THE SOUTH GEORGIAN MOSS FLORA: *VITTIA*

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ABSTRACT. *Vittia pachyloma* (Mont.) Ochyra, a species previously known from South Georgia as *Sciaromium conspissatum* (Hook. f. & Wils.) Mitt., is described and illustrated on the basis of material from the island. Habitat details and a distribution map are provided together with a full list of specimens examined. Taxonomic notes to assist in the identification of the species are also given.

INTRODUCTION

Vittia pachyloma forms an important and locally frequent component of the bryophyte flora of South Georgia. It is one of the major constituents of stream-bed and stream-side vegetation associated with such moss species as *Schistidium rivulare* (Brid.) Podp., *Calliergon sarmentosum* (Wahlenb.) Kindb., *Philonotis acicularis* (C. Muell.) Kindb., *Tortula fontana* (C. Muell.) Broth., *T. arenae* (Besch.) Broth. and others. The species has previously been reported from South Georgia as *Sciaromium conspissatum* (Hook. f. & Wils.) Mitt. by Cardot (1906, 1908) from collections made by C. Skottsberg during the Swedish South Polar Expedition of 1902–03.

The present paper is based upon the conclusions of a taxonomic revision of the genus *Sciaromium* (Mitt.) Mitt., and in particular on the part dealing with the section *Limbidium* Dusén (Ochyra, 1987*a*). Because the generic name *Sciaromium* proved to be synonymous with *Echinodium* Jur., the new generic name *Vittia* was introduced to accommodate species that had been placed in the section *Limbidium* of *Sciaromium* by Brotherus (1925). In addition, careful evaluation of the interrelationships of *Vittia* led to the conclusion that the genus was anomalous in the Amblystegiaceae, a family in which it had traditionally been placed, and it was necessary to establish a new monogeneric family, Vittiaceae Ochyra. The genus *Vittia* is monotypic, containing *V. pachyloma* as the only species.

This paper is the twelfth in a series revising the moss flora of South Georgia, previously titled 'A synoptic flora of South Georgian mosses'. The earlier papers in the series are: Greene (1973), Bell (1973, 1974, 1984), Clarke (1973), Lightowlers (1985), Matteri (1977) and Newton (1974, 1977, 1979, 1983). As with other papers in this series, most of the material for this study came from unidentified collections made by British Antarctic Survey personnel. These collections are held in the British Antarctic Survey Herbarium (AAS), the bryophyte section of which is currently on loan to the Institute of Terrestrial Ecology, Bush Estate, Penicuik, Midlothian. AAS specimens identified during this work have been distributed to herbaria as shown in Appendix 1.

VITTIACEAE

Vittia Ochyra

V. pachyloma, the only species of the genus, is distinctive and is unlikely to be confused with any other moss species on South Georgia. The diagnostic features

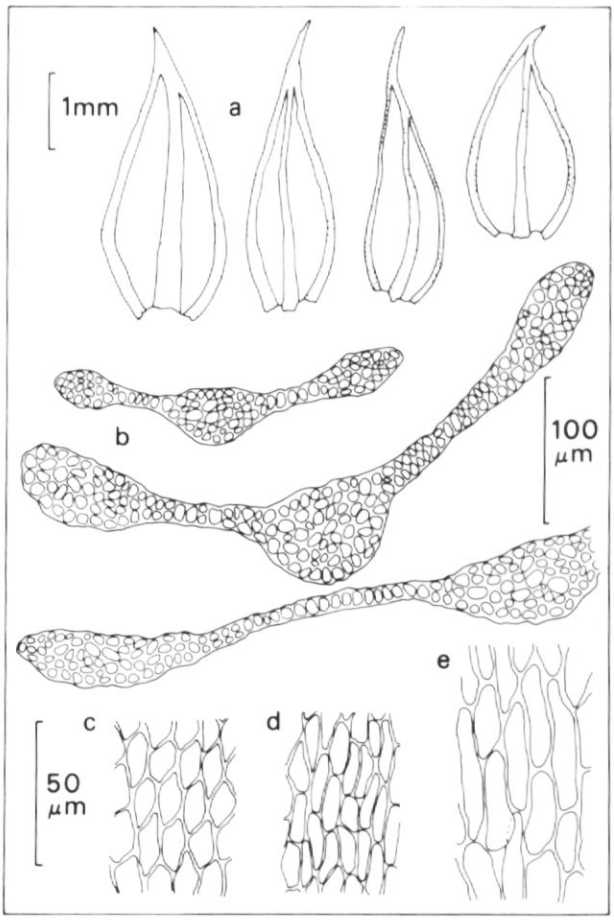

Fig. 1. *Vittia pachyloma*. (a) Leaves; (b) transverse sections of leaves; (c) and (d) lamina cells at mid-leaf; (e) basal lamina cells. Scales: upper left for leaves, centre right for leaf sections and lower left for cells.

occur in the leaves which are entire, or almost entire, and have strongly thickened leaf margins forming wide multistratose costa-like borders. These are connivent at the leaf apex with the single true costa of the leaf (Fig. 1). In addition, the genus is characterized by rhomboid to shortly oblong-rhomboidal, smooth or very slightly prorulose* lamina cells that are unistratose or bistratose, a single costa which is percurrent to longly excurrent and confluent with the marginal thickenings, and ovate, ovate-lanceolate to lanceolate leaves. Neither sporophytes nor inflorescences have been found in material from South Georgia.

Vittia pachyloma (Mont.) Ochyra

J. Hattori bot. lab. **62**, 395. 1987. *Sciaromium pachyloma* (Mont.) *Par. Ind. Bryol.* 1155. 1898. *Gymnostomum pachyloma* Mont. *Anns. Sci. Nat. Bot.*, sér. 2, **9**, 51. 1838. Type '(In aquis vivis propre Valparaiso in Regno Chilensi á cl. d'Orbigny lecta)'. (Neotype (Ochyra 1987*a*) AAS, H: 'Chile, Prov. Nuble, Recinto, Las Trancas, El Purgatorio, 1200 msm, 14.IV.1929. Leg. H. Roivainen No. 994').

* The term prorulose is used here to describe cells in which the ends project out from the plane of the leaf, thus producing a papillose leaf surface.

Fig. 2. *Vittia pachyloma*; portion of shoot (drawn from Greene 1442).

Sciaromium conspissatum (Hook. f. & Wils.) Mitt. *J. Linn. Soc. Bot.* **12**, 572. 1869. *Hypnum conspissatum* Hook. f. & Wils. *Lond. J. Bot.* **3**, 553. 1844. Type 'Kerguelen's Island and Falkland Islands'. Leg. J. D. Hooker. (Lectotype (Ochyra 1987*a*) BM: 'Christmas Harbour, Kerguelen's Land, June 1840, Antarct. Exp. 1839–1843 J.D.H.').

Plants pleurocarpous, medium sized to very robust forming dense or loose intricate mats, stiff and wiry in texture, bright green, yellow–green, yellow or golden–brown above, becoming black to blackish–brown below. Stems prostrate or ascending, irregularly branched, elongate, up to 12 cm long, usually with dense foliage in the upper part and appearing bristly below because of erosion of laminae leaving costae and leaf margins, in transverse section with small but distinct central strand surrounded by 4–6 layers of large, thin-walled medullary cells and 2–4 layers of small and incrassate cortical cells. Rhizoids lacking or few in fascicles at stem base, smooth and brown, paraphyllia lacking, pseudoparaphyllia foliose, triangular. Stem and branch leaves similar in shape, (1.2–) 1.6–3.0 (–3.2) × (0.5–) 0.6–2.2 (–1.3) mm, close to distant, erect to erecto-patent, little altered on drying, straight to falcato-secund, ovate, ovate-lanceolate to narrowly lanceolate, gradually tapering to long, narrow acumen, sometimes shortly acuminate or bluntly tipped, plane to concave, smooth, not decurrent. Margins plane, entire to obscurely serrulate at the apex, bordered by many rows of linear, yellowish-brown to brown, thick-walled cells arranged in (2–) 4–6 (–8) layers, (30–) 60–90 (–100) μm wide, sharply demarcated from the lamina cells and forming strong, thickened borders joining at the apex. Lamina cells unistratose throughout or sometimes partially to fully bistratose towards apex, 12–25 (–39) × 6–7 μm, rhomboid or oblong-rhomboidal, *c.* 2–5 times as long as broad, becoming somewhat widened at the insertion but not differentiated in the alar region, smooth or very slightly papillose because of projecting cell ends, pellucid to obscure, thin- to moderately thick-walled. Inflorescences and sporophytes unknown on South Georgia (Figs 1, 2).

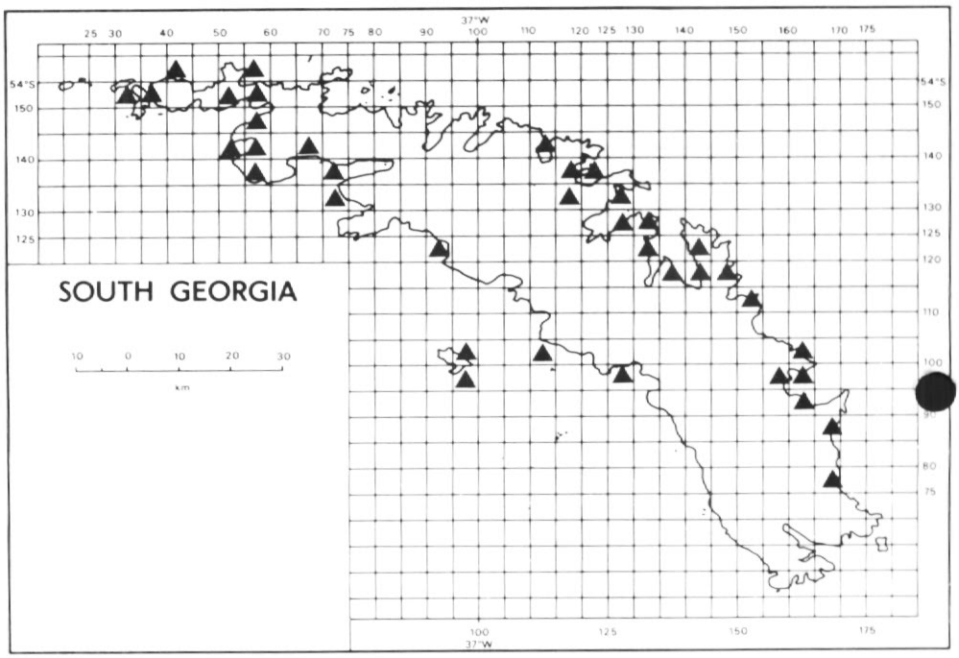

Fig. 3. The known distribution of *Vittia pachyloma* on South Georgia, by 5 km squares.

Habitat

This species occurs in a variety of wet habitats, but it is predominantly associated with swiftly running water. It is most often found on rocks and boulders in stream-beds, usually submerged to a depth of about 50 cm and in splash areas near waterfalls. However, it sometimes grows in sluggish streams and lakes, in stream-side seepage areas, on wet cliffs and sheltered rock surfaces and in wet crevices of boulders by rivers and streams. Altitude 0–330 m.

Distribution

Widespread on South Georgia (Fig. 3). Kerguelen, South America, the Falkland Islands and South Africa.

Notes

Although the leaf shape of *V. pachyloma* is very similar to that of a number of other pleurocarpous mosses, the presence of strong marginal thickenings that are connivent with the costa at the leaf apex is unique among the mosses of South Georgia. The only other known species having limbate leaves and growing in similar environmental niches in the island's flora is *Philonotis vagans* (Hook. f. & Wils) Mitt. However, this is an acrocarpous moss with unistratose leaf margins, whereas *V. pachyloma* is pleurocarpous with polystratose leaf margins, and has a completely different habit in the field.

As with many species thriving in running water, the laminae of the older vegetative leaves are often totally eroded. In *V. pachyloma* this leaves only the costa and

thickened borders attached to the stem and branches. In this condition the species is quite unmistakable and readily identified in the field by the peculiar tricostate appearance of the eroded leaves.

Vittia pachyloma is occasionally associated with aquatic forms of *Pseudoleskea* sp. and the two are similar in general appearance and in the stiff texture of the plants. However, they are quite distinct microscopically, the leaf of the latter being without thickened leaf margins, although occasionally the marginal cells towards the apex of the leaf are more brownish, giving the leaves a hint of a border. There is also a slight possibility of confusion of some forms of *V. pachyloma* with other pleurocarps occurring in similar flooded habitats, for instance *Campyliadelphus polygamus* (B.S.G.) Kanda (= *Campylium polygamum* (B.S.G.) C. Jens.), *Calliergon sarmentosum* (Wahlenb.) Kindb., and various species of *Brachythecium*, but microscopic examination will dispel any doubt regarding the identity of these taxa, which have [illegible]bate and unistratose leaves.

Despite its marked generic distinctiveness, *V. pachyloma* is a variable polymorphous species, a feature typical of aquatic or hydrophytic mosses. The species displays a wide range of variation on South Georgia which, however, is parallel to that observed in populations from other parts of its geographical range, and is discussed in detail elsewhere (Ochyra, 1987*a*). There is little difference in the variation pattern of the South Georgian and South American populations. There is a steady continuum in expression of the width of the costa and borders, stratosity of the leaf borders and lamina cells as well as the cell length. As a result, any attempt to segregate various extreme forms and to give them formal taxonomic recognition would be highly arbitrary, resulting in the random placement of many intermediates.

Taxonomy

The present genus has long been known under the familiar name *Sciaromium* (Mitt.) Mitt. However, Churchill (1986) and Ochyra (1987*b*) drew attention to the fact that Mitten's (1869) genus was actually synonymous with *Echinodium* Jur., which had been described by Juratzka (1866) to accommodate two species from Macronesia and New Zealand. Ochyra (1987*a*) introduced a new generic name *Vittia*, for species that had hitherto been placed in the section *Limbidium* of *Sciaromium*. The genus is interpreted as monotypic, consisting of only *V. pachyloma*, which includes about 15 [illegible]onymous names proposed for the taxa from various parts of South America, South Africa and the Kerguelen Islands. The genus has traditionally been placed in the Amblystegiaceae (Brotherus, 1925), mainly because of the association of plants with aquatic habitats. However, a unique combination of gametophyte features warrants the recognition of the separate family Vittiaceae for this peculiar genus, which seems to be a close relative of the brachythecioid group of families (Ochyra, 1987*a*).

Vittia pachyloma was first described by Montagne (1838) as *Gymnostomum pachyloma* for material collected by d'Orbigny near Valparaiso, Chile. Unfortunately the type specimen of *G. pachyloma* has not been located either in the personal herbarium of Montagne in Paris (PC) or in other world herbaria. Ochyra (1987*a*) studied material of this species from Santiago, Chile, which had been examined and named by Montagne (1850). It confirms the original concept of this species and its correct interpretation by subsequent bryologists. As none of the type material of *G. pachyloma* has been traced, a neotype has been selected by Ochyra (1987*a*) (Chile, Prov. Nuble, Recinto, Las Trancas, El Purgatorio, 1200 msm, 14.IV.1929, leg. H. Roivainen No. 994, AAS, H).

Vittia pachyloma was reported for the first time from South Georgia by Cardot (1906, 1908) as *Sciaromium conspissatum* (Hook. f. & Wils.) Mitt. This species was first described by Hooker and Wilson (1844), as *Hypnum conspissatum* Hook. f. & Wils., from material collected from the Falkland Islands and the Kerguelen Islands by J. D. Hooker in the course of the Antarctic Expedition of 1839–43. The type specimens (Lectotype, Hooker sp.nov., BM, '*Hypnum conspissatum* nob. Christmas Harbour, Kerguelen's Land, June 1849, Antarct. Exp. 1839–1843 J.D.H.': syntype, Hooker sp.nov., BM, '*Hypnum conspissatum* HfW, Falkland Islands, Antarct. Exp. 1839–1843 J.D.H.') have been examined and they fall within the range of variability shown by *V. pachyloma* and there is no doubt that this is the same species. *Sciaromium conspissatum*, as the later name, is therefore reduce to synomyny with *V. pachyloma*.

Acknowledgements

We wish to thank Directors and Curators of the following institutes and herbaria for kindly allowing us to borrow specimens during the course of this study: British Museum (Natural History), London; Botanical Museum, Helsinki; Museum National d'Histoire Naturelle, Laboratoire de Cryptogamie, Paris and Naturhistoriska Riksmuseet, Stockholm. Thanks are also due to Halina Ochyra who prepared the habit drawing in Fig. 2.

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References

Bell, B. G. 1973. A synoptic flora of South Georgian mosses: II. *Chorisodontium, Dicranoloma, Dicranum, Platyneurum* and *Conostomum*. *British Antarctic Survey Bulletin*, No. 37, 33–52.

Bell, B. G. 1974. A synoptic flora of South Georgian mosses. V. *Racomitrium* and *Willia*. *British Antarctic Survey Bulletin*, No. 38, 73–102.

Bell, B. G. 1984. A synoptic flora of South Georgian mosses: *Grimmia* and *Schistidium*. *British Antarctic Survey Bulletin*, No. 63, 71–109.

Brotherus, V. F. 1925. Musci (Laubmoose), III. Unterklasse Bryales: II. Spezieller Teil, Amblystegiaceae. (*In* Engler, A. *and* Prantl. K. *Die Natürlichen Pflanzenfamilien*. Leipzig, Wilhelm Englemann, Aufl. 2, Band 11, Hälfte 2, 332–49.)

Cardot, J. 1906. Notice préliminaire sur les mousses recueillies par l'Expédition Antarctique Suédoise. II. Espèces de la Géorgie du Sud. *Bulletin d l'Herbier Boissier* 2ème sér., No. 6, 1–12.

Cardot, J. 1908. La flore bryologique des Terres Magellaniques, de la Géorgie du Sud et de l'Antarctide. *Wissenschaftliche Ergebnisse der Schwedischen Südpolar expedition 1901–03*, Bd. 4, Lf. 8, 298 pp.

Churchill, S. P. 1986. A revision of *Echinodium* Jur. (Echinodiaceae: Hypnobryales). *Journal of Bryology*, **14**, 117–33.

Clarke, G. C. S. 1973. A synoptic flora of South Georgian mosses: III. *Leptotheca, Philonotis, Mielichhoferia* and *Pohlia*. *British Antarctic Survey Bulletin*, No. 37, 53–79.

Greene, S. W. 1973. A synoptic flora of South Georgian mosses: I. *Dendroligotrichum, Polytrichum* and *Psilopilum*. *British Antarctic Survey Bulletin*, No. 36, 1–32.

Hooker, J. D. *and* Wilson, W. 1844. Musci Antarctici. *London Journal of Botany*, **3**, 533–66.

Juratzka, J. 1866. Muscorum frondosorum species novae. *Botanische Zeitung*, **24**, 20–1.

Lightowlers, P. J. 1985. A synoptic flora of South Georgian mosses: *Tortula*. *British Antarctic Survey Bulletin*, No. 67, 41–77.

Matteri, C. M. 1977. A synoptic flora of South Georgian mosses: VII. *Pottia*. *British Antarctic Survey Bulletin*, No. 46, 23–8.

Mitten, W. 1869. Musci austro-americani. *Journal of the Linnean Society, Botany*, **12**, 1–659.

Montagne, C. 1838. Centurie de plantes cellulaires exotiques nouvelles. Musci. *Annales des sciences naturelles, Botanique*, sér. 2, No. 9, 49–57.

Montagne, C. 1850. Flora chilena, plantas cellulaires I. Musgos. (*In* Gay, C. *Historia fisica y politica de Chile*. Vol. 7 Botanica, C. Gay, Paris, Museo de Historia Naturel de Santiago, Chile, 5–202.)

NEWTON, M. E. 1974. A synoptic flora of South Georgian mosses. IV. *Bartramia* and *Brueteliau*. *British Antarctic Survey Bulletin*, No. 38, 59–71.

NEWTON, M. E. 1977. A synoptic flora of South Georgian mosses. VI. *Cheilothela*, *Dicranella*, *Distichium*, *Myurella* and *Catagonium*. *British Antarctic Survey Bulletin*, No. 46, 1–21.

NEWTON, M. E. 1979. A synoptic flora of South Georgian mosses. VIII. *Calliergon* and *Brachythecium*. *British Antarctic Survey Bulletin*, No. 48, 133–57.

NEWTON, M. E. 1983. A synoptic flora of South Georgian mosses: *Campylium*. *British Antarctic Survey Bulletin*, No. 61, 53–8.

OCHYRA, R. 1987*a*. A revision of the moss genus *Sciaromium* (Mitt.) Mitt. II. The section *Limbidium* Dusén, with a description of *Vittia* gen.nov. (Vittiaceae fam.nov.). *Journal of the Hattori Botanical Laboratory*, **62**, 387–415.

OCHYRA, R. 1987*b*. A revision of the moss genus *Sciaromium* (Mitt.) Mitt. I. General remarks and the section *Aloma* Dusén. *Journal of Bryology*, **14**, 454–64.

APPENDIX 1. SPECIMENS EXAMINED

All of the specimens listed here originate from the British Antarctic Survey Herbarium, unless otherwise stated. Major sets of identified material have been deposited in AAS, BM, and KRAM. Other duplicates have been distributed to ALTA, B, BA, CHR, H, LE, MEL, NIPR, NY, O, PC, PRE, S and TNS. Specimens are listed in grid reference order:

030 150 Greene 275, 316
035 150 Greene 502
040 155 R. Smith 5567
050 140 R. Smith 5563, 5564. 050 150 Bell 659
055 135 R. Smith 4997. 055 140 R. Smith 4999. 055 145 R. Smith 5565. 055 150 Bell 810, 1092, 1093. 055 155 Bell 1104
065 140 R. Smith 4998
070 130 R. Smith 5560. 070 135 R. Smith 5561, 5562
090 120 BAS Misc. 196
095 095 BAS Misc. 198. 095 100 BAS Misc. 193
110 100 BAS Misc. 195. 110 140 BAS Misc. 197
115 130 Bell 3462, Greene 3094A. 115 135 Greene 1442, 3243
120 135 Greene 3377, R. Smith 5566
125 095 BAS Misc 194, Greene 2528. 125 125 Greene 1541. 125 130 Skottsberg 415 (PC), 416 (PC)
[illegible]120 Bell 1030, Clarke and Greene 202, Greene 144, R. Smith 1173, 130 125 Clarke and Greene 168, 315, Greene 1910
135 115 Bell 3463, Clarke and Greene 213
140 115 Longton 344, 362, 363. 140 120 Greene 566, 1041
145 115 Greene 842
150 110 R. Smith 2048
155 095 Greene 2379
160 090 Bell 3460. 160 095 Greene 2292. 160 100 Bell 994
165 075 Bell 3461
165 085 Bonner 193