves; b. Upper cells and margin; c. Lower cells. Scales: upper for leaves; lower for cells.

that the South Georgian material should be referred to this species as the falcato-secund leaf arrangement together with the wide diffuse nerve are quite distinctive.

Schistidium hyalino-cuspidatum (C. Muell.) B. G. Bell

Syn. *Grimmia hyalino-cuspidata* C. Muell. Müller, C. 1890. In Neumayer, G. *Die Internationale Polarforschung 1882-83. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. 2, p. 315.

Grimmia hyalino-cuspidata var. *mutica* Card. et Broth.

Stems forming short moderately compact cushions 0.5-1.5 (-1.9) cm high, yellow-green above, black below, regularly dichotomously branched, fastigiate, the

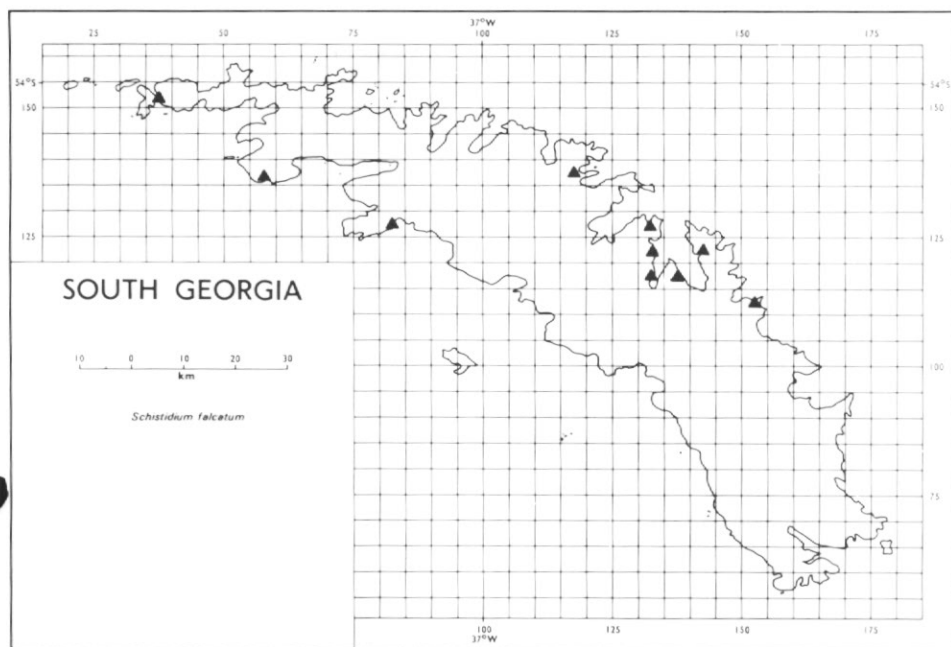


Fig. 12. The known distribution on South Georgia, by 5-km squares, of *Schistidium falcatum* based on the specimens and field records given in the Appendix.

leaves crowded, imbricate, erect when dry, erecto-patent to erect when moist. Leaves (0.9–) 1.0–2.3 × 0.2–0.5 (–0.6) mm, narrowly oblong-lanceolate to more widely ovate-lanceolate, apex acute, extreme tip rarely hyaline. Lamina frequently inflexed on one side. Margin revolute on one or both sides for varying lengths, variably bistratose. Nerve percurrent, channelled above. Cells above 5–14 (–20) × 5–8 (–14) μm , irregularly quadrate to shortly rectangular, sinuose, at base (20–) 24–40 (–60) × 8–10 (–11) μm longly rectangular, never lax, becoming nodulose immediately above. Paroecious. Perichaetial bracts widely ovate-lanceolate to ovate to elliptical, much larger than vegetative leaves sometimes with hairpoint. Seta short 0.2–0.4 mm long. Capsule 0.6–1.1 × 0.5–0.9 mm, immersed, ovoid or obloid. Exothecial cells thin-walled, i.e. <0.3 μm thick. Operculum rostrate to rostellate. Columella dehiscent. (Fig. 13.)

Habitat and distribution (Fig. 14)

A widespread local species of wet and dry rock surfaces, crevices, ledges, etc. Alt. 0–650 m.

Notes

Schistidium hyalino-cuspidatum is an extremely variable species with several apparently habitat related character modifications. Thus cushions growing in dry exposed conditions are shorter than those in less demanding niches, they possess vegetative leaves that are smaller, more regularly oblong-lanceolate and they have ovate-lanceolate perichaetial bracts with moderately long hairpoints. Plants growing in moist sheltered conditions on the other hand are generally more robust, with larger ovate-lanceolate leaves invariably with an inflexed lamina and with extremely

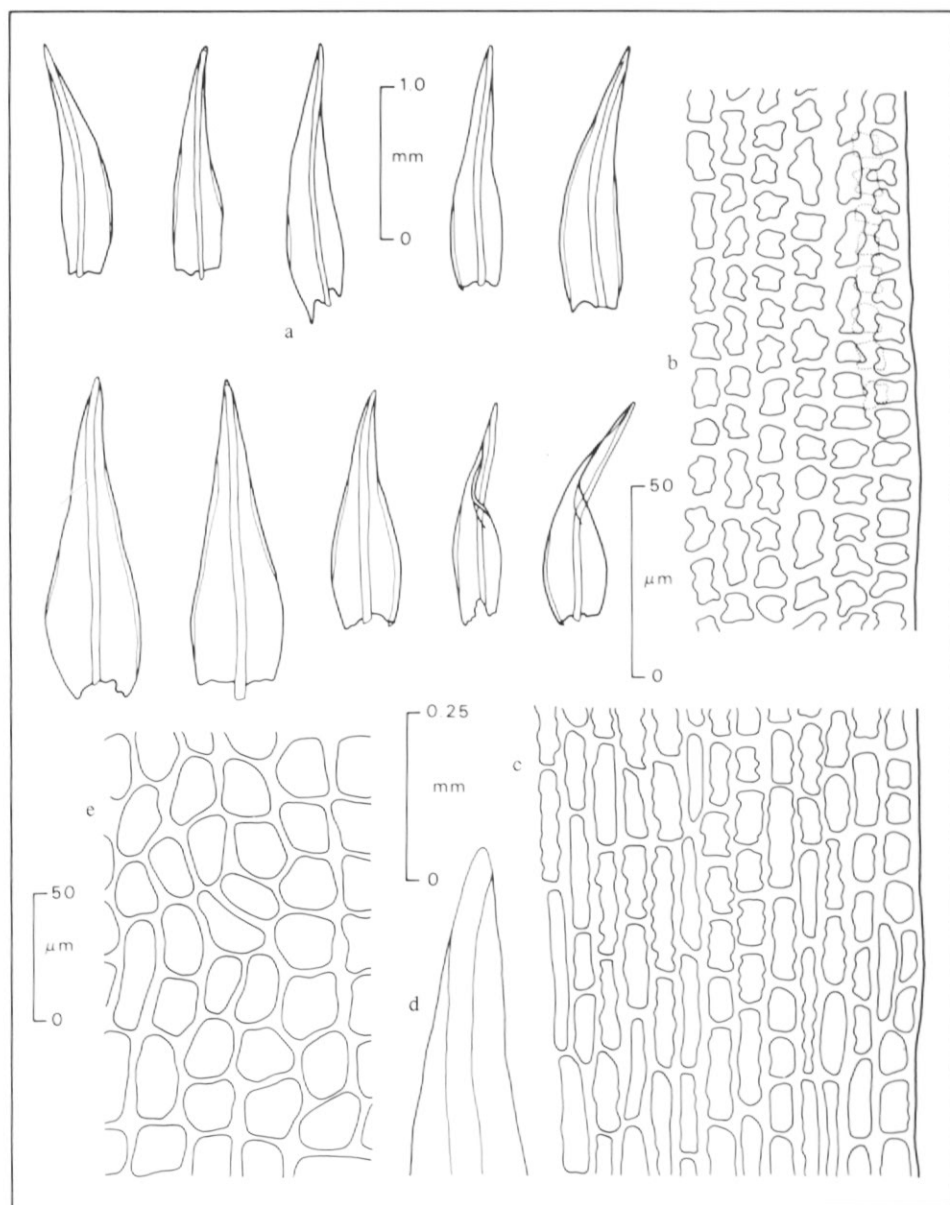


Fig. 13. *Schistidium hyalino-cuspidatum*. a. Leaves; b. Upper cells and margin; c. Lower leaf cells and margin; d. Apex; e. Exothecial cells of capsule. Scales: upper for leaves; median for leaf cells; lower left-hand for exothecial cells; lower right-hand for apex.

large perichaetial bracts, some of which are ovate and obtuse and rarely possess a short hairpoint. Between these two extremes of environment the 'typical' cushion possesses a range of leaf shape, i.e. oblong-lanceolate to more widely ovate-lanceolate, and bracts that are ovate-lanceolate to ovate, sometimes with short hairpoints. The constant feature that distinguishes the present species (from all

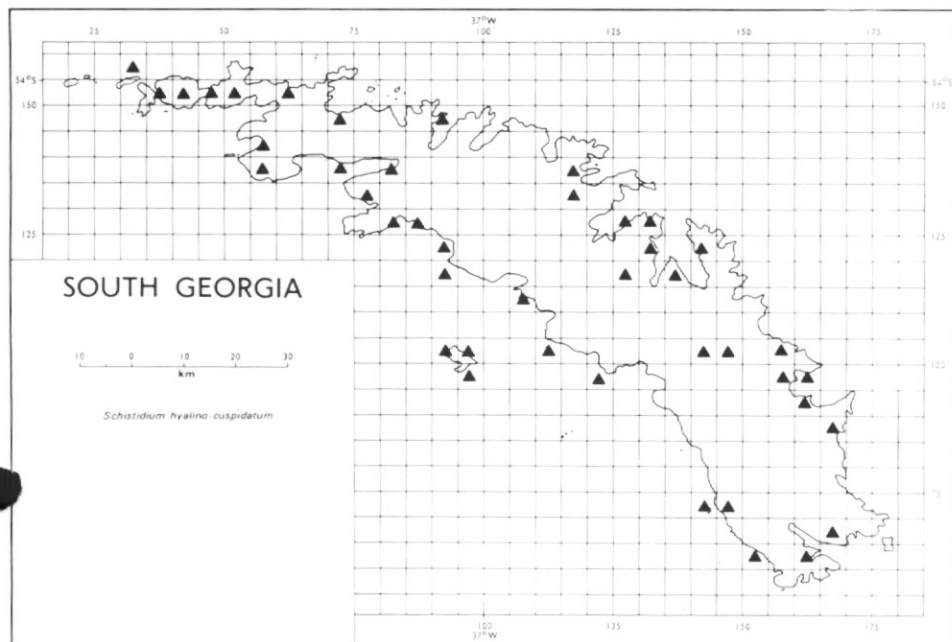


Fig. 14. The known distribution on South Georgia, by 5-km squares, of *Schistidium hyalino-cuspidatum* based on the specimens and field records given in the Appendix.

except *S. urnulaceum*, which has thickened exothecial cells in its capsules) is the presence of long rectangular nodulose cells near the base, which continue to mid-leaf before shortening to quadrate or shortly rectangular above.

The species with which *S. hyalino-cuspidatum* can be confused are *S. urnulaceum* and *S. celatum*. The means of distinguishing the present species from *S. urnulaceum* are given in the notes under that species. Separation from *S. celatum* is more difficult. Cushions of *S. celatum* occupy the most sheltered niches alongside the form of the present species mentioned above and it is only with this form that confusion may exist. Leaves of *S. celatum* are more regularly ovate-lanceolate with fewer having an inflexed lamina, the basal cells are sometimes lax and rarely thickened, and merge into shorter sinuose cells immediately above the base. The cells above are more strictly irregularly quadrate, rarely becoming shortly rectangular as in *S. hyalino-cuspidatum*.

The presence of nodulose cells in the present species may cause confusion with species of *Racomitrium* however, the short compact growth form and normally present immersed capsules contrast with the more robust growth forms and exserted capsules of taxa in that genus.

Taxonomy

Schistidium hyalino-cuspidatum was first described from South Georgia by Müller (1890) as *Grimmia (Dryptodon) hyalino-cuspidata* (Type Will s.n. HBG, *Dryptodon hyalino-cuspidatus* C. Müll. n. sp., Köppenber an Felsen, Austro-Georgia. 9.V.83; Will s.n., HBG, SW-Gletscherthal, Austro-Georgia. 7.V.83). These syntypes have been examined and while the specimen from 'SW-Gletscherthal' possesses the characters associated with those South Georgian specimens from exposed, dry

habitats, that from 'Koppenberg' exhibits the features of a cushion growing in the less exposed, moist habitats. Thus the range of variation shown by these two specimens reflects that found in the remaining specimens from South Georgia. The constancy of the degree of cellular nodulosity, the long basal cells and the range of shape of the vegetative leaf confirms the belief that South Georgian specimens belong to this taxon. As the columella falls with the operculum and as the capsule is immersed, the sexual habit monoecious, the species described by Müller (1890) as *Grimmia hyalino-cuspidatum* is here transferred to *Schistidium* as *S. hyalino-cuspidatum* (C. Muell.) B. G. Bell comb. nov.

The type specimen of the variety *G. hyalino-cuspidata* var. *mutica* Card. et Broth. described by Cardot and Brotherus (1923) as differing from the type of *G. hyalino-cuspidata* by being totally muticous has not been traced during the present work. However, as the presence or absence of a short hairpoint is a variable feature and as the species has been shown to be variable in several characters, it is considered unwise to delimit varieties within it on the slender basis proposed by Cardot and Brotherus (1923).

Unfortunately, it has also been impossible to trace type material of *Grimmia sub-orthotrichacea* and *Grimmia serrato-mucronata*, two species that Müller (1883) described from Îles Kerguelen, which he compares to the present species in his notes (Müller, 1890) following the type description. The former has subsequently been reduced to synonymy with *Racomitrium crispulum* by Clifford (1955) but the latter remains extant, although it would appear to be distinct from *Grimmia hyalino-cuspidata* by possessing a denticulate or serrate hairpoint on all leaves. A third species from Îles Kerguelen, *G. stylostegia* (Müller, 1883), has been seen and the type specimen (Type, Naumann s.n. BM, *Grimmia stylostegia* C. Müll. Kerguelen. Dec. 1874. Hb. C. Müll., Herb. Emile Bescherelle, 1900) resembles the present species in its vegetative leaf shape and areolation, but the presence of a hairpoint on most leaves indicates the desirability of studying more material from Îles Kerguelen before a decision is taken on whether or not it should be reduced to synonymy under the present species. Bremer (1980b) considered it a synonym of *S. angustifolium* (Mitt.) Herz. but as indicated in the taxonomic note for *S. urnulaceum*, it should perhaps be considered alongside that species.

Schistidium rivulare (Brid.) Podp.

Stems forming loose cushions 0.9–4.1 cm high yellow-brown above, brown-black below, irregularly branched, the leaves imbricate, when dry erect, when moist erecto-patent, rarely falcato-secund towards apex. Leaves (0.8–) 1.8–3.0 (–3.5) × 0.4–1.3 (–1.5) mm, widely ovate to ovate-lanceolate with acute or obtuse apex, lacking a hairpoint, weakly decurrent. Margin frequently revolute on both sides for varying but usually long distances. Nerve well-defined, percurrent or ceasing just below apex, channelled above, reddish brown in colour. Cells above (3–) 6–12 (–14) × (5–) 6–9 (–11) μm, irregularly quadrate, below 11–40 (–46) × 6–15 (–18) μm, rectangular. Monoecious. Perichaetial bracts ovate- to oblong-lanceolate to elliptical with obtuse apex, nerve often ceasing well below tip. Seta short 0.2–0.5 mm. Capsule 0.8–1.1 × 0.8–1.1 mm, immersed, ovoid-obloid, wide-mouthed when dry. Operculum rostellate. Columella dehiscent (Fig. 15.)

Habitat and distribution (Fig. 16)

A common species growing on rocks at streamsides, in moist crevices and by waterfalls, rarely submerged. Alt. 0–500 m.

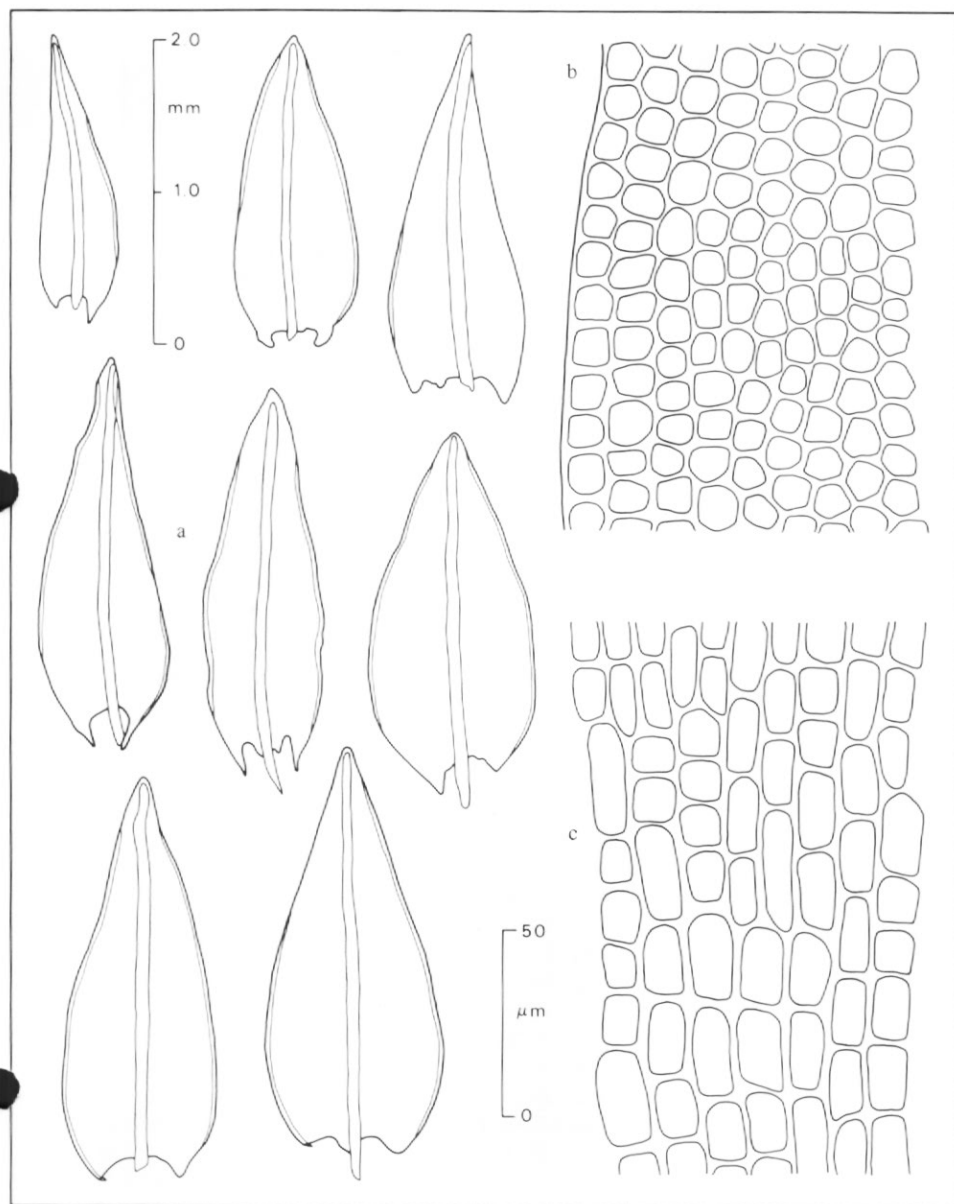


Fig. 15. *Schistidium rivulare*. a. Leaves; b. Upper cells and margin; c. Lower cells. Scales: upper for leaves; lower for cells.

Notes

A distinctive species in the field only likely to be confused with *Schistidium falcatum* as both grow in wet habitats and neither possess hairpoints on any leaves. However, the triangular to oblong-lanceolate shape of the vegetative leaf of that species together with its wide nerve is quite distinct from the present species.

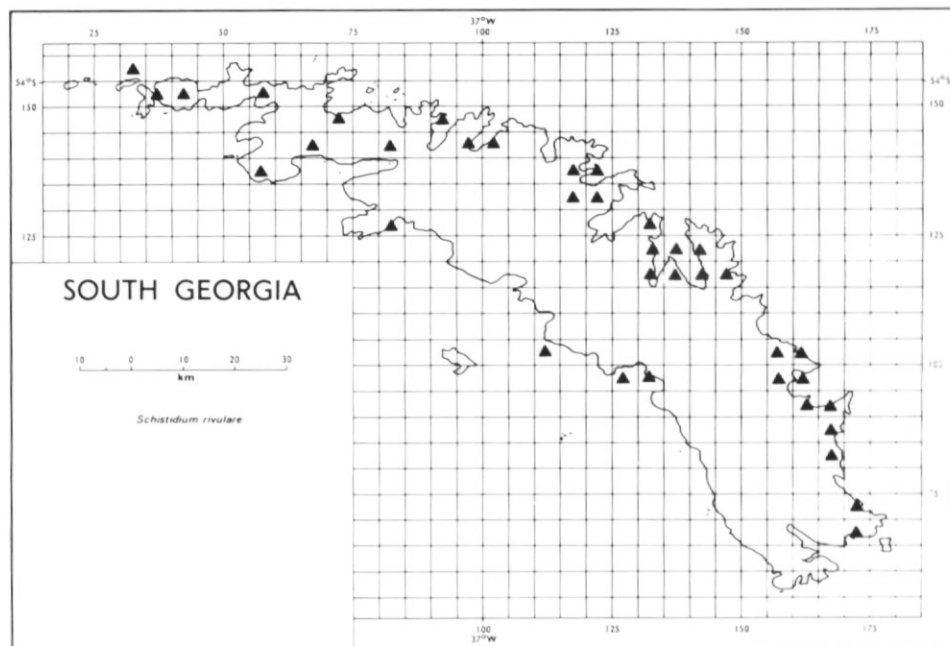


Fig. 16. The known distribution on South Georgia, by 5-km squares, of *Schistidium rivulare* based on the specimens and field records given in the Appendix.

Taxonomy

Schistidium rivulare has not previously been reported from South Georgia. The taxon was first described as *Grimmia rivularis* by Bridel (1801) but was subsequently considered a variety of *G. alpicola* by Wahlenberg (1812) and of *G. apocarpa* by Nees von Esenbeck and others (1827). Bruch and Schimper (1845) transferred it to *Schistidium* and treated it as *Schistidium apocarpum* var. *rivulare*, Limpricht (1889) retained it as *Schistidium alpicola* var. *rivulare* while Podpera (1911) made *Grimmia rivularis* a species of *Schistidium*. According to Van der Wijk and others (1967), Loeske (1930) reduced all three existing taxa to the rank of forma of *S. apocarpum*. This is not the case as he retains *Schistidium alpicola* var. *rivulare* (Brid.) Wahlenb. as a separate taxon (Loeske, 1930, p. 68). It is unfortunate that recent authors, who agree that a well-defined taxon exists, continue to use differing nomenclature. For example, Deguchi (1979) referred Japanese material to *Schistidium rivulare* (Brid.) Podp., Smith (1978) referred British material to *S. alpicola* var. *rivulare* (Brid.) Limpr., Flowers (1973) referred Utah material to *Grimmia alpicola* var. *rivularis* (Brid.) Wahl. and Scott and Stone (1976) referred Australian material to *Grimmia apocarpa* var. *rivularis*. The present author agrees with Bremer (1980a) who accepted the conclusion of Deguchi (1979) in referring material to *Schistidium rivulare*. The South Georgian material also readily agrees with his description (Deguchi, 1979) of Japanese *S. rivulare* in all respects. Type material of *S. rivulare* has not been traced for this study but many specimens determined by eminent European bryologists, e.g. Bruch and Schimper (s.n., BM, *Schistidium apocarpum* var. *rivulare* Br. Eur. auf Granwackefelsen in der Lahn bei Biedenkopf in Oberhepen, Marz. 1836, Herb. Bruch. Herbarium Schimperianum Proprium); Wilson (s.n., BM, *Grimmia rivularis*, Braddon Mountain, Irel. 1829. Oct. W. Wilson. Herbarium Hookerianum, 1867); Brotherus (Brotherus s.n., BM, *Grimmia*

apocarpa (L.) Hedw. var. *rivularis* (Brid.) Web. et Mohr. cfr. *Lapponia Kemensis*, par. Sodankyla, ad saxa vere inundata fl. Kemijoki inter Pelkosenniemi et Martti. 17 Jul. 1909. Leg. V. F. Brotherus. V. F. Brotherus. Bryotheca Fennica); Dixon (Knight and Dixon s.n., BM, *Grimmia alpicola* var. *rivularis* Brid. Loc. In the Saas, Saas Grund, Valais, Switzerland. Leg. H. H. Knight and H. N. Dixon. Date. 4 July 1913, Det. H.N.D. Herb. H. N. Dixon) have been examined and support the existence of a single taxon with which the South Georgian material is in agreement.

Bremer (1980a) subdivided the present species into two subspecies, ssp. *rivulare* and ssp. *latifolium* (Zett.) B. Bremer. It is clear that the South Georgian taxon agrees most closely with her description of the ssp. *latifolium* but further examination of the range of variation expressed by *S. rivulare* in the Southern Hemisphere is necessary before sub-specific categorization can be purposefully applied.

Schistidium syntrichiaceum (C. Muell.) B. G. Bell

Syn. *Grimmia syntrichiacea* C. Muell. Müller, C. 1890. In Neumayer, G. *Die Internationale Polarforschung 1882–83. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. 2, p. 315.

Stems forming short, loose to moderately compact tufts 0.6–1.6 cm high, red-brown above, black-brown below, infrequently dichotomously branched, often fastigiate, the leaves crowded, closely imbricate, erect when dry, erecto-patent when moist. Leaves (0.5–) 0.7–1.5 (–1.6) × (0.2–) 0.3–0.5 (–0.6) mm, ovate-lanceolate, strongly concave, upper with short hyaline hairpoint (<0.5 mm), lower without hairpoint and with rounded tip. Lamina frequently has a single plica on one side below. Margin revolute for varying distances on both sides, variably bistratose, inflexed on one side. Nerve ceasing at or just below apex, conspicuously red-brown. Cells above (3–) 4–11 (–12) × (3–) 4–8 μm, irregularly quadrate, strongly incrassate, below (8–) 12–23 (–31) × 3–8 (–9) μm, the majority shortly rectangular, never lax, incrassate, usually merging into straight sided cells above. Monoecious. Perichaetial bracts very much longer and wider than vegetative leaves, with long hairpoint, margin strongly revolute on both sides for varying distances. Seta 0.4–0.5 mm. Capsule 0.8–1.0 × 0.4–0.6 mm, immersed, obloid. Operculum rostrate. Columella dehiscent. (Fig. 17.)

Habitat and distribution (Fig. 18)

A local widely distributed species of rock surfaces preferring moist conditions. Alt. 0–660 m.

Notes

The characteristic reddish brown colour of the cushions of this species is a useful distinguishing feature in the field. Under the microscope the vegetative leaves are similarly coloured and the incrassate nature of the cells, together with the short hairpoint and frequent inflexing of the lamina above mid-leaf, aid in its identification. Discriminatory features to separate the present species from *Schistidium apocarpum* and *S. celatum*, with which it may be confused, are provided in the notes for those species.

Taxonomy

G. syntrichiacea was first described from South Georgia by Müller (1890) as *Grimmia* (*Eugrimmia*) *syntrichiacea* (Type Will s.n. HBG, *Grimmia syntrichiacea* C. Müll. n. sp. Inter *Blindiam pallidifoliam* C. Müll. von Süd-Georgien auf Felsblocken der südl. Landzunge. Südpolarexpedition). It is transferred here to *Schistidium* as

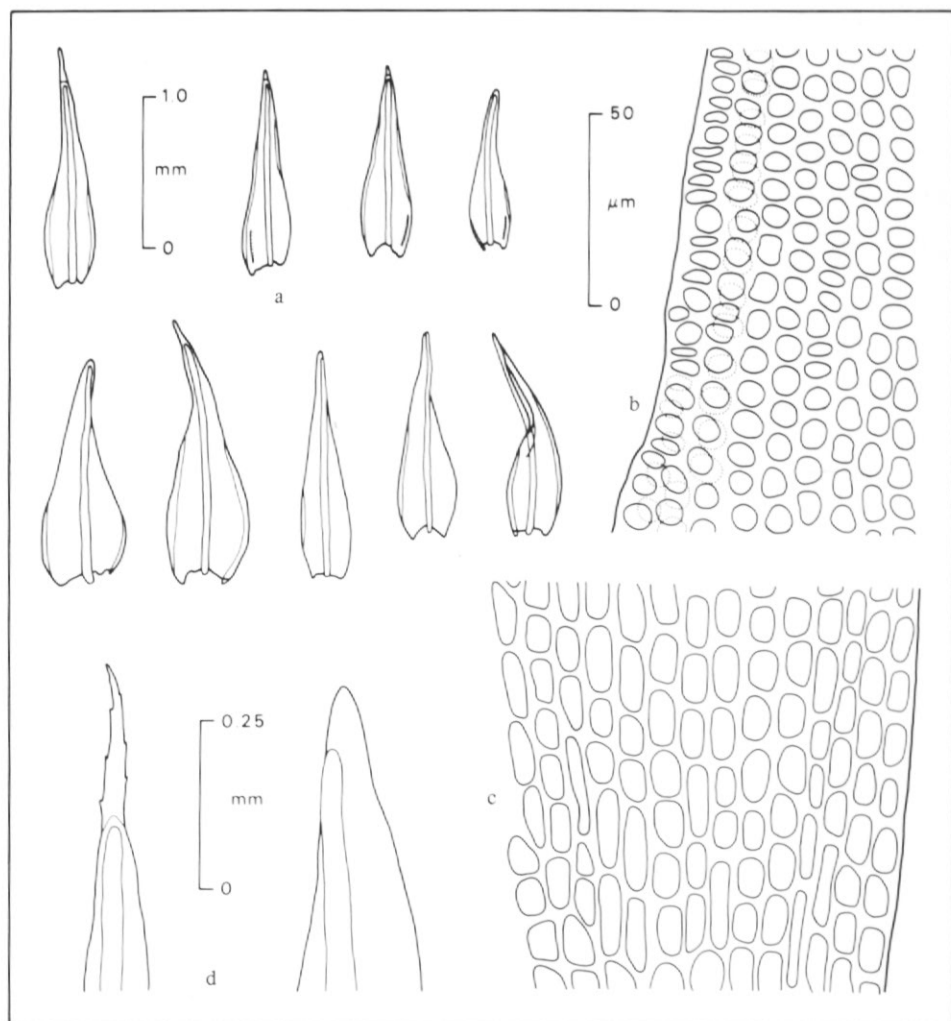


Fig. 17. *Schistidium syntrichiaceum*. a. Leaves: three upper right showing single plica; b. Upper cells and margin; c. Lower cells and margin; d. Apices. Scales: upper left-hand for leaves; upper right-hand for cells; lower for apices.

the columella falls with the operculum, supporting evidence being provided by the presence of immersed capsules and the monoecious sexual habit. The type specimen has been examined and agrees well with Müller's description although hairpoints are not present on all vegetative leaves as he implies. There is no difficulty in referring the remaining South Georgian material, including a specimen that Cardot determined as *G. syntrichiacea* (Skottsberg 30 pp, BM, *Grimmia syntrichiacea* C.M. South Georgia, Cumberland Bay, Moraine Fiord. 18.4.1909. Det. J. Cardot. Expeditio suecica 1907-09) to this species, but they do possess some characters that are not mentioned in Müller's description and are useful in diagnosis. These include the regularly incrassate nature of the vegetative leaf cells, particularly towards the base, and the frequent inflexing of the lamina above the mid-leaf position.

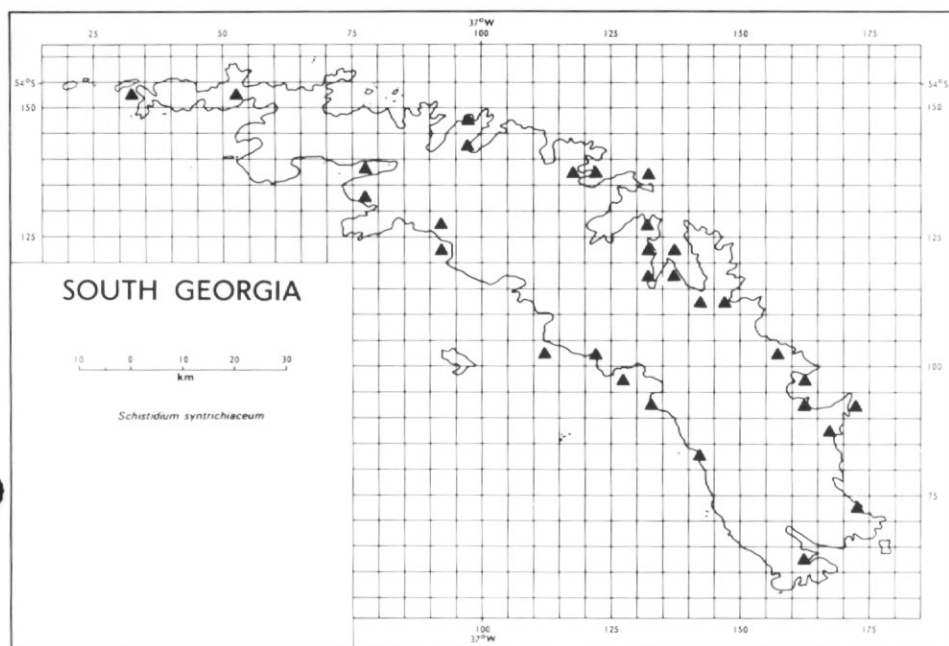


Fig. 18. The known distribution on South Georgia, by 5-km squares, of *Schistidium syntrichiaceum* based on the specimens and field records given in the Appendix.

Schistidium urnulaceum (C. Muell.) B. G. Bell

Syn. *Grimmia urnulaceae* C. Muell. Müller, C. 1890. In Neumayer, G. *Die Internationale Polarforschung 1882–83. Die Deutschen Expeditionen und ihre Ergebnisse*, Bd. 2, p. 313.

Stems forming short compact cushions 0.5–1.5 cm high, yellow-green, weakly hoary above, brown below, regularly dichotomously branched, fastigiate, the leaves crowded, imbricate, erect to recto-patent when dry, erecto-patent when moist. Leaves (0.1–) 1.3–1.9 (–2.0) × 0.2–0.4 (–0.5) mm, narrowly ovate- to oblong-lanceolate tapering to an acute apex normally possessing a short, hyaline denticulate hairpoint (<0.5 mm). Margin narrowly revolute on one or both sides for varying lengths, variably bistratose, often inflexed on one side. Nerve excurrent in hairpoint, channelled above. Cells above 6–17 (–18) × (3–) 6–11 μm, quadrate to shortly rectangular, sinuose, incrassate, below 20–44 (–59) × 5–11 (–12) μm, longly rectangular, rarely lax, strongly sinuose immediately above extreme base or towards mid-leaf. Paroecious. Perichaetial bracts longer and wider than vegetative leaves with long hyaline hairpoint. Seta short, 0.1–0.2 mm long. Capsule 0.6–0.8 × 0.6 mm, immersed, sub-globuse to ovoid-obloid, wide-mouthed when dry. Exothecial cells strongly incrassate with walls 7–8 μm thick. Operculum rostrate. Columella dehiscent. (Fig. 19.)

Habitat and distribution (Fig. 20)

An uncommon but widespread species found on exposed dry rock faces usually at high altitudes. Alt. 100–650 m.

Notes

The areolation of the vegetative leaf of the present species is very similar to that of *Schistidium hyalino-cuspidatum*. However, the presence of a hairpoint on the

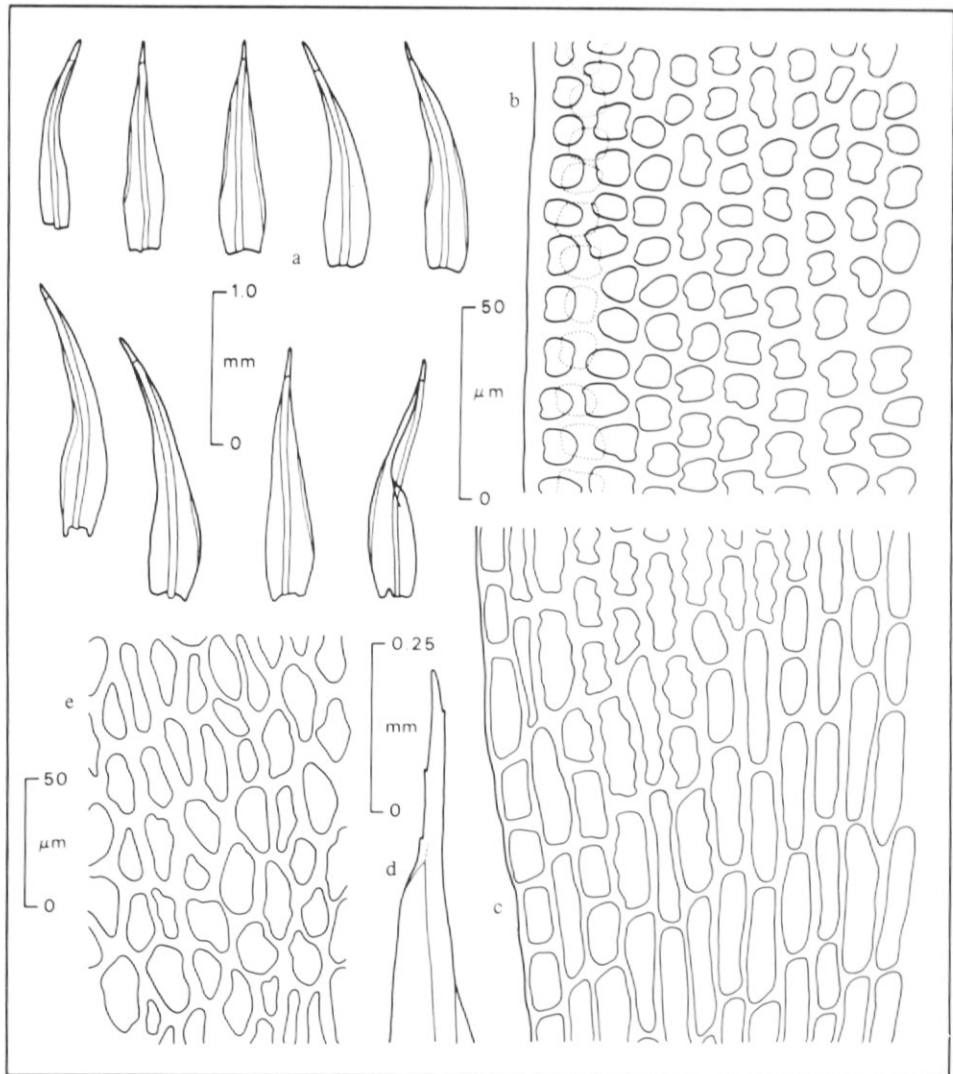


Fig. 19. *Schistidium urnulaceum*. a. Leaves; b. Upper leaf cells and margin; c. Lower leaf cells and margin; d. Apex; e. Exothecial cells of capsule. Scales: upper left-hand for leaves; upper right-hand for leaf cells; lower left-hand for exothecial cells; lower right-hand for apex.

majority of vegetative leaves as well as the perichaetial bracts should enable separation. A further very distinctive feature of *S. urnulaceum* is the strongly incrassate nature of the exothecial cells in the abundantly produced small sub-globose capsules. The only other species in the Grimmiaceae from South Georgia with thickened exothecial cells is *G. incrassicapsulis*, which has a quite different leaf anatomy as described for that species.

Taxonomy

The present species was first described from South Georgia by Müller (1890) as *Grimmia urnulaceae* (Type Will s.n., HBG, *Grimmia urnulacea* C. Müll. n. sp. Ad

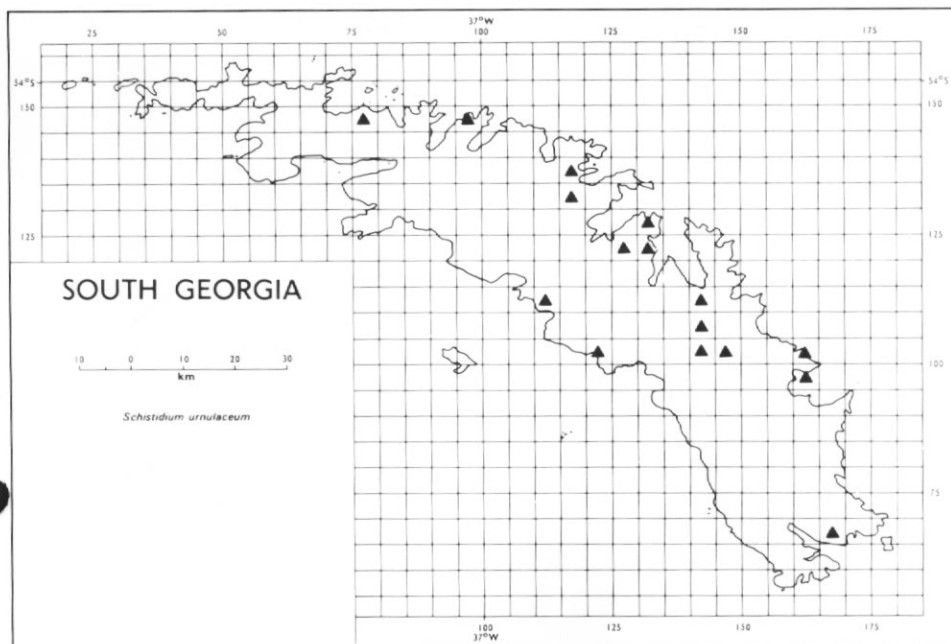


Fig. 20. The known distribution on South Georgia, by 5-km squares, of *Schistidium urnulaceum* based on the specimens and field records given in the Appendix.

rupes am Ausgange des Brockenthal. Austro-Georgia. Südpolar expedition). It is transferred here to *Schistidium* as the columella falls with the operculum, supporting evidence for this contention is provided by the presence of immersed capsules and the monoecious sexual habit. Although Müller (1890) failed to comment on the thickened exothecial cell walls of the capsule, the feature is visible in the type specimen and, together with the size and shape of the capsule and the presence of a hairpoint on almost all leaves, which Müller emphasized in his description, form a basis for a division between the present species and *Schistidium hyalino-cuspidatum*. However, although the Will specimen does not show any appreciable difference in size between perichaetial bracts and vegetative leaves (Müller described them as larger, not projecting) the remaining South Georgian material indicates that, whilst never attaining the size of the bracts of *S. hyalino-cuspidatum* (e.g.), they may be larger and more prominent than he suggested.

The presence of hairpoints on most vegetative leaves, the leaf shape and the pattern of the areolation in *S. urnulaceum* suggest an affinity to *G. stylostegia*, a species Müller (1883) described from Îles Kerguelen. The type specimen of this taxon (see taxonomy notes for *S. hyalino-cuspidatum* for details) has been examined and unfortunately bears no sporophytes which are very important for certain separation of the present species from *S. hyalino-cuspidatum* as indicated above. A further specimen from Îles Kerguelen determined as *G. stylostegia* by Dixon (Lars Christensen 47, BM, *Grimmia stylostegia* C. M. Kergueln [sic]. 8 Jan. 1937. Comm. Bof. Mus. Oslo. Det H.N.D.) has been examined and does bear capsules but the exothecial cells are not as thickened as the South Georgian material. Although not an entirely satisfactory solution, it is considered that further material from Îles Kerguelen as well as South American specimens of *S. angustifolium* (with which *S.*

stylostegia has been reduced to synonymy by Bremer (1980b)) must be examined before a more complete answer to this problem is possible.

Bremer (1980b) reduced *G. urnulaceae* to synonymy with *S. apocarpum* but the clear differences in leaf shape, areolation and capsules characteristics suggest that the two taxa should remain separate.

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APPENDIX

DETAILS OF THE SPECIMENS AND FIELD RECORDS FROM WHICH THE DISTRIBUTION FIGURES WERE COMPILED

The references to the herbaria cited after each specimen follow those recommended by Holmgren, Keuken and Schofield (1981) as follows:

AAS: Cambridge - British Antarctic Survey Herbarium, British Antarctic Survey Life Sciences Division, Madingley Road, Cambridge CB3 0ET, England.

BA: Buenos Aires – Museo Argentino de Ciencias Naturales, Bernardino Rivadavia, Avenida Angel Gallardo 470, Casilla de Correo 10, Secursal 5, 1405 Buenos Aires, Argentina.

BM: London – British Museum (Natural History), Cromwell Road, London, SW7 5BD, England.

CHR: Christchurch – Botany Division, Department of Scientific and Industrial Research, Private Bag, Christchurch, New Zealand.

LE: Leningrad – Herbarium of the Department of Higher Plants, V. L. Komarov Botanical Institute of the Academy of Sciences of the USSR, Prof. Popov Street 2, 197022 Leningrad, USSR.

MEL: Melbourne – National Museum of Victoria, Royal Botanic Gardens, Birdwood Avenue, South Yarra, Victoria 3141, Australia.

NY: New York – New York Botanical Garden, Bronx, New York 10458, USA.

PC: Paris – Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie, 12 Rue de Buffon, 75005 Paris, France.

PRE: Pretoria – National Herbarium, Botanical Research Institute, 2 Cussonia Avenue, P. Bag X101, Pretoria, 0001 South Africa.

S: Stockholm – Swedish Museum of Natural History, Rolagsvägen 106, PO Box 50007, S-10405 Stockholm, Sweden.

SGO: Santiago – Herbario, Seccion Botánica, Museo Nacional de Historia Natural, Casilla 787, Santiago, Chile.

TNS: Tokyo – National Science Museum, Department of Botany, 3-23-1 Hyakunincho, Shinjuku-ku, Tokyo 160, Japan.

It should be noted that the British Antarctic Survey bryophyte herbarium is housed at the Institute of Terrestrial Ecology's Bush Research Station, Penicuik, Midlothian EH26 0QB, Scotland. The six digits before the specimens or field records refer to the 5-km squares of the distribution maps, eastings being cited before northings.

Field records have only been cited for those squares from which no permanent specimens exist, their numbers indicating their file order in the databank associated with the Survey's herbarium. Field records were provided by the following people: C. J. Barrow, 1972–83; B. G. Bell, 1971–72; T. V. Callaghan, 1967–74; C. M. Clapperton,

1967–68; G. C. S. Clarke, 1967–68; N. J. Collins, 1969–70; J. A. Edwards, 1969–70; D. M. Greene, 1967–68; S. W. Greene, 1967–68; T. Gunn, 1973–74; R. I. L. Smith, 1969–71; D. W. H. Walton, 1969–74; R. Webb, 1971–72; E. P. Wright, 1969–70.

A print-out from the databank of the collecting details for the specimens cited in the Appendix is available on request from the Institute of Terrestrial Ecology (see above).

Grimmia grisea Card.

- 040 155 R. Smith 2797 (AAS).
 050 150 Bell 582 (AAS).
 050 155 Bell 587 (AAS).
 055 140 R. Smith 2795 (AAS).
 055 150 Bell 585 (AAS).
 075 145 R. Smith 2793 (AAS).
 080 125 Greene 2622 (AAS).
 080 140 R. Smith 2794 (AAS).
 090 120 Field record 8171.
 090 145 Greene 1666 (AAS).
 100 145 R. Smith 2796 (AAS).
 110 140 Field record 8172.
 115 130 Bell 566 (BM, PC), Bell 567 (AAS, BA, PRE, S, SGO), Bell 571b (BM, CHR, TNS), Greene 3021a (BM, LE), Greene 3083 (AAS), Greene 3118 (BM, MEL, NY, PC).
 115 135 Greene 1425 (AAS), Longton 205 (BM, SGO).
 115 140 Clarke and Greene CG 155 (AAS).
 120 100 Field record 8176.
 120 130 Greene 2959a (AAS), Longton 191 (AAS, PC, PRE).
 120 135 Clarke and Greene CG 113 (AAS), Greene 3379 (AAS, PRE, S, SGO, TNS).
 120 140 Webb 187 (BM, S).
 125 120 Field record 1877.
 125 135 Clarke and Greene CG 133 (BM).
 130 120 Bell 508 (AAS), Bell 516 (AAS), Bell 519 (AAS), Bell 534 (AAS), Bell 536 (BM), Bell 537 (BM), Bell 538 (BM), Bell 905 (BM, NY), Bell 920 (BM, PC, PRE, SGO), Bell 922 (AAS, CHR, LE, MEL, NY, PC, PRE, S, SGO, TNS). Bell 1192a (AAS), Greene 3541 (AAS), Greene 3542 (BM, LE, MEL), Tröim 57 (BM).
 130 125 Bell 532 (AAS), Bell 914 (AAS), Bell 1196 (BM, MEL), Greene 584a (AAS, S, SGO, TNS), Greene 2014 (BM, MEL), Greene 2906a (AAS), Greene 3492a (BA, BM, CHR), R. Smith 1087 (AAS).

- 130 135 Clarke and Greene CG 88 (BM).
 135 105 Field record 8181.
 135 115 Bell 555 (AAS, BA, CHR, LE, MEL, NY), Bell 556 (AAS), Clarke and Greene CG 210 (BM, NY).
 135 120 Bell 541 (AAS, BA, LE), Bell 545 (BM, MEL), Bell 548 (AAS, NY, PC, PRE), Bell 551 (BA, BM, S, SGO, TNS).
 140 100 Field record 8173.
 140 110 Field record 1955.
 140 115 Bell 1266 (AAS).
 140 120 Greene 559 (BM, NY, PC, PRE).
 145 100 Field record 8174.
 145 115 Greene 826 (BA, BM, CHR, LE).
 155 095 Bell 1176 (AAS), Bell 1191 (AAS), Greene 2170 (AAS, NY).
 155 100 Bell 588 (AAS), Bell 594 (BM, LE, MEL), Bell 597 (AAS), Bell 1178 (AAS).
 160 060 Greene 2477 (AAS), Greene 2859 (BM, CHR).
 160 065 Field record 8175.
 160 090 Field record 1984.
 160 095 Greene 2282 (BM, PC, PRE, SGO).
 160 100 Bell 1188 (BA, BM, CHR, LE), Greene 2432 (AAS, BA, S, TNS).
 165 075 Bell 3293 (AAS).
 165 080 Bell 3291 (AAS).
 165 085 Bell 3289 (AAS, BA, CHR, MEL, NY, PC, PRE, S, SGO, TNS), Cameron and Kennet 5 (AAS).
 165 090 Field record 1823.
 170 065 Field record 1795.
 170 070 Bell 3290 (AAS).
 170 090 Bell 563 (AAS).
 175 065 Bell 3292 (AAS).

Inadequately localized

Near sea-level, Grytviken, South Georgia, 5.II.1929, Tröim 10 (BM); Cumberland Bay, alt. 40 m., South Georgia, 15.XI.1931, Tröim 35 (BM); South Georgia, Cumberland Bay, valley between S and W Fiords, 21.V.1902, Skottsberg 307 (PC, S); South Georgia, in monte supra, Cumberland Bay, 21.V.1902, Skottsberg 308 (PC, S); Sydgeorgien, Cumberland Bay, Klipper in Morain fjorden, 18.IV.1909, Skottsberg 32 (S); South Georgia, leg. R. I. L. Smith, BAS Misc. 124 (AAS).

Grimmia immerso-leucophaea (C. Muell.) Kindb.

- 050 150 Bell 573 (BM, PRE), Bell 574 (AAS, S, SGO, TNS).
 055 140 R. Smith 2813 (AAS).

- 070 135 R. Smith 2814 (AAS).
 070 145 Greene 1185 (AAS), Greene 1233 (AAS), Greene 1284 (AAS), Greene 1322 (BM, CHR), Greene 1360 (AAS, S, TNS), Greene 1361 (BM, LE, MEL, NY).
 075 145 R. Smith 2816 (AAS).
 080 145 Clarke and Greene CG 6 (BM, MEL, NY, PC).
 090 140 Field record 8192.
 095 140 BAS Misc. 165 (AAS).
 095 145 R. Smith 2812 (AAS).
 110 100 Field record 8197.
 110 140 Field record 8193.
 115 130 Bell 570 (BM), Bell 571a (AAS, NY, PC), Greene 3021b (AAS), Longton 135 (AAS, BA, TNS).
 115 135 Greene 1444 (AAS, PC, PRE), Greene 3204 (BA, BM, CHR, LE, TNS), Greene 3276 (AAS), Longton 74 (BM, CHR, LE, MEL).
 120 130 Greene 2959b (AAS).
 120 135 Longton 99 (AAS, NY, PC, PRE), Longton 100 (BM, S, SGO).
 125 115 R. Smith 2815 (AAS).
 125 120 Greene 1526 (BA, BM, S, SGO, TNS), Greene 1527 (AAS).
 125 125 Field record 1776.
 125 135 Clarke and Greene CG 117 (AAS, BA, TNS).
 130 115 Bell 3311 (AAS).
 130 120 Bell 509 (AAS, BA, CHR), Bell 511 (BM, LE), Bell 522 (AAS), Bell 540 (AAS), Bell 1192b (AAS), Clarke and Greene CG 243 (AAS), Greene 1849 (BM, CHR, LE, MEL, NY), Longton 423 (AAS), Longton 424 (AAS), Longton 425 (BM, PC, PRE, SGO).
 130 125 Bell 523 (AAS, BA, LE, MEL, NY, PC, PRE, S, SGO, TNS), Bell 524 (BA, BM, CHR, LE), Bell 525 (AAS, MEL), Bell 526 (BM, NY, PC), Bell 528 (AAS, PRE, SGO), Bell 529 (BM, S), Bell 530 (AAS, BA, CHR, TNS), Bell 531 (BM, LE, MEL), Bell 906 (BM, PC, PRE, S, SGO, TNS), Bell 909 (AAS, BA, CHR, LE, MEL, NY), Bell 1200 (AAS), Bell 1271 (BM, SGO), Clarke and Greene CG 342 (BM, PRE, S, SGO), Greene 93 (AAS), Greene 584b (BM), Greene 2906b (AAS), R. Smith 1086 (AAS), R. Smith 1310 (AAS).
 135 115 Field record 1920.
 135 120 Field record 2012.
 140 100 Field record 8194.
 140 110 Field record 1954.

- 140 115 Bell 1268 (BM, MEL, NY), Bell 1269 (AAS, PC, PRE), Longton 246 (BM, CHR, LE, MEL), Longton 345 (AAS).
 140 120 Greene 560 (AAS), Greene 949 (AAS, BA).
 145 100 Field record 8195.
 145 110 Longton 387 (BM, NY).
 145 115 Longton 318 (AAS).
 155 095 Bell 1189 (AAS, CHR, LE), Greene 2410 (AAS, S, SGO).
 155 100 Bell 598 (BM, BA, CHR, LE), Bell 599 (AAS, MEL, NY).
 160 090 Bell 3304 (AAS).
 160 095 Bell 955 (BM, PC, PRE, SGO), Greene 2249 (AAS), Greene 2257 (BM, PC, PRE).
 160 100 Bell 1180 (AAS, S, TNS), Bell 1181 (BA, BM), Greene 2440 (BM).
 165 060 Field record 8196.
 165 075 Bell 3310 (AAS).
 165 080 Bell 3307 (AAS).
 165 090 Bell 3306 (AAS).
 170 065 Field record 1785.
 170 070 Bell 3305 (AAS).
 175 065 Bell 3309 (AAS).
 175 070 Bell 3308 (AAS).

Inadequately localized

Felsen am Ausgange des Brockenthales, Selten Süd-Georgien, 23.I.83, Will 52 (HBG, as *Gümbelia immerso-leucophaea*); Koppenberg, an Felsen, Süd-Georgien, 19.V.83, Will 52 (HBG, as *Gümbelia immerso-leucophaea*); SW-Gletscherthal, Austro-Georgia, 9.V.83, Will s.n. (HBG, as *Gümbelia immerso-leucophaea*); Am Ross-Gletcher, Süd-Georgien, 9.V.83, Will s.n. (M, as *Grimmiaceae (Gumbelia) immerso-leucophaea*); S Georgie du Sud, Baie Royale, 27.IV.1902, Skottsberg s.n. (PC, as *Grimmia nordenskjoeldii*).

Grimmia incrassicapsulis B. G. Bell

- 070 145 Greene 1308 (AAS), Greene 1309 (AAS).
 115 100 BAS Misc. 168 (AAS).
 120 100 BAS Misc. 167 (AAS).
 130 125 Bell 907 (AAS, BA), Bell 908 (BM, PC, S), Bell 1272 (AAS, TNS), Greene 3492b (BM).
 140 105 R. Smith 2817 (AAS).
 160 065 BAS Misc. 166 (BM, MEL).
 170 070 Bell 3312 (BM).
Schistidium apocarpum (Hedw.) B.S.G.
 030 150 Bell 501 (AAS).
 035 150 BAS Misc. 164 (AAS).
 050 150 Bell 575 (BM, S), Bell 579 (AAS).
 055 150 Bell 428 (BM).
 060 150 R. Smith 2807 (AAS).
 075 130 R. Smith 2805 (AAS).
 075 145 R. Smith 2804 (AAS).
 080 125 Greene 2623 (AAS), Greene 2629a (BM).
 080 140 R. Smith 2806 (AAS).
 085 140 Field record 8187.
 090 120 Field record 8188.
 090 145 Greene 1646 (AAS).
 095 100 Field record 8183.
 100 115 Field record 8189.
 100 145 R. Smith 2811 (AAS).
 105 140 R. Smith 2810 (AAS).
 115 105 Field record 8186.
 115 130 Bell 311 (BA, BM, CHR), Bell 331 (AAS), Bell 332 (AAS), Bell 333 (AAS), Bell 572 (AAS).
 120 130 Longton 184 (AAS, TNS).
 120 135 Greene 3380 (BM, SGO), Sladden 19/31 (BM), R. Smith 2809 (AAS).
 125 135 Clarke and Greene CG 134 (AAS, BA).
 130 090 Field record 8185.
 130 110 Bell 3303 (AAS).
 130 115 J. Smith 18b (BM).
 130 120 Bell 535 (BM, LE, MEL, NY), Bell 1195 (BM, LE), Greene 3533 (BM, S), R. Smith 1159b (BM).
 130 125 Bell 1198 (AAS), Greene 1899 (BM, NY), Greene 1904 (AAS, PC, PRE), Greene 2013 (AAS), Greene 3468a (AAS), R. Smith 1084 (AAS).
 135 115 Bell 3302 (AAS), Clarke and Greene CG 211 (BM).
 135 120 Bell 542 (AAS, PC, PRE), Bell 546 (AAS, BA, CHR, LE, MEL, S, SGO, TNS), Bell 547 (BM, NY), Bell 548 (AAS), Bell 554 (BM, PC, PRE, SGO), Clarke and Greene CG 271b (AAS), Clarke and Greene CG 280 (BM).
 140 070 Field record 8184.
 140 110 J. Smith 2808 (AAS).
 140 115 Longton 245 (BA, BM).
 140 120 Greene 912 (BM, MEL).
 145 070 Greene 2764b (AAS), Greene 2773 (AAS).
 145 110 Longton 385 (AAS, MEL).
 155 095 Bell 1175 (AAS), Bell 1190b (AAS).
 160 060 Bell 3301 (AAS), Greene 2478 (AAS), Greene 2834 (AAS).

- 160 090 Bell 3296 (AAS).
 160 100 Bell 1187 (BA, BM, CHR, TNS).
 165 075 Bell 3299 (AAS).
 165 090 Bell 3298 (AAS).
 170 065 Bell 3300 (AAS).
 170 070 Bell 3297 (AAS).

Inadequately localized

Drehkuppel, zwischen Moor, Austro-Georgia 6.II.83. Will s.n. (HBG, M, as *Grimmia occulta*).

Schistidium celatum Card.) B. G. Bell

- 045 150 R. Smith 2801 (AAS).
 075 120 R. Smith 2803 (AAS).
 080 135 R. Smith 2802 (BM).
 120 130 Greene 2959d (BM).
 125 135 Greene 3392 (AAS, MEL).
 125 125 Greene 1588 (AAS).
 130 115 Bell 557 (AAS, BA), Bell 3294 (AAS, NY, PC, S), Bell 3295 (BM).
 130 120 Greene 1850 (AAS).
 140 100 BAS Misc. 163 (BM).
 140 120 Greene 560a (BM).

Inadequately localized

South Georgia, Cumberland Bay, connecting valley between S and W Fiords, 21.V.1902, Skottsberg 318 in parte (PC, S, as *Grimmia celata*).

Schistidium falcatum (Hook f. et Wils.) B. Bremer

- 035 150 Greene 501 (BA, BM, CHR, LE, MEL).
 055 135 R. Smith 2818 (AAS).
 080 125 Greene 2711 (AAS, CHR, PC).
 115 135 Greene 3277 (BM, PC, S).
 130 115 Bell 3313 (AAS).
 130 120 Greene 149 (AAS).
 130 125 Greene 1911 (BA, BM, MEL, S, TNS).
 135 115 Clarke and Greene CG 209 (AAS, BA).
 140 120 Greene 572 (AAS, NY, PC, PRE, SGO).
 050 110 R. Smith 2047 (BM, TNS).

Schistidium hyalino-cuspidatum (C. Muell.)

- B. G. Bell
 030 155 BAS Misc. 146 (AAS).
 035 150 Greene 689a (AAS).
 040 150 BAS Misc. 147 (AAS), Greene 736 (AAS).

- 045 150 Field record 8154.
 050 150 Bell 578 (BA, BM), Bell 583 (AAS).
 055 135 R. Smith 2784 (AAS).
 055 140 Greene 1152 (AAS).
 060 150 R. Smith 2786 (AAS).
 070 135 R. Smith 2787 (AAS).
 070 145 Greene 1188 (AAS), Greene 1287 (BM, PC, PRE), Greene 1355 (AAS).
 075 130 R. Smith 2788 (AAS).
 080 125 Greene 2621 (AAS, S).
 080 135 R. Smith 2785 (AAS).
 085 125 Field record 8158.
 090 100 Field record 8150.
 090 115 Field record 8159.
 090 120 BAS Misc. 148 (AAS).
 090 145 Greene 1648a (AAS).
 095 095 BAS Misc. 145 (AAS).
 095 100 BAS Misc. 143 (AAS), BAS Misc. 144 (AAS).
 105 110 BAS Misc. 149 (AAS).
 110 100 Field record 8153.
 115 130 Longton 133 (AAS, MEL).
 115 135 Greene 3275 (BA, BM, PC, TNS).
 120 095 Field record 8148.
 125 115 R. Smith 2783 (AAS).
 125 125 BAS Misc. 141 (AAS).
 130 120 Bell 507 (AAS), Bell 510 (BM), Bell 514 (AAS), Greene 3536 (BM, S).
 130 125 Bell 1199 (AAS), Bell 1265 (BM, CHR, LE), Clarke and Greene CG 398 (AAS), Greene 1798 (AAS), Greene 3468b (AAS).
 135 115 BAS Misc. 142 (AAS).
 140 070 Field record 8152.
 140 100 Field record 8156.
 140 120 Greene 1027 (BM, NY).
 145 070 Field record 8146.
 145 100 Field record 8157.
 150 060 Field record 8147.
 155 095 Bell 1190a (BM).
 155 100 Bell 590 (AAS).
 160 060 Greene 2839b (AAS).
 160 090 Bell 3287 (AAS).
 160 095 Greene 2238 (BM, SGO).
 165 065 Lawson 20d (AAS).
 165 085 Bell 3288 (AAS).

Inadequately localized

SW-Gletscherthal, Austro-Georgia, 7.V.83, Will. s.n. (HBG, as *Dryptodon hyalino-cuspidatus*); Köppenbergen an Felsen, Austro-Georgia, 9.V.83, Will. s.n. (HBG, as *Dryptodon hyalino-cuspidatus*).

Schistidium rivulare (Brid.) Podp.

- 030 155 Bell 46 (AAS), Bell 512 (BM), Bell 513 (BM), Bell 515 (BM), Greene 394 (BM, MEL, NY, PC), Greene 397 (AAS, PRE, SGO).
 035 150 Greene 494 (BA, BM, S, TNS).
 040 150 Greene (BM, S, TNS).
 055 135 R. Smith 2819 (AAS).
 155 150 Bell 586 (AAS).
 065 140 R. Smith 2821 (AAS).
 070 145 Greene 1323 (BA, BM, CHR, LE).
 080 125 Greene 2710 (AAS).
 080 140 R. Smith 2820 (AAS).
 090 145 Greene 1658 (AAS, MEL, NY).
 095 140 BAS Misc. 170 (AAS).
 100 140 BAS Misc. 169 (AAS).
 110 100 BAS Misc. 171 (AAS).
 115 130 Greene 3095 (BM, MEL, NY, PC).
 115 135 Greene 1427 (AAS), Greene 1445a (BM).
 120 130 Longton 123 (BM, TNS).
 120 135 Longton 80 (AAS, PRE, S, SGO).
 125 095 Greene 2518 (BM).
 130 095 BAS Misc. 172 (AAS).
 130 115 Clarke and Greene CG 153 (AAS).
 130 120 Bell 533 (AAS), Bell 1194 (AAS), Clarke and Greene CG 361 (AAS), Greene 1837 (AAS, PRE, S, SGO, TNS), R. Smith 1190 (AAS), R. Smith, 1243a (AAS), R. Smith 1309 (AAS).
 130 125 Bell 1263 (BM, S, SGO, TNS), Bell 1264 (AAS, BA, CHR), Greene 1821 (BM, PC), Greene 1898 (AAS), Greene 2901b (AAS).
 135 115 Clarke and Greene CG 386 (BM).
 135 120 Clarke and Greene CG 270 (BM).
 140 115 Bell 1267 (BM, LE, MEL, NY, PC, PRE, S, SGO), Bell 1270 (AAS, BA, CHR, LE, TNS).
 140 120 Greene 561 (AAS, CHR, LE, MEL), Greene 569 (BM, NY), Greene 574 (AAS, PC, PRE, SGO), Greene 1012 (AAS).
 145 115 Greene 830 (AAS), Greene 844 (AAS).
 155 095 Bell 1179 (AAS, MEL, NY, PC, PRE), Greene 2152 (AAS), Greene 2301 (AAS, CHR, LE).
 155 100 Bell 591 (BA, BM, CHR, LE).
 160 090 Bell 3314 (AAS).
 160 095 Greene 2262 (BA, BM).
 160 100 Bell 1185 (BM).
 165 080 Bell 3318 (AAS).

165 085 Bell 3315 (AAS).

165 090 Bell 3317 (AAS).

170 065 Bell 3319 (AAS).

170 070 Bell 3316 (AAS).

Schistidium syntrichiaceum (C. Muell.)

B. G. Bell

- 030 150 Bell 506 (AAS).
 050 150 Bell 688 (BM).
 075 130 R. Smith 2790 (AAS).
 075 135 R. Smith 2791 (AAS).
 090 120 BAS Misc. 156 (AAS).
 090 125 BAS Misc. 157 (AAS).
 095 140 BAS Misc. 155 (AAS).
 095 145 R. Smith 2789 (AAS).
 110 100 BAS Misc. 152 (AAS).
 115 135 Longton 76 (AAS, PRE, S, SGO).
 120 100 BAS Misc. 154 (AAS).
 120 135 Clarke and Greene CG 68 (AAS).
 125 095 BAS Misc. 151 (AAS).
 130 090 Field record 8160.
 130 115 R. Smith 1259 (AAS).
 130 120 Bell 520 (AAS), Bell 539 (AAS), Greene 789 (AAS, PC).
 130 125 Greene 2901a (AAS), R. Smith 1085 (AAS).
 130 135 Clarke and Greene CG 87 (BM).
 135 115 Field record 1926.
 135 120 Field record 2011.
 140 080 BAS Misc. 153 (AAS).
 140 110 Field record 1953.
 145 110 Longton 386 (BM, TNS).
 155 100 Bell 592 (AAS), Bell 1177 (AAS, BA, CHR, LE).
 160 060 Greene 2893a (AAS).
 160 090 Field record 1987.
 160 095 Bell 1183 (BM, MEL, NY).
 165 085 BAS Misc. 158 (AAS), BAS Misc. 159 (AAS).
 170 070 BAS Misc. 160 (AAS).
 170 090 BAS Misc. 161 (AAS).

Inadequately localized

South Georgia, leg. R. I. L. Smith, BAS Misc. 123 (AAS); Auf Felsblöcken der Südl. Landzunge, Süd-Georgien, Will s.n. (HBG, as *Grimmia syntrichiaceum*).

Schistidium urnulaceum (C. Muell.)

B. G. Bell

- 075 145 R. Smith 2799 (AAS).
 095 145 R. Smith 2798 (AAS).
 110 110 Field record 8177.
 115 130 Greene 3084 (BM, PC).
 115 135 Greene 3278b (AAS).

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- 120 100 Field record 8179.
125 120 Field record 1881.
130 120 R. Smith 1308 (AAS).
130 125 Bell 1197b (BM), Clarke and
Greene CG 414 (AAS), Greene 91
(AAS), Greene 585 (BM, MEL, NY,
TNS), J. Smith M68f (BM).
140 100 Field record 8178.
140 105 R. Smith 2800 (AAS).
140 110 Longton 260 (AAS, PRE, SGO).
145 100 BAS Misc. 162 (AAS).
160 095 Greene 2328 (AAS).
160 100 Bell 1182 (AAS, BA, CHR, LE,
S).
165 065 Lawson 20e (BM).

Inadequately localized

Austro-Georgia, Ad rupes am Ausgange
des Brockenthales, Will s.n. (HBG, as
Grimmia urnulacea).