SHORT NOTES

OBSERVATIONS ON TRANSPLANTS OF ANTARCTIC LICHENS

By D. C. LINDSAY*

ABSTRACT. Transplant experiments using three species of lichen were undertaken to investigate phytogeographical barriers apparently present in the maritime Antarctic. None of the transplants survived for long enough for definite conclusions to be reached.

TRANSPLANTS have been used in a number of investigations of the factors underlying floristic differences between regions to determine whether such differences have arisen from the operation of geographical, ecological or other barriers. Transplants of vascular plants have proved useful in demonstrating the factors behind the paucity of the vascular Antarctic and sub-Antarctic flora (Edwards and Greene, 1973). However, little work has been carried out using long-distance lichen transplants as an aid in the assessment of phytogeographical barriers between isolated floras. Holdgate (1964) reported that some Falkland Islands lichens were transplanted to the west coast of the Antarctic Peninsula but no data on their subsequent performance are available.

The lichen floras of the South Orkney Islands (lat. 60–61°S., long. 44–46°W.) and South Georgia (lat. 54–55°S., long. 36–38°W.), although possessing a number of species in common, show a number of striking differences. For instance, a range of bi-polar species, frequent at high latitudes in the Northern Hemisphere, are common on South Georgia but absent from the South Orkney Islands. Other species, however, occur in both regions. Since most of the species involved exhibit wide ecological amplitudes, the absence of certain bi-polar species from the South Orkney Islands is probably due to the geographical isolation of that island group or its harsher environment compared with that of South Georgia.

In order to investigate these factors, three species were selected for use in transplant experiments, namely *Cetraria islandica* (L.) Ach., *Pseudocyphellaria freycinetii* (Del.) Malme and *Sphaerophorus globosus* (Huds.) Vain. *Cetraria islandica* is widely distributed in the Boreal and Arctic regions of the Northern Hemisphere and is bi-centric sub-Antarctic in its distribution in the Southern Hemisphere (Lindsay, 1974). *Pseudocyphellaria freycinetii* is absent from the Northern Hemisphere but is also bi-centric sub-Antarctic in its Southern Hemisphere distribution. Both of these species have their southernmost known localities on South Georgia. *Sphaerophorus globosus* was selected as a control, since it occurs on both South Georgia and the South Orkney Islands (Lindsay, 1972).

MATERIAL AND METHODS

Large colonies of all three species, *c.* 10–20 cm. in diameter, were collected from west-facing *Chorisodontium* banks about 10 m. a.s.l. near Hope Point, Cumberland East Bay, South Georgia (grid ref. 133 123) on 17 November 1965. The material was sealed in polythene bags and transported to Signy Island, South Orkney Islands, where it was transplanted into what were judged to be similar habitat conditions behind the British Antarctic Survey station on 25 November 1965. Three replicate colonies of each species were established. The transplants were first examined in February 1966 and then at frequent intervals until they were covered by winter snow in April 1966. No special treatment was given, although excess water was given to *Pseudocyphellaria freycinetii* on three occasions.

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Although attempts were made to locate the material during the spring thaw in October 1966, they were unsuccessful. During that period, penguins frequently congregated in small groups on or adjacent to the transplant site before moving to their rookeries. It thus seems that the transplant material was dislodged from the moss bank by penguin trampling and the loose thalli were dispersed by wind.

Results and Discussion

Observations on the three species are summarized in Table I. Changes were observed in all three species, the most noticeable being varying degrees of intensification of pigmentation of the thallus and crisping of lobes. Noticeable only in *Cetraria islandica* was an accelerated rate of basal decay, causing transplanted colonies to collapse. However, in April 1966, all transplant colonies appeared to be in reasonable health.

Table I. Changes observed in transplants to Signy Island after 5 months

Species	*Observations*
Cetraria islandica	No colour change; light lobe crisping; rapid dying of base, colonies collapsed
Pseudocyphellaria freycinetii	Extensive brown discoloration, especially at lobe tips; extensive lobe crisping; no decay of thalli noted
Sphaerophorus globosus	Light discoloration of branch tips; no distortion of branches; no decay of thalli

Pigmentation of thalli consisted of a brown coloration occurring at lobe tips and spreading gradually to older parts of the thallus. *Ps. freycinetii* showed extensive discoloration in April 1966 with about 90 per cent of the surface area of the transplanted thalli being brown in contrast to the normal green. *S. globosus* developed little pigmentation, showing only a light browning of the branch tips. The increase in pigmentation may have been a response to the increased climatic severity of the South Orkney Islands, having been noted in a number of Antarctic lichens where it increases with increase in latitude (Lindsay, in press). The environmental factors inducing this are unknown. No colour change was noted in the brown-coloured *Cetraria islandica*.

Light to severe lobe crisping occurred in *C. islandica* and *Ps. freycinetii*. Such a response has been noted in a number of lichens undergoing desiccation, the inrolling of lobes increasing the boundary-layer resistance of the thallus and so reduces the rate of water loss by evaporation. However, crisping observed in the transplants appeared to have been induced by some other factor. Crisped thalli of *Ps. freycinetii* were wetted with excess water on three occasions but no unrolling of lobes occurred, the crisping thus appearing to be permanent.

The mechanisms causing the changes observed in the transplants are unknown but, if degree of development of pigmentation and lobe crisping are considered to indicate the degree of acclimatization of a species to its new environment, then *S. globosus* with its almost minimal response seems well adapted to the South Orkney Islands environment whereas *C. islandica* and *Ps. freycinetii* seem poorly adapted. Thus, if propagules of the latter two species managed to surmount the ocean barrier between South Georgia and the South Orkney Islands, the environment would pose problems which they are probably not physiologically adapted to overcome. Further experiments investigating the establishment of diaspores of South Georgian species on Signy Island would greatly assist in delimiting the phytogeographical barriers in operation between the two regions.

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NOTES ON ANTARCTIC BRYOPHYTES: VII. THE OCCURRENCE OF *Distichium* B.S.G. AND *Dicranella* (C. Muell.) Schimp. IN THE ANTARCTIC BOTANICAL ZONE

By M. E. NEWTON*

ABSTRACT. A description is provided of Antarctic material of *Distichium capillaceum* (Hedw.) B.S.G., together with details of its habitat and distribution within the Antarctic botanical zone. Consideration is also given to the single record of *Dicranella hookeri* (C. Muell.) Card. from this area.

Distichium capillaceum (Hedw.) B.S.G. var. *brevifolium* B.S.G. and *Dicranella hookeri* (C. Muell.) Card. are the only representatives of these moss genera reported from the Antarctic botanical zone (Steere, 1961; Greene, 1968) but Robinson (1972) has recently questioned the former determination at generic level. The purpose of this paper is, therefore, to present the results of a study carried out in conjunction with a taxonomic revision of these species on the sub-Antarctic island of South Georgia (Newton, 1977).

Material in the herbarium of the British Antarctic Survey, at present on permanent loan to the Bryophyte Research Group, Institute of Terrestrial Ecology, Bush Estate, Penicuik, Midlothian, Scotland, undoubtedly confirms that a species of *Distichium* forms part of the Antarctic flora. It has been examined biometrically and assessed against the type and other specimens mentioned below. A search of relevant herbaria has failed to locate Antarctic specimens referred to *Dicranella* but the significance of the historical record of *D. hookeri* is considered briefly in the context of named material from South Georgia.

Duplicates of the *Distichium* specimens have been distributed to world herbaria, as indicated by means of the abbreviations recommended by Holmgren and Keuken (1974) and Greene (1973).

Distichium capillaceum (Hedw.) B.S.G.

D. capillaceum is widespread in the Antarctic Peninsula sector of the Antarctic botanical zone and is typically associated with calcareous rocks, occurring on ledges and screes or in

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crevices, but it also forms part of the vegetation around fumaroles in the South Sandwich Islands. The bright or dull green shoots often show a pronounced brownish tinge and are densely caespitose, 0·5–6·5 cm. tall, and copiously interwoven with reddish brown rhizoids. The distichous leaf arrangement is unique among Antarctic mosses, the leaves, 1·5–2·8 (–3·4) mm. long, having closely sheathing white membranous bases, (0·8–) 0·9–1·7 (–1·8) mm. in length, and densely mamillose green subulae, 0·4–1·3 (–1·6) mm. long (Fig. 1a–d). Cells in the leaf base, 17·5–44·0 (–75·5) × 5·0–13·5 (–14·5) μm., show a considerable range of variation (Fig. 1e and f), their shape being usually irregular and elongated but in a few specimens there is a tendency for the basal cells to be wider and more nearly quadrate. The small

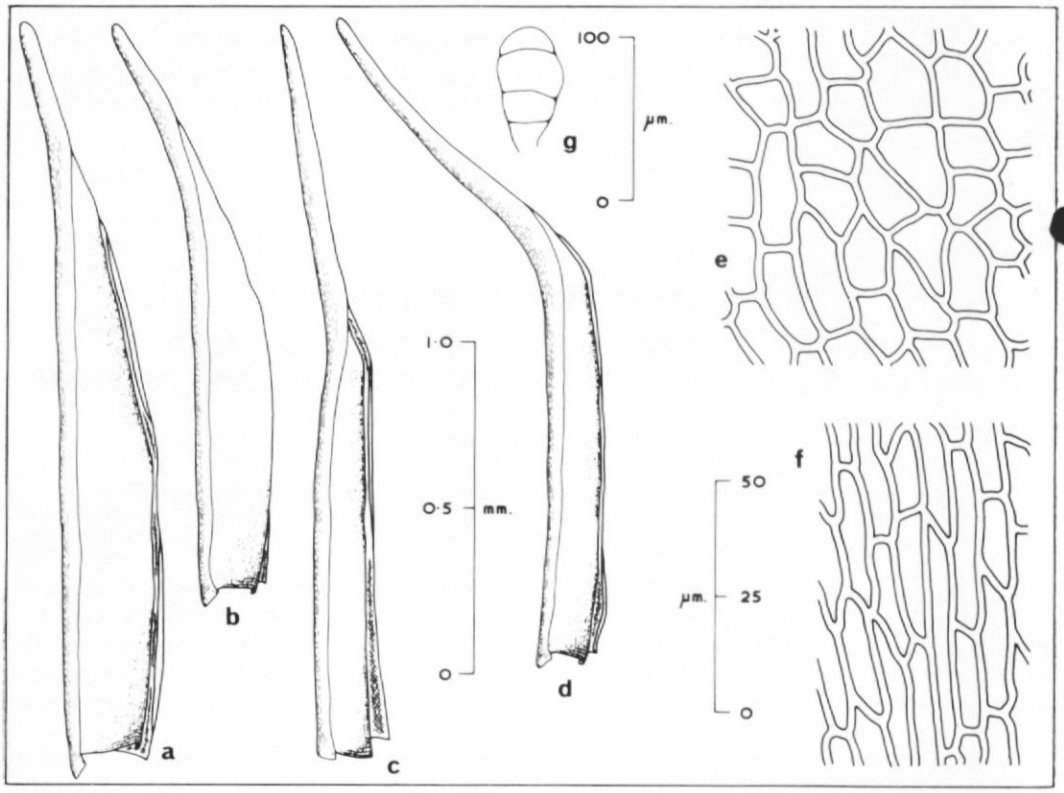

Fig. 1. *Distichium capillaceum.*
a–d. Leaves; e and f. Cells of leaf bases; g. Gemma. Scales: upper for gemma, lower left-hand for leaves, lower right-hand for cells.
a and e from R. Smith 342; b from Taylor 426; c from R. Smith 34; d and f from Lindsay 379; g from Longton 572.

quadrate or shortly rectangular cells of the leaf limb fall in the range 6·3–12·6 (–14·7) × 6·0–9·5 μm. Neither gametangia nor sporophytes have been seen but specimens from the South Sandwich Islands are noteworthy for their 4-celled clavate gemmae (Fig. 1g) which are borne in clusters below leaf insertions.

These dimensions lie within but towards the lower limits of those given for *D. capillaceum* on South Georgia (Newton, 1977) with the exception that basal leaf-cell breadth includes some comparatively high values observed in the four specimens, R. Smith 342, 489, 663 and Taylor 426 (Fig. 1e). Scatter diagrams based on statistical samples of leaf and leaf-cell dimensions

have shown that the first three of these can be clearly separated from other Antarctic and South Georgian specimens by their relatively long leaf bases (Fig. 1a), accounting for about three-quarters of the total leaf length compared with just over half in the remaining material (Fig. 1b–d). In addition, the junction between the very short limb and the base is typically straight in these three specimens, whereas the limb is usually more or less spreading or reflexed in at least some leaves per stem of other gatherings. Neither the width of the basal cells nor the form of the limb-base junction alone affords an unambiguous diagnostic character since intermediates occur but, correlated with the discontinuity of variation shown by the relative length of the leaf base, the definition of a separate species could be justified by analogy with previous treatment of the genus. Although Müller (1890) drew attention to short leaves and large basal cells in describing *D. austro-georgicum* C. Muell. from South Georgia, the taxonomic points discussed in detail elsewhere (Newton, 1977) are considered sufficient by the author to exclude that species from present consideration.

The genus *Distichium* is well known for the shortage of reliable specific characters provided by the gametophyte and few species are defined by sporophytic characters. Of those that are, *D. inclinatum* (Hedw.) B.S.G. (Hedwig, 1801) has been recognized by recent authors (e.g. Dixon, 1924; Nyholm, 1954; Gams, 1957) as having more or less erect leaf limbs. However, the leaf bases of all the material in the Hedwig–Schwaegrichen herbarium referred to this taxon, including two possible type specimens (G, *Swartzia inclinata* Hedw. *Br. Crypt.*, Vol. 11, p. 74, t. 27; Schwaegrichen, G, *Cynontodium inclinatum*, Göbniz ad rivulos, 1800), are proportionately shorter than those of the aberrant Antarctic specimens, whereas the cells are indistinguishable from the remaining austral material. Leaf bases in the types are also less membranous with the result that the margins of detached leaves are rarely involute, a character that clearly separates *D. inclinatum* from all Antarctic material.

The significance of relative leaf-base length as the only clear difference between the two Antarctic groups is unknown and, until this can be assessed by a monographic treatment of the genus, it seems best to refer both groups to a single species. Therefore, since the majority of Antarctic specimens closely resemble South Georgian *D. capillaceum* and its type material (Newton, 1977), it has been decided to recognize all specimens included in the present study as *D. capillaceum*.

Early Antarctic gatherings of *D. capillaceum* (Racovitza, PC, Canal de Gerlache, IXème débarquement, sur tendise ditrempis de la falaise, 29.i.1898; L. Valette, PC, Ile Laurie, Orcades del Sud, 9.xii.1904; L. Valette, S-PA, Orcades del Sud, Isla Laurie, 4.i.1904; Gain, PC, Shetland du Sud, Ile du roi George, Admiralty Bay, 2e expédition Charcot, 25.xii.1909; Gain 299, H, Shetland du Sud, île du Roi George, fentes des rochers, 2e expéd. Charcot, 1909) were identified as the variety *brevifolium* (=var. *compactum* (Hueb.) Torre et Sarnth.) by Cardot (1900, 1901, 1911, 1912, 1913) but, since they fall within the continuous variation that includes the type specimens, the variety is not recognized by the author, a view supported by the opinion of Dixon (1924) and Nyholm (1954). Further specimens referred in the literature (Cardot, 1907, 1908) to the variety *brevifolium* (Discovery Expedition, Granite Harbour, McMurdo Bay, Victoria Land; Skottsberg, Louis Philippe Peninsula, Esperance Bay and Moss I., Palmer Peninsula) have not been included in this study because their present location is unknown.

Distribution in the Antarctic botanical zone

South Sandwich Islands *Candlemas Island*: Longton 554 (BM, NY, PC, SGO, TNS); Longton 572 (AAS, S-PA). *Leskov Island*: Summit Ridge, Longton 509b (AAS).

South Orkney Islands *Coronation Island*: Saunders Point, R. Smith 34 (AAS). *Signy Island*: south-east of North Point, R. Smith 663 (BM); west side of Stygian Cove, R. Smith 489 (AAS, MEL, NY, S-PA, TNS); north of Elephant Flats, R. Smith 378b (AAS), R. Smith

390 (BA, BM, CHR, LE, MEL, NY, PC, S-PA, TNS); Thulla Point, Holdgate 767a (B, BM, CHR, LE); Foca Point, R. Smith 342 (B, BA, BM, CHR, LE, MEL, NY, PRE, SGO, S-PA, TNS). *Laurie Island*: Valette s.n. (PC); Valette s.n. (S-PA).

South Shetland Islands *King George Island*: Martel Inlet, Taylor 272b (AAS, B, CHR, MEL, PC); Gain s.n. (PC); Gain 299 (H). *Livingston Island*: bay off New Plymouth, Lindsay 379 (BA, BM, LE).

Antarctic Peninsula, west coast *Gerlache Strait*: Racovitza s.n. (PC). *Jenny Island*: Taylor 426 (BM, CHR, LE, MEL, NY, PC, PRE, SGO), Taylor 439 (AAS, PC, PRE, SGO, S-PA, TNS). *Adelaide Island*: R. Smith 97 (AAS, B, BA). *Alexander Island*: south part of Succession Cliffs, Taylor 532 (AAS, BA, SGO); Eros Glacier, Taylor 526 (BA, BM, CHR, MEL, NY, PC, PRE); Uranus Glacier, Taylor 519b (AAS, B, S-PA); north part of Waitabit Cliffs, Taylor 514 (BM, LE, TNS).

Dicranella hookeri (C. Muell.) Card.

In describing a badly preserved specimen (Cape Royds, 1908, leg. British Antarctic Expedition 1907–9) as *D. hookeri*, Cardot (1910) provided the only record of the species in the Antarctic botanical zone. He considered that leaf morphology was sufficiently distinct to allow specific determination but this remains unconfirmed because the present whereabouts of the specimen is unknown. Neither of the two herbaria in which it might have been deposited, the British Museum (Nat. Hist.), London, or the Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie, Paris, which holds Cardot's personal herbarium, has been able to trace it. However, there is reason to suggest that Cardot's original determination was probably correct. Not only was he familiar with the species on South Georgia (Cardot, 1906, 1908) and elsewhere, as shown for example by correctly determined herbarium specimens of *D. hookeri* (C. Skottsberg 266, S-PA, South Georgia, Cumberland Bay, Pot Harbour, 18.v.1902, 2 spec.; Skottsberg 266, H, Géorgie du Sud, Cumberland bay, 1902) that he referred to the variety *brevifolium* Card., but he also recognized it *in scheda* as distinct from *D. cardotii* (R. Brown ter.) Dix., a second species recently added to the sub-Antarctic flora (Newton, 1977). In view of Cardot's knowledge of *D. hookeri*, therefore, it would be wrong to disregard his report at this stage.

Distribution in the Antarctic botanical zone

Victoria Land Cape Royds, British Antarctic Expedition (?).

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NOTES ON ANTARCTIC BRYOPHYTES: VIII. TWO SPECIES OF *Campylopus* ORIGINALLY DESCRIBED FROM SOUTH GEORGIA

By B. G. BELL*

ABSTRACT. The nomenclatural history of two species of *Campylopus*, *C. muricatus* Dix. and *C. nano-caudatus* C. Muell., initially reported as new to science from South Georgia, is discussed. An examination of type material of both species establishes their synonymy with *Chorisodontium aciphyllum* (Hook. f. et Wils.) Broth.

SOME uncertainty remains as to the precise status of two species of *Campylopus* first reported from South Georgia. The present study attempts to clarify the nomenclatural history and taxonomic position of both taxa.

Campylopus muricatus Dix. was originally described by Dixon (1932) based on material collected by a Norwegian, T. Trøim (Trøim s.n., BM, *Campylopus muricatus* Dix. sp. nov. Near sea level, Maiviken, South Georgia. 25.1.1929. Herb. H. N. Dixon. Ref. No. 2). However, he later considered the material to be *Dicranum aciphyllum* Hook. f. et Wils. (Dixon, 1935) and suggested he was misled by the absence of the prominent alar cells considered characteristic of that species, although subsequently he found variation of this character common within the taxon.

The Trøim specimen has been examined and is typical material of *Dicranum aciphyllum*, a species placed in *Chorisodontium* by Brotherus (1924). There is therefore little doubt that *Campylopus muricatus* should be considered synonymous with *C. aciphyllum* and not remain as a separate species as indicated by van der Wijk and others (1959).

The second species, *Campylopus nano-caudatus* C. Muell., was described from South Georgia by Müller (1901). Greene (1973) has indicated that the type specimen of this taxon is the only surviving holotype material of the 51 species described from South Georgia as new to science by Müller (1885, 1890, 1901). This specimen (Dr. Wilkens s.n., B, *Campylopus nano-caudatus* n. sp. Austro-Georgia. Sept. 1883. lg. Corvette Marie), unlike most specimens seen by Müller, was collected by the doctor on board the corvette *Marie* which, acting as a relief vessel, visited Royal Bay briefly towards the end of the German International Polar-Year Expedition of 1882–83. H. Will collected the majority of specimens during this expedition (Greene, 1973). Examination of the holotype shows it should also be considered as *Chorisodontium aciphyllum* (Hook. f. et Wils.) Broth. van der Wijk and others (1959) rightly indicated Müller's inadequate description of the species by considering the name a nomen nudum but, as there has been no further mention of the species since Müller's (1901) work, the opportunity is taken here to provide an up-to-date statement about the specimen.

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NOTES ON ANTARCTIC BRYOPHYTES: IX. A PREVIOUSLY UNREPORTED BOTANICAL COLLECTION MADE ON SOUTH GEORGIA DURING THE GERMAN INTERNATIONAL POLAR-YEAR EXPEDITION, 1882-83

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ABSTRACT. A small unnamed collection of mosses from South Georgia, together with a single flowering plant, have been traced in the herbarium of the Institut für systematische Botanik, Graz, Austria. Determinations are provided for all the specimens and the historical significance of the material is discussed.

CURRENT studies on the moss flora of South Georgia require constant reference to the first major bryophyte collection made on the island by H. Will during the German International Polar-Year Expedition, 1882–83. The whereabouts of the moss types and other relevant specimens from this collection have been indicated elsewhere (Greene, 1973). The purpose of this note is to report the existence of a further small amount of unpublished Will material in the Institut für systematische Botanik, University of Graz, Austria (GZU), which apparently was not examined by Müller (1890) to whom, it was thought, all of Will's moss collections were sent. Although no collectors name or number appears on any of the specimens, there is no doubt that they were collected by Will as the dates of collection coincide with those of the German expedition and the hand-written labels are in Will's distinctive rather illegible style.

The collection comprises 13 packets of mosses and a single flowering plant, and their determinations together with their habitat data are given in Table I. A comparison of the locality details and the dates of collection with those published by Müller (1890) and those on labels of other authenticated Müller-determined material in a number of other herbaria shows the specimens from Graz to belong to a quite different collecting series. But as Will and Mosthaff, the members of the German expedition who were responsible for the botanical collections, did not travel far from their base in Royal Bay, some of the localities given in Table I are near to those of known specimens.

Most of the species represented in the collection are now well known from South Georgia and have been described in the series "A synoptic flora of South Georgian mosses" (Bell, 1973, 1974; Clarke, 1973; Greene, 1973; Newton, 1974), and almost without exception each

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TABLE I. SPECIMENS FROM SOUTH GEORGIA IN A PREVIOUSLY UNNAMED COLLECTION IN GRAZ

Locality and date of collection	*Species*	*Herbarium accession number*
Musci		
Am Ufer des Hausbaches 'Wally' in der Nähe der Station, 24 Februar 1883	*Philonotis acicularis* (C. Muell.) Kindb.	136531
Sumpfiges Terrain in der Nähe der Station, 24 Februar 1883	*Drepanocladus* sp.	136525
Am Ufer des Hausbaches 'Wally' in der Nähe der Station, 24 Februar 1883	*Bartramia subsymmetrica* Card.	136527
Am Ufer des Hausbaches 'Wally' in der Nähe der Station, 24 Februar 1883	*Pohlia wahlenbergii* (Web. et Mohr) Andrews var. *glacialis* (Schleich. ex Brid.) E. F. Warburg	136533
Ufer des Hausbaches 'Wally' in der Nähe der Station, 24 Februar 1883	*Polytrichum alpestre* Hoppe	136534
Nördliche Seite der Landzunge, 22 Marz 1883	*Conostomum pentastichum* (Brid.) Lindb.	136535
Nördliche Seite der Landzunge, 22 Marz 1883	*Bartramia patens* Brid.	136536
Nördliche Seite des Köppenberges, 9 Mai 1883	*Bartramia patens* Brid.	136528
Nördliche Seite des Krokisiusberges, 9 Mai 1883	*Willia austro-leucophaea* (Besch.) *Broth.*	136529
Nördliche Seite des Krokisiusberges, 9 Mai 1883	*Chorisodontium aciphyllum* (Hook. f. et Wils.) Broth.	136530
Nördliche Seite des Krokisiusberges, 9 Mai 1883	*Dicranoloma hariotii* (C. Muell.) Par.	136526
Nördliche Seite des Köppenberges in einer Wasserrinne, 19 Mai 1883	*Chorisodontium aciphyllum* (Hook. f. et Wils.) Broth.	136532
Süd Seite des Krokysiusberges etwa 100 m. Höhe, 13 Juli 1883	*Racomitrium lanuginosum* (Hedw.) Brid.	136524
Spermatophyta		
Little-hafen an einer Felsmand in der Nähe des Strandes, 20 Mai 1883	*Montia fontana* L. ssp. *fontana*	136519

specimen falls within the morphological and anatomical limits of each species in those papers. There are two specimens, however, which are not altogether straightforward, i.e. those named *Drepanocladus* sp. and *Bartramia subsymmetrica*. An account of *Drepanocladus* has not yet been published in the series and, until work on this genus is completed, it is inappropriate to suggest a specific diagnosis for the specimen particularly as the leaves are not falcato-secund and therefore would appear not to fall within the well-known *D. uncinatus* group which constitutes the majority of the specimens of this genus so far collected on South Georgia.

Although the genus *Bartramia* has recently been treated by Newton (1974), the Graz specimen is not easily placed in either *B. patens* or *B. subsymmetrica*, the two species of the genus reported from South Georgia. Its leaves fall mid-way between the 4 : 1 leaf length : basal

portion width ratio which would indicate *B. subsymmetrica* and the 6 : 1 ratio which would indicate *B. patens*. The central cells of the nerve in general show the uniform size in transverse section as described for *B. subsymmetrica* but occasionally a larger central cell is indicative of *B. patens*. Unfortunately there are no sporophytes available which could be expected to confirm a specific diagnosis but the typical compact growth form and the obvious very wet habitat strongly suggest the material belongs to *B. subsymmetrica*. This species was first described by Cardot (1906) for material collected by Skottsberg on South Georgia during the German International Polar-Year Expedition, thus making the Will specimen in Graz the earliest known from the island.

The specimen of *Montia fontana* ssp. *fontana* may have been inadvertently included in this moss collection, because its growth form and small pandurate leaves are not dissimilar to certain genera of mosses. It is interesting to note that Greene (1964) was unable to locate a Will-collected specimen of this vascular species during his preparation of the vascular flora of South Georgia and, although the specimen from Graz was collected on a date different from that given by Engler (1890), it is from the same locality as the first-cited record of the species from the island. According to Engler, Will collected material of *M. fontana* in "Thal im Little-Hafen; in einer Felspalte am Strand, 20.i.83", while the label of the Graz specimen reads "Little-Hafen an einer Felsmand in der Nähe des Strandes, 20.v.83".

The existence of this previously undocumented collection suggests that further specimens from the Swedish South-Polar Expedition of 1901–03 may be extant in other European herbaria but that, like the Graz material, they are unnamed and consequently their historical significance has not been appreciated.

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NOTES ON ANTARCTIC BRYOPHYTES: X. THE GENUS *Pottia* FROM THE ANTARCTIC BOTANICAL ZONE

By C. M. MATTERI*

ABSTRACT. *Pottia austro-georgica* Card. is reported for the first time from within the Antarctic botanical zone from various localities in the South Orkney and South Sandwich Islands. *Pottia heimii* (Hedw.) Hamp. is reported as new for the South Orkney and South Shetland Islands. *Pottia heimii* var. *charcotii* (Card.) L. Savicz et Z. Smirn. is reduced to synonymy. Notes on habitat and distribution, as well as a key for the identification of species, are provided.

THREE taxa of *Pottia* have been reported from within the Antarctic botanical zone, *Pottia heimii* (Hedw.) Hamp. (Bartram, 1957), *P. heimii* var. *brevinervis* L. Savicz et Z. Smirn. (Savicz-Ljubitzkaja and Smirnova, 1963) and *P. charcotii* Card. (Cardot, 1911), the latter being subsequently re-defined as a variety of *P. heimii* (Savicz-Ljubitzkaja and Smirnova, 1963, 1965).

Recent examination of bryophyte collections from the South Sandwich, South Orkney and South Shetland Islands has revealed the presence of *P. austro-georgica* Card., so far considered restricted to South Georgia, and of *P. heimii* var. *heimii* previously known from Antarctica from a single locality on Neny Island. *P. heimii* var. *brevinervis* is so far only known from the Bunger Hills (Savicz-Ljubitzkaja and Smirnova, 1963) and is not treated here.

All the material examined, except for the types, is from the bryophyte herbarium of the British Antarctic Survey (AAS) at present housed at the Institute of Terrestrial Ecology's Research Station at Bush, Penicuik, Midlothian, Scotland. Herbarium abbreviations are those recommended by Holmgren and Keuken (1974).

Pottia austro georgica Card.

The species was first reported and described from South Georgia by Cardot (1906) and subsequently reduced to synonymy with *Hennediella microphylla* (R. Brown ter.) Par. by Dixon (1923). Examination of type material of the taxa involved has shown that *P. austro-georgica* should be considered a distinct taxon. A full discussion of the taxonomy of the species will be found in Matteri (1977).

The material from the South Orkney Islands includes 20 specimens of fruiting *P. austro-georgica*, some abundantly so, e.g. R. Smith 127 and Longton 1085. The typical small dense cushions, characterized by short stems with crowded erecto-patent leaves, occur on rock surfaces and on soil between screes. When present, the short cylindrical mature capsule almost completely covered by a long cucullate calyptra is a further typical feature of the species and should enable ready separation from *P. heimii*. Mature capsules of the latter only rarely bear the characteristically shorter calyptrae and also differ in having a persistent operculum attached to the columella, a feature not found in *P. austro-georgica*.

The following key should enable identification of sterile specimens of both taxa:

Areolation lax, cells>15 μm. long; plants light green to yellow; leaves without a prominent border .. .. ***P. heimii***

Areolation not lax, cells<15 μm. long; plants dark green to brown; leaves with a prominent border .. .. ***P. austro-georgica***

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When moist, small sterile specimens of *Tortula* may be distinguished from material of both species by their spreading leaves with reflexed apices in contrast to the erecto-patent leaves of the *Pottia* spp.

Distribution in the Antarctic botanical zone

South Sandwich Islands *Vindication Island:* Longton 730b (AAS). **South Orkney Islands** *Coronation Island:* East side of Olivine Point, R. Smith 127 (AAS, CHR, LE, MEL, NY); Cape Vik, R. Smith 566 (BM); Meier Point, R. Smith 586 (AAS, PC); "Windscoop Buttress", Webb 159a (AAS). *Lynch Island:* R. Smith 526 (BM, S, SGO, TNS). *Signy Island:* Outcrop between streams running from lake 4, Webb 5 (AAS); south-east of marble outcrop between streams from lake 4, Webb 27 (BM); between lakes 3 and 4, Webb 84 (BM); south-west of Factory Cove, Webb 37 (BM), Webb 77 (AAS), Webb 91 (AAS), Webb 124 (AAS), Webb 139 (BM); Factory Cove, Longton 840 (BM), Webb 32 (AAS); between Factory Cove and Moraine Valley, Webb 104 (BM); north side of Observation Bluff, R. Smith 325a (BM); between Observation Bluff and Polynesia Point, Longton 1085 (AAS, BA); ridge north-east of Thulla Point, R. Smith 406 (AAS); Foca Point, R. Smith 336 (AAS, BA).

Pottia heimii (Hedw.) Hamp. var. *heimii*

Syn. Pottia charcotii Card.
Pottia heimii var. *charcotii* (Card.) L. Savicz et Z. Smirn.

The first record of this species from within the Antarctic botanical zone was based on a single specimen collected by a member of the United States Antarctic Service Expedition 1939–41 (Bartram, 1957). This specimen (FH, Bryant 36, Neny Island) was examined by the author and is similar to plants formerly referred to *Pottia charcotii*.

Antarctic material of *Pottia heimii* forms compact short cushions, light green to yellow above, growing frequently on moist soil amongst scree and boulders and also in rock crevices at *c.* (5—) 15–60 m. a.s.l., and shows remarkable variability in vegetative and sporophytic characters. The most variable vegetative organs are the leaves which may range from being shortly ovate and very concave with erect to incurved margins to widely ovate or oblongo-lanceolate with plane margins. Leaf size varies from 1·0–2·0 × 0·5–1·0 mm. increasing from base to apex of the shoots (Fig. 1). In most leaves a robust nerve reaches the apex or disappears just below it but occasionally the nerve may be excurrent in a shorter or longer mucro. Some distinct teeth are usually present on the apical margins, although they differ considerably in number and structure, at times the margin being only sinuose or even entire. Upper leaf cells may have C-shaped or circular papillae or both, being denser near the nerve and fewer towards the margin, but frequently the papillae are poorly developed or absent so that the cells look completely smooth. All these variations may be found occurring among the shoots of the same specimen and very often along one shoot. Cell shape and size seem to be more consistent characters. They are always thin-walled, lax, irregularly polygonal, 5–6 sided, not differentiated at the margins, 15·0–29·0 × 12·0–29·0 mm. and generally pellucid. Amongst the sporophyte characters, the yellowish seta varies from 5·0 to 10·0 mm. in length, is usually straight and bears shortly ovate to longly cylindrical capsules with a persistent rostrate operculum attached to the columella. The calyptrae are usually fugacious and are not found on mature capsules.

Pottia charcotii, as defined by Cardot (1911, 1913), was distinguished from *P. heimii* by "... ses feuilles plus courtes, plus concaves, plus brusquement contractées au sommet, entières, son tissu plus lâche, pellucide, lisse ...". It has already been pointed out by Savicz-Ljubitzkaja and Smirnova (1963) and corroborated by the author from an examination of

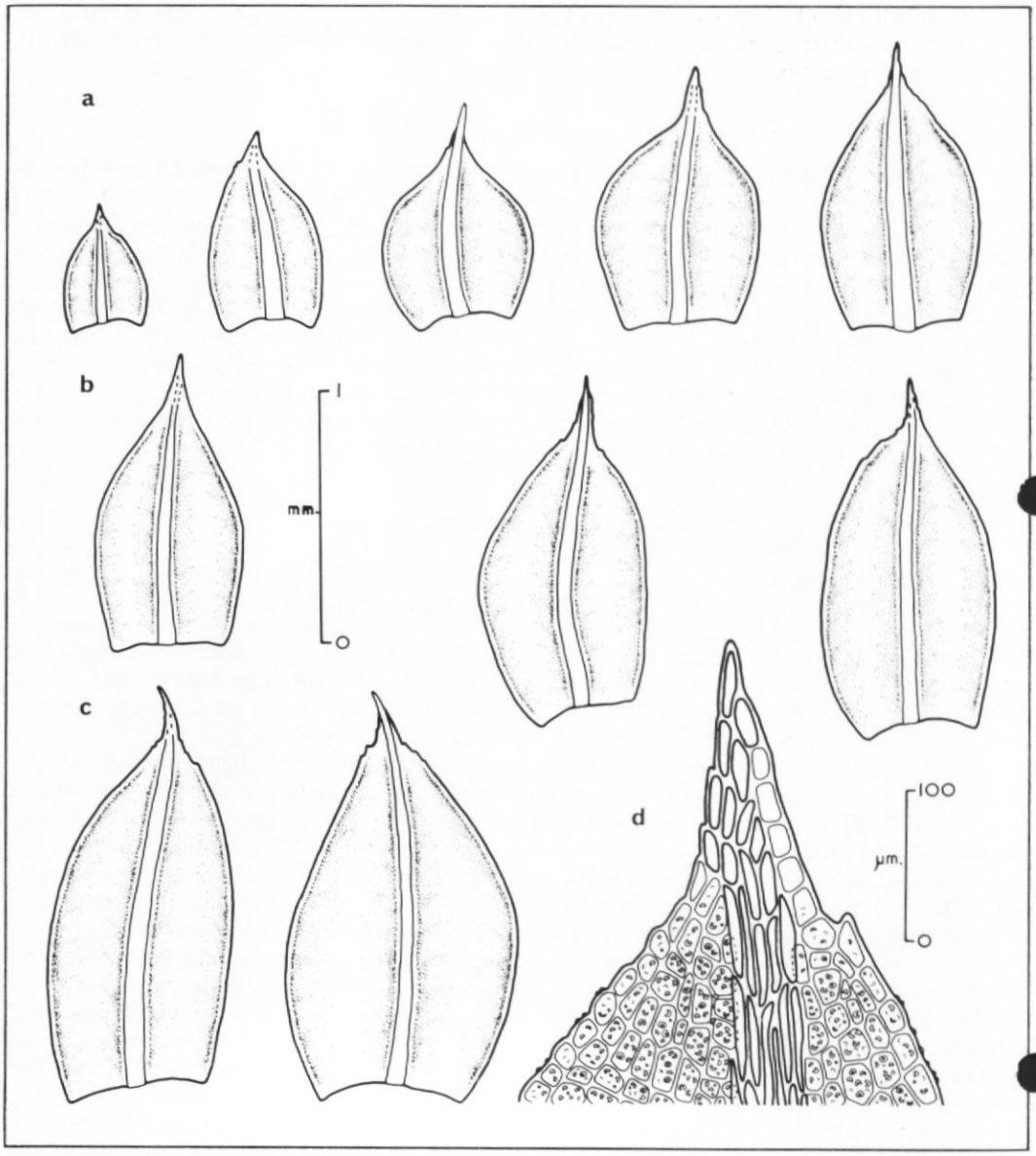

Fig. 1. *Pottia heimii* (Hedw.) Hamp. var. *heimii*.
a. Lower leaves; b. and c. Upper leaves; d. Leaf apex.
Scales: Left-hand for leaves; right-hand for cells.

syntypes (Gain 272b PC and Gain 273c H, PC, Terre de Graham, Cap des Trois Perez,* leg. Gain 6.iii.1909) that smooth leaves very often alternate with slightly or densely papillose leaves having both C-shaped and circular papillae. Moreover, the characters of the vegetative leaves fall well within the range of variation of *Pottia heimii* and are inseparable from the

* Now known as Cape Pérez.

Antarctic material of that species. In view of these facts and the evidence of several specimens, notably R. Smith 216 and Longton 1054 which showed on the same stem a striking variability in leaf structure (Fig. 1) clearly linking characteristic *P. heimii* and *P. charcotii* leaves, there seems to be no justification for maintaining *P. charcotii* as a separate taxon, not even as a variety of *P. heimii*, and it is accordingly here reduced to synonymy of that species.

Distribution in the Antarctic botanical zone

South Orkney Islands *Powell Island:* Promontory on south-east coast, R. Smith 215 (AAS), R. Smith 216 (BM). *Matthews Island:* North-west coast, R. Smith 161 (AAS), R. Smith 167 (BM). *Coronation Island:* Shingle Cove, R. Smith 453 (AAS); *Signy Island:* South of North Point, R. Smith 657 (BM); Factory Cove, Longton 1054 (AAS, BA); Orwell Glacier, Moraine Valley, R. Smith 412 (BM), R. Smith 545 (AAS); Observation Bluff, R. Smith 16 (BM), R. Smith 325b (AAS); Polynesia Point, Webb 96 (BM); Port Jebsen, R. Smith 427 (AAS).

South Shetland Islands *Livingston Island:* Byers Peninsula, Lindsay 328 (BM). *Deception Island:* Base of Ronald Hill, Longton 897b (AAS, BA); Cathedral Crags, R. Smith 78 (BM).

Antarctic Peninsula, Loubet Coast *Blaiklock Island:* R. Smith 842b (AAS).

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