BRITISH ANTARCTIC SURVEY

SCIENTIFIC REPORTS

No. 89

THE MACROLICHENS OF SOUTH GEORGIA

By

D. C. LINDSAY, B.Sc., Ph.D.

British Antarctic Survey
and
Department of Botany, University of Birmingham

LONDON: PUBLISHED BY THE BRITISH ANTARCTIC SURVEY: 1974
NATURAL ENVIRONMENT RESEARCH COUNCIL

BRITISH ANTARCTIC SURVEY SCIENTIFIC REPORTS: No. 89

THE MACROLICHENS OF SOUTH GEORGIA

By

D. C. LINDSAY, B.Sc., Ph.D.

*British Antarctic Survey**
and
Department of Botany, University of Birmingham

(Manuscript received 10th July, 1974)

ABSTRACT

THE physical and biological features of the sub-Antarctic island of South Georgia are outlined. Earlier lichenological investigations are briefly noted and details of collectors, collections and herbaria, and previous publications are tabulated.

The systematic account of the macrolichens contains a tabulation of all genera and species, including microlichens, known from the island. The detailed account of the macrolichens includes keys to genera and species, details of synonymy, iconography, literature descriptions and world distribution. Descriptions are given of 28 genera of macrolichens, comprising 64 species, and their distribution on South Georgia is mapped by means of 5 km. grid squares.

A brief outline of the main lichen-rich plant communities is given and comparisons are made with similar communities occurring in the maritime Antarctic. Attention is drawn to the serious effects of reindeer grazing and trampling at several localities.

Several provisional distribution patterns within South Georgia are considered and the strong bi-polar and cosmopolitan elements amongst the macrolichens are emphasized. Dispersal mechanisms are discussed in relation to possible origins of the macrolichen flora with reference to availability of habitats and various phases of glaciation.

Three appendices are provided which itemize specimens examined together with details of herbaria and field records, give notes on four fungal parasites, and provide an index to the genera and species described.

* Present address: The Museum and Art Gallery, New Walk, Leicester LE1 6TD.

CONTENTS

I. INTRODUCTION

THE island of South Georgia (Fig. 1) lies just south of the Antarctic Convergence, between lat. 53°30′ and 55°00′S., and long. 35°30′ and 38°30′W., about 1,500 km. east of Cape Horn, the southernmost tip of South America. It is thus very isolated in the vast Southern Ocean that surrounds Antarctica but, in this respect, it is similar to the other islands or island groups, such as Iles Kerguelen, Heard and Macquarie Islands, all of which lie between lat. 45° and 60°S., and which were included in the sub-Antarctic botanical zone by Greene (1964). Some of these islands may have acted as plant refugia when the glaciation of the Antarctic continent forced species to migrate northward, or as links in a chain of long-distance dispersal during the re-colonization of the Antarctic continent after the retreat of the ice following the glacial maximum.

Because of its geographical position, South Georgia may be thought to have strong floristic affinities with the other sub-Antarctic islands, and more particularly with Tierra del Fuego and the Falkland Islands as well as with the island groups of the Scotia Ridge, i.e. South Sandwich, South Orkney and South Shetland Islands. During his extensive travels in the Southern Hemisphere in 1839–43, J. D. Hooker was the first to notice this affinity, stating "The Fuegian flora possesses some other points of interest, especially when viewed in comparison with that of the other Antarctic islands lying south of New Zealand, also with that of the Falklands, South Georgia, Tristan da Cunha, and Kerguelen Island. All these countries, though the latter is distant more than 5,000 miles, seem to have borrowed many plants from this [Fuegia], the great botanical centre of the Antarctic Ocean" (Hooker *in* Ross, 1847, Vol. 2, p. 294–95).

From a phytogeographical point of view, the features common to the islands of the sub-Antarctic botanical zone may be summarized thus:

i. Geographical isolation from continental land masses. South Georgia is about 1,500 km. from South America and the Antarctic Peninsula, while Iles Kerguelen are over 4,000 km. from either Australia or South Africa.

ii. The effects of present or previous glaciation. Most of the sub-Antarctic islands still support ice caps but glaciation was formerly much more extensive with most, if not all, of the islands being ice-covered.

iii. Proximity to the Antarctic Convergence. The existence of cold-water currents flowing northward from Antarctica, meeting with south-flowing warmer waters, has a profound influence on climate, which is thus extremely oceanic, i.e. low mean annual temperature with low annual sunshine values, although there may be great diurnal temperature variation and high precipitation.

iv. Some degree of floristic endemism. This has been demonstrated in most plant groups, apart from the lichens, for South Georgia and the other sub-Antarctic islands.

While attempts have been made to relate phytogeographical ideas concerning the distribution of Southern Hemisphere phanerogams to the problems posed by the region's lichen flora, in comparison with the northern polar regions, few collections have been made in the Antarctic or sub-Antarctic botanical zones and even fewer lichenologists have worked there. The result has been a small and infrequent literature based on scanty collections. With regard to the Antarctic botanical zone, a number of reports have been published dealing with the collections of national expeditions. Typical of these are the reports of Darbishire (1912, 1923), Dodge (1948), Dodge and Baker (1938), and Hue (1915). In these reports, the authors have developed distinctive species concepts to deal with the problems posed by the high degree of environmental variation exhibited by their material. As a result, species concepts have varied widely. Darbishire (1912, 1923) was conspicuous in the constancy of his geographical concepts and he strove continuously to find affinities between floras, although occasionally his conclusions were erroneous, being based on a faulty taxonomy. More recently, Lamb (1948*a*, 1964, 1968), through a critical and comparative approach, has reviewed several families of Antarctic lichens and produced some interesting phytogeographical information (discussed on p. 68–74). The most recent statement on Antarctic lichens has been given by Dodge (1973) in his lichen flora of Antarctica and adjacent islands. However, this flora has a number of

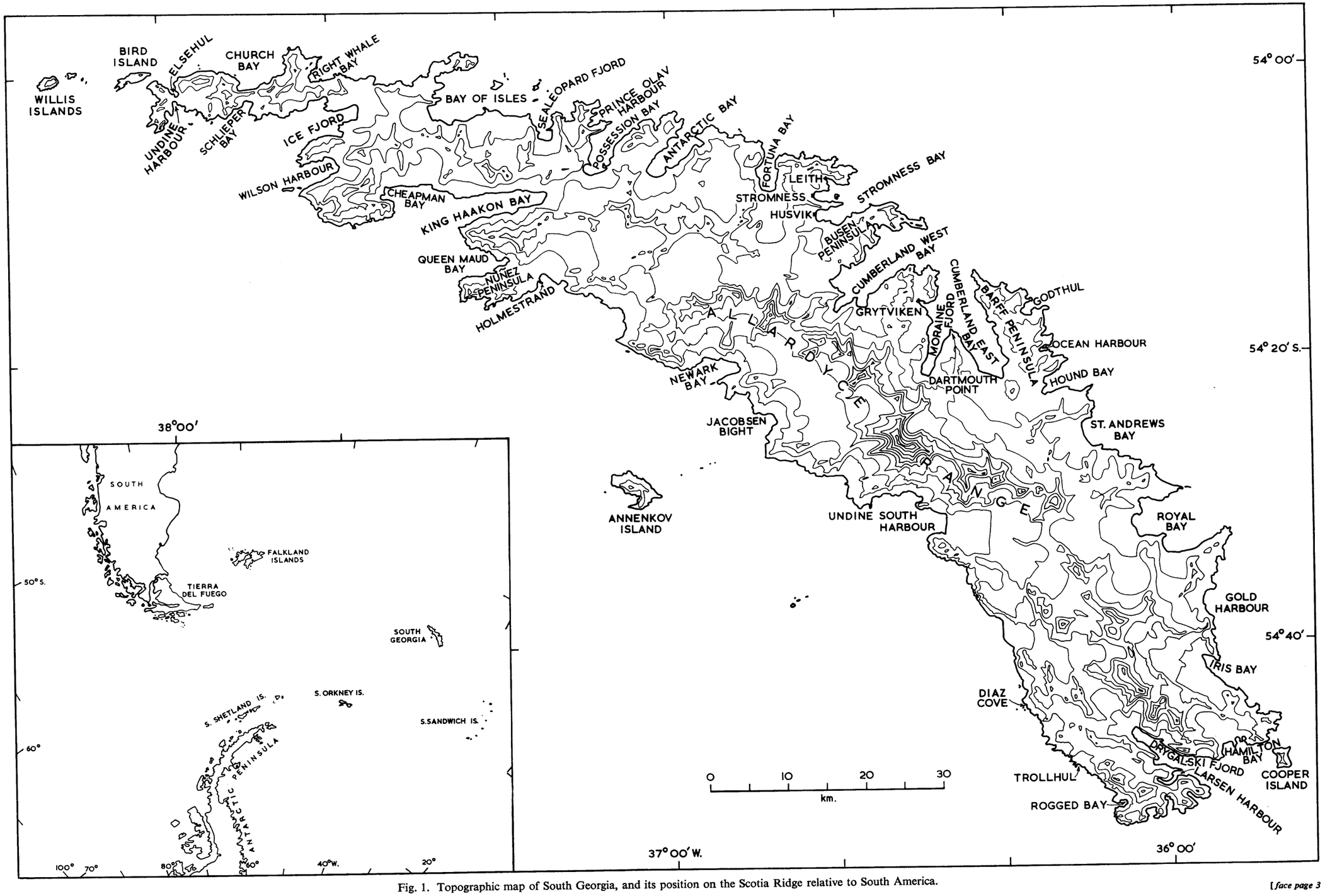


Fig. 1. Topographic map of South Georgia, and its position on the Scotia Ridge relative to South America.

[face page 3

defects, most notable being the unique species concept of the author, which precludes comparison of his work with that of others.

Regarding the lichens of the sub-Antarctic botanical zone, very little has been published. Dodge (1948) has presented species lists for Iles Kerguelen and some of the New Zealand shelf islands, but these lists are based in part on publications dating from the nineteenth century with no revision of species concepts. The temperate regions of the Southern Hemisphere have received slightly more attention than the sub-Antarctic botanical zone and, in an attempt to stimulate further studies on taxonomic and phytogeographical problems, several check lists have been published, e.g. for Australia (Weber and Wetmore, 1972), Tasmania (Wetmore, 1963), New Zealand (Martin, 1966), South Africa (Doidge, 1950), and Argentina and the Falkland Islands (Grassi, 1950). However, all of these are mainly compilations of literature, without a critical review of species concepts. Thus any distribution patterns of Southern Hemisphere lichens obtained by a perusal of these lists must be treated with caution.

The purpose of the present report is to outline the nature and extent of the South Georgian macrolichen flora, to provide a basis for comparisons between various regions in the Southern Hemisphere. Thus, a revision of species concepts of the island's macrolichens has been attempted to provide a firm basis for these comparisons. The availability of representative collections of macrolichens, together with some uniformity in acceptance of species concepts and limits, allows a number of phytogeographical conclusions to be drawn, but their value and number will be greatly enhanced as similar detailed taxonomic studies are undertaken in related floras. Such an approach is not yet possible for the microlichens, a group which has suffered severely from undercollecting and inadequate taxonomic study and so any attempt to discuss their distribution patterns in the Southern Hemisphere cannot result in any worthwhile conclusions.

II. THE ISLAND OF SOUTH GEORGIA

A. Physical and Climatic Characteristics

1. *Geology and topography*

South Georgia (Fig. 1) is a small crescent-shaped island elongated in a north-west to south-east direction, being *c.* 160 km. in length with an average width of *c.* 30 km. Its geology has been studied by Trendall (1953, 1959) and summarized by Adie (1964), who stated that South Georgia is composed of low-grade metamorphosed sediments of Palaeozoic to Mesozoic age, the deposits being mainly volcanic greywackes. These rock types form the exposures encountered along most of the north-east coast and the northern half of the south-west coast. At the south-eastern end of the island there is an igneous complex, whereas sedimentary rocks of Lower Cretaceous age are interbedded with lavas and intruded by basic dykes along the eastern half of the southern coast.

The island is very mountainous with the axial Allardyce Range, which rises to *c.* 2,950 m. in Mount Paget, separating two contrasting coasts. The south-west, or weather coast, is heavily glacierized with numerous glaciers debouching into the sea. It is broken by headlands rising abruptly from the sea and development of extensive lowland areas behind the beach is uncommon on this coast. By contrast, the north-east coast is much less extensively glacierized and many glaciers terminate on land, so that the coast is very deeply indented and embayed, and frequently there are large areas of coastal lowland. The interior of the island is heavily glacierized with large cirques, although there are a few snow fields towards the less mountainous northern end. Passes through the central mountain range are few and these occur mainly on the northern half of the island. In only a few places, such as Stromness Valley and Hestesletten (Cumberland East Bay), is there any expanse of level ground, other ice-free areas being more broken, e.g. glacially eroded valleys, ridges and features of marine origin such as wave-cut platforms.

Glacial deposits in the form of moraines are found widely on the north-east coast, particularly in the Cumberland Bay area. Moreover, as the fine-grained greywackes are very susceptible to frost-shattering, the result is an abundance of steep unstable screes in many valleys. The permanent snow line lies about 450–600 m. a.s.l. on the north-east coast, depending on the degree of exposure, but is much lower, about 300 m. a.s.l., on the south-west coast. In summer, ice-free pools, sometimes reaching the proportions of lakes, are extensive along the north-east coast, where waterfalls and streams are numerous.

Detailed accounts of the geomorphology and Quaternary history for the Cumberland Bay–Stromness Bay and Prince Olav Harbour–Stromness Bay areas have been published by Clapperton (1971) and Skidmore (1973), respectively. Both of these authors have shown that South Georgia has been subjected to considerable glacial and marine erosion. Clapperton (1971) has discussed the geomorphological evolution of the landscape of the Cumberland Bay area in great detail, and has given evidence for four phases of glaciation in this area. The first was the most extensive with an ice cap covering most of the rock and extending at least 15 km. out to sea beyond the present coastline. The age of this glaciation is not known accurately but it probably took place several million years ago. The second phase was less extensive with valley glaciers advancing only 4–5 km. at the most. However, considerable erosion of valleys occurred and many, such as Moraine Fjord, were overdeepened by the removal of several hundred metres of debris during this period. The large terminal and lateral moraines, which are prominent in several parts of the Cumberland Bay area, mark the maximum limits of the glaciers during the second phase, which probably occurred about 6,000–10,000 yr. B.P. The two latest phases involved only relatively minor fluctuations of the glacier snouts, the maximum advances occurring in the eighteenth or nineteenth centuries and the decade between 1920 and 1930. The significance of these events with regard to the history of the lichen flora on South Georgia is discussed on p. 71–74.

2. *Climate*

The climate of South Georgia is cool oceanic, with no well-defined seasonal variations in any parameter. Data on the climate of the island, based on observations made at the meteorological station at King Edward Point, Cumberland East Bay, have been published by Pepper (1954) and Smith (1971), and a summary is given in Table I. The mean annual temperature is 1·8° C, the mean for August, the coldest

TABLE I
SUMMARY OF SYNOPTIC METEOROLOGICAL DATA FROM KING EDWARD POINT, CUMBERLAND EAST BAY, SOUTH GEORGIA, 1944–64

Month	*Mean day length* (hr.)	*Mean daily sunshine* 1950–64 (hr./day)	*Temperature* (°C)			*Mean daily wind speed* 1944–45, 1950–61, 1963–64 (m./sec.)	*Mean daily relative humidity* 1944–63 (per cent)	*Total water-equivalent rainfall* 1944–64 (mm.)
			Mean daily 1944–64	*Mean daily maximum* 1944–45, 1950–63	*Mean daily minimum* 1944–45, 1950–63			
January	16·5	4·7	4·6	8·7	1·9	4·2	74	119·6
February	14·7	5·2	5·4	9·5	2·3	4·6	72	117·8
March	12·6	4·1	4·8	8·6	1·9	4·8	73	144·9
April	10·4	2·3	2·5	6·1	−0·3	4·2	77	140·6
May	8·4	1·1	0·3	3·8	−1·9	3·9	78	154·5
June	7·4	0·3	−0·9	2·4	−3·3	4·0	78	153·1
July	7·9	0·7	−1·6	1·6	−4·3	4·1	77	132·5
August	9·5	2·3	−1·8	1·7	−4·4	4·2	76	135·0
September	11·6	4·1	−0·2	3·1	−1·5	4·4	75	102·2
October	13·8	5·4	1·9	5·3	−0·6	4·3	75	97·4
November	15·8	5·8	3·0	7·1	0·3	4·4	70	97·5
December	17·0	5·1	3·6	7·3	1·0	4·2	73	90·6
Mean for month	—	3·4	1·8	5·4	−0·7	4·3	75	123·8
Mean annual total	—	—	—	—	—	—	—	1,485·7

Extreme maximum temperature: 24·0° C (February 1947); extreme minimum temperature: −13·3° C (July 1964).
Adapted from Smith (1971, table I) and based on data given by Pepper (1954) and *Annual tables of Falkland Islands Dependencies Meteorological Service*, 1951–59, and *Annual tables of British Antarctic Meteorological Service*, 1960–64.

month, being −1·8° C and that for February, the warmest month, being 5·4° C. Precipitation is heavy and falls evenly throughout the year. The prevailing wind comes from the north-west quadrant and gales are frequent. Since the path of depressions is almost always from the south-west, the south-west coast experiences more severe weather conditions than the north-east coast in the lee of the Allardyce Range. Richards and Tickell (1968) have provided some data which show the local amelioration of climate on the lee side of the Allardyce Range from a comparison of meteorological records at King Edward Point (Cumberland East Bay) and Bird Island at the north-western tip of South Georgia. Cumberland Bay was shown to have drier, warmer sunnier weather than Bird Island. Precipitation at King Edward Point may come from clouds of orographic origin but, since this locality is relatively landlocked, it is much less susceptible to the sea fogs which occur more than twice as frequently at Bird Island, which consequently has a higher relative humidity. This results in Bird Island receiving less sunshine than King Edward Point, but the height of the Allardyce Range also has the effect of breaking up layers of cloud, such as stratocumulus.

Owing to the frequent föhn winds coming down the valleys from the Allardyce Range, the Cumberland Bay area and many other valleys on the lee side of the island experience rapid temporary rises in temperature. The maximum air temperature recorded in 1963 at King Edward Point was 21·5° C, whereas the maximum recorded at Bird Island, which does not have the benefit of föhn winds, was 9·3° C (Richards and Tickell, 1968).

Unfortunately, observations at Bird Island have only been intermittent and, as no regular readings have been made at sites along the south-west coast, the data in Table I are for one of the most sheltered sites on South Georgia.

3. *Soils*

A variety of soil types is encountered, ranging from the raw mineral detritus of recently deposited ground moraines to deep peat banks. Although many of the South Georgian lichens are saxicolous, a number of ecologically prominent species occur on soil in phanerogam-dominated communities and so only a brief mention is necessary of the relevant soil types. No detailed studies have yet been published on the soils of South Georgia.

The greywackes appear to be very susceptible to various forms of glacial erosion (Clapperton, 1971) and the resulting soils include till and fluvio-glacial sand and gravel. In many localities little evolution of these soils has occurred, the till consisting of boulders and gravel in a clay matrix, especially at altitudes above the limit of closed phanerogamic communities, and the fluvio-glacial deposits as gravel and sand that may have been slightly re-worked by aeolian action. These glaciogenic soils are entirely mineral and are frequently subject to cryoturbation processes. On such soils, the only prominent lichen community is formed by *Placopsis cribellans*, which covers large areas of fluvio-glacial outwash deposits at both Right Whale Bay and Moltke Harbour (Royal Bay).

At low altitudes, these glaciogenic deposits have been modified by the development of extensive stands of various phanerogamic communities. The soil under *Festuca–Acaena* communities resembles the brown earth soils of the Arctic but, with the prevailing high precipitation, they may be subject to considerable leaching. Peat deposits may accumulate under *Rostkovia magellanica*, *Poa flabellata* and the mosses *Chorisodontium aciphyllum* and *Polytrichum alpestre*, sometimes up to several metres in depth. All of these soil types bear a number of macrolichens, several of which may be locally abundant, such as *Cetraria islandica*, *Cladonia rangiferina* and *Stereocaulon glabrum*.

B. Vegetation and Plant Communities

Although there is a wide range of habitats available for colonization, lichens only rarely form a prominent component of the South Georgian vegetation. Greene (1964) has described the main types of phanerogam-dominated plant communities noting three formations, namely tussock, grass heath, and marsh and bog formations.

The tussock formation is represented by only one association, dominated by *Poa flabellata*, and is more or less restricted to coastal areas. Greene (1964) has noted that lichens are common in open, undisturbed areas of tussock, but it appears from the lichen collections that this association is poor in terms of numbers of species.

The grass heath formation is represented by three associations, namely an *Acaena–Tortula* association, an *Acaena–Festuca* association and a *Festuca–Acaena* association. As noted by Greene (1964), this formation, which is the climax vegetation over most of the north-east sheltered coast of South Georgia, is the richest in terricolous and epiphytic lichens. The *Acaena–Tortula* association was regarded by Greene (1964) as a pioneer community which colonizes scree and moraine as a first stage in succession to the climax of grass heath. *Festuca erecta* (= *F. contracta* T. Kirk) may occur as scattered individuals and, as its frequency increases, an *Acaena–Festuca* association is formed on level ground at low altitude. At high altitudes (i.e. over *c.* 170 m.) and in exposed situations, *Phleum alpinum* and *Deschampsia antarctica* tend to replace *F. erecta*. The grass heath communities reach their climax in the *Festuca–Acaena* association, which develops on well-drained stabilized ground and contains more associated species than either of the other two grass heath associations.

The marsh and bog formation is represented by two communities. The first, a *Juncus–Deschampsia* association dominated by *Juncus scheuchzerioides* and *Deschampsia antarctica*, is found beside streams and in seepage areas, and does not appear to be rich in lichens. The second community, a *Rostkovia magellanica* association, forms bogs on valley floors and hollows with inadequate drainage. Greene (1964) noted that the surface of such bogs was mainly bryophytic with lichens being uncommon.

The next collection of lichens from the island was the relatively large one obtained by C. J. F. Skottsberg during the Swedish South-Polar Expedition of 1901–03. Over 60 specimens, mostly unnumbered, were gathered representing 33 species (Darbishire, 1912). Skottsberg re-visited the island in 1909 during the Swedish Magellan Expedition of 1907–09 and the lichens he collected were reported by Zahlbruckner (1917), who listed 13 species from South Georgia, two of them being new to science. Zahlbruckner (1917) also revised most of the material reported by Darbishire (1912) and Müller [Argoviensis] (1886, 1888*a*, 1890), correcting several erroneous determinations by these authors.

Skottsberg's 1902 collection is preserved in Stockholm (S) and was examined by the author, but it may be noted in passing that a small set of duplicates, stated by Darbishire (1912) to be at Kew (K), could not be traced. Part of this collection was revised by Du Rietz (1924).

Almost at the same time as Skottsberg's second visit to South Georgia, C. A. Larsen, manager of the whaling station at Grytviken (Cumberland East Bay) made a small collection which was eventually reported by Du Rietz (1924, 1926). This material is believed to be preserved at Uppsala (UPSV). R. C. Murphy visited the island on an ornithological expedition during 1912–13 and collected botanical specimens from which seven lichens were identified (Taylor, 1914). This collection has not been located, enquiries at Brooklyn (BKL) and New York (NY) failing to confirm its presence. The collection is in need of revision since some of Taylor's determinations seem very dubious.

A small general plant collection was made by D. Bergström in 1921, of which only one lichen specimen appears to have been published (Lamb, 1948*b*). Lamb noted that the material was housed at Göteborg (GB) but enquiries there failed to reveal its existence.

The existence of a collection of 83 packets of lichens collected by T. Trøim during 1927–33 has recently been discovered at Trondheim (TRH). Some identifications were published by Lindsay (1972*c*) and the remainder of the macrolichen data is published in this report.

From 1933 to 1955 no lichens appear to have been collected as, so far as is known, none is present in the collections of Operation Tabarin (1943–45) or of W. J. L. Sladen (1949–51), but since the early 1960's some have been obtained by British Antarctic Survey personnel as part of more general plant collections. So far, few results from the study of this material, numbering over 2,000 specimens, have been published (Lindsay, 1969*b*, 1971*a*, *b*, *c*, *d*), but the results of the study of the macrolichens are included in this report. The largest collection so far made on South Georgia was that obtained by the author, who surveyed the island lichenologically during 1971–72.

III. PREVIOUS LICHENOLOGICAL INVESTIGATIONS

ALTHOUGH many plant collections have been made on South Georgia (Greene, 1964), no account of the work on the island's lichen flora has yet been published. A summary of the lichen collections so far known and their related publications are given in Table II.

The first known lichen collection from South Georgia was made by H. Will, a member of the German International Polar-Year Expedition, in 1882–83. From this material, 26 species were listed, nine being

considered as new to science (Müller [Argoviensis], 1886, 1890). Dr. Wilken, a surgeon on board S.M.S. *Marie* which transported the members of the Expedition homeward in September 1883, collected two lichens presumably from the Royal Bay area and these two crustose species were described by Müller [Argoviensis] (1888*a*).

To complete this review of literature relating to the South Georgian lichen flora, it may be mentioned that some data on the microlichens of South Georgia have already been published. The genera *Buellia* and *Rinodina* have been revised (Lindsay, 1973*d*) and some phytogeographical problems raised by their patterns of distribution within the Antarctic regions briefly discussed. Some data relating to changes within the South Georgian lichen flora have also been published. A number of lichens considered to be aliens, which were introduced on timber during the construction of buildings on the island, have been discussed by Lindsay (1973*a*). Changes in the lichen flora of certain areas affected by reindeer grazing and trampling, where it appears some lichen species are in danger of local extinction, have been mentioned briefly by Lindsay (1973*b*).

Almost all of the collections listed in Table II were made by untrained personnel or botanists specializing in plant groups other than lichens, so that frequently only the larger, more conspicuous macrolichens are represented. This imbalance has been partially redressed by S. W. Greene's and the author's collections, which contain representatives of all lichen groups.

Table II does not include details of the field records in the British Antarctic Survey's data bank which were obtained mainly for distribution mapping purposes, and which are not supported by any permanent specimens. In these cases, small voucher specimens of nearly all records were confirmed by the author before each record was accepted. Field records were provided by C. J. Barrow, T. V. Callaghan, N. J. Collins, J. A. Edwards, T. C. Gunn, I. Hogg, R. I. L. Smith, J. R. Tallowin, D. W. H. Walton and E. P. Wright, as well as the author, at various times between 1967 and 1974, and details will be found in Appendix A (p. 77).

IV. SYSTEMATIC ACCOUNT

A. Arrangement of Text

A systematic classification of all lichen genera so far known from South Georgia is presented below, it being considered that the inclusion of microlichen genera, with estimates of their number of species, will be of use in showing how the macrolichens relate to the composition of the island's total known lichen flora. The present total of 50 genera and *c.* 152 species is a considerable advance on the 23 genera and 58 species listed in the last published check list (Darbishire, 1912). Of the genera listed below, the 28 printed in bold italics, comprising 64 species, are considered as macrolichens and are treated in this report.

Preliminary studies have been carried out on the microlichen genera (Lindsay, 1973*d*, 1974) and from these and other studies, apart from *Lecidea*, the number of species in each appears to be well established. In *Lecidea* several species seem to be polymorphic and, as a result of problems of assessing the limits of variation in taxa, the number of species is currently estimated at *c.* 16.

Classification of South Georgian Lichens

Class Ascomycetes

Subclass Ascomycetidae

Order Lecanorales

Collemataceae	***Leptogium*** (2 spp.)
Pannariaceae	***Pannaria*** (1 sp.)
	Parmeliella (1 sp.)
	Psoroma (3 spp.)
Placynthiaceae	*Antarctomia* (1 sp.)
Peltigeraceae	***Massalongia*** (1 sp.)
	Peltigera (5 spp.)

TABLE II
KNOWN LICHEN COLLECTIONS FROM SOUTH GEORGIA UP TO 1973–74

Collector and season	*Expedition*	*Publication*	*Main herbarium*	*Number of specimens**
H. Will, 1882–83	German International Polar-Year Expedition, 1882–83	Müller [Argoviensis], 1886, 1890	HBG	7
Wilken, 1883	German International Polar-Year Expedition, 1882–83	Müller [Argoviensis], 1888*a*	HBG	2
C. J. F. Skottsberg, 1901–02	Swedish South-Polar Expedition, 1901–03	Darbishire, 1912; Zahlbruckner, 1917; Du Rietz, 1924; Dodge, 1965*a*, 1970	S	67
C. J. F. Skottsberg, 1908–09	Swedish Magellan Expedition, 1907–09	Zahlbruckner, 1917; Du Rietz, 1924	UPSV	Not known
C. A. Larsen, 1909–10	Manager, Grytviken whaling station	Du Rietz, 1924, 1926	UPSV	Not known
R. C. Murphy, 1912–13	South Georgia Expedition	Taylor, 1914	Not located	Not known
D. Bergström, 1921	Unknown	Lamb, 1948*c*	GB†	Not known
T. Trøim, 1927–33	Chemist, Grytviken whaling station	Lindsay, 1972*c*	TRH	83
W. N. Bonner, 1955–58	Government Sealing Inspector, Falkland Islands Dependencies	—	BM	37
J. Smith, 1956–58	Falkland Islands Dependencies Survey	—	AAS	44
J. B. Cragg, 1957–58	Falkland Islands Dependencies Survey	—	DHM	5
S. W. Greene, 1960–61	Botanical expedition to South Georgia	Lindsay, 1971*a*, *b*, *c*, *d*, 1972*a*, *c*	AAS	342
M. W. Holdgate, 1961–62	British Antarctic Survey	Lindsay, 1973*c*	AAS	1
R. E. Longton, 1963–65	British Antarctic Survey	Lindsay, 1972*c*, 1973*c*	AAS	17
R. W. M. Corner, 1963–64	British Antarctic Survey	—	AAS	1
T. Lynch, 1963–64	Combined Services Expedition to South Georgia	—	AAS	6
D. C. Lindsay, 1965–66	British Antarctic Survey	Lindsay, 1969*b*, 1972*c*	AAS	6
R. I. L. Smith, 1966–67	British Antarctic Survey	Lindsay, 1972*c*	AAS	72
G. C. S. Clarke and S. W. Greene, 1967–68	British Antarctic Survey	Lindsay, 1972*c*	AAS	5
R. I. L. Smith, 1969–71	British Antarctic Survey	Lindsay, 1972*c*, 1973*c*	AAS	134
D. C. Lindsay, 1971–72	British Antarctic Survey	Lindsay, 1973*c*, *d*, 1974	AAS	1,462

* Figures include the number of macrolichens and microlichens examined by the author.
† According to Lamb (1948*c*) but enquiries at Göteborg (GB) in 1970 failed to reveal the existence of this collection.

	Stictaceae	***Pseudocyphellaria*** (2 spp.)
		Sticta (1 sp.)
	Lecideaceae	*Lecidea* (*c.* 16 spp.)
		Lecidella (1 sp.)
		Lopadium (1 sp.)
		Psora (1 sp.)
		Rhizocarpon (3 spp.)
	Stereocaulaceae	***Stereocaulon*** (4 spp.)
	Cladoniaceae	***Cladonia*** (13 spp.)
	Clathrinaceae	***Cladia*** (1 sp.)
	Umbilicariaceae	***Umbilicaria*** (2 spp.)
	Pertusariaceae	*Ochrolechia* (3 spp.)
		Pertusaria (7 spp.)
	Acarosporaceae	*Acarospora* (4 spp.)
		Sporastatia (1 sp.)
	Lecanoraceae	*Aspicilia* (1 sp.)
		Haematomma (1 sp.)
		Lecania (1 sp.)
		Lecanora (5 spp.)
		Placopsis (3 spp.)
	Parmeliaceae	***Cetraria*** (1 sp.)
		Cornicularia (2 spp.)
		Hypogymnia (1 sp.)
		Menegazzia (1 sp.)
		Parmelia (4 spp.)
		Platismatia (1 sp.)
	Usneaceae	***Alectoria*** (3 spp.)
		Himantormia (1 sp.)
		Ramalina (1 sp.)
		Usnea (4 spp.)
	Physciaceae	*Buellia* (10 spp.)
		Physcia (2 spp.)
		Rinodina (8 spp.)
	Teloschistaceae	*Caloplaca* (9 spp.)
		Huea (1 sp.)
		Xanthoria (2 spp.)
Order Sphaeriales		
	Verrucariaceae	***Dermatocarpon*** (1 sp.)
		Verrucaria (8 spp.)
	Mastodiaceae	***Mastodia*** (1 sp.)
Order Caliciales		
	Sphaerophoraceae	***Sphaerophorus*** (2 spp.)
Subclass Loculoascomycetidae		
Order Pleosporales		
	Arthopyreniaceae	*Arthopyrenia* (1 sp.)
Class Fungi Imperfecti		
		Cystocoleus (1 sp.)
		Lepraria (2 spp.)

The systematic arrangement of genera in the classification follows that of Hale (1967). Lamb (1964) placed *Cornicularia* with members of the Usneaceae but it is here placed in the Parmeliaceae, because of its close affinity with *Cetraria*. The South Georgian endemic genus *Antarctomia* D. C. Lindsay (Lindsay, 1974) is placed in the Placynthiaceae because of its close relationship with *Arctomia* Th. Fr.

For convenience the descriptions of the macrolichen genera, and of the species within genera, are arranged alphabetically. The descriptions have been compiled from South Georgian material and comments on variation only refer to that occurring on the island, unless stated otherwise. Colours have been described by reference to the appropriate colour chips in Rayner (1970). For each species some reference has been made to photographs, descriptions and taxonomic discussion where these are available, but synonymy has been restricted to Antarctic, sub-Antarctic and Fuegian literature.

Distribution within South Georgia is summarized on maps showing the occurrence of all species by 5 km. squares of the South Georgian grid, while a list of all specimens examined will be found in Appendix A (p. 77). In addition, a map (Fig. 2) is provided showing all squares in which lichens have been collected, while Fig. 3 shows the distribution of permanent snow and ice. Thus a comparison of each species distribution with Figs. 2 and 3 will indicate whether absences are due to lack of collecting, absence of summer snow-free ground or some other factor. A summary of world distribution is given for each species where such information is available.

B. Artificial Key to Genera

As this key is based on characters of moderately to fully developed specimens, stunted material may be difficult to identify. Difficulties may occur with species of *Cladonia* and *Stereocaulon*, and in these cases the notes on the variability of the species at the end of each description should be consulted.

1. Thallus fruticose, either of erect or prostrate, branched or unbranched, cylindrical filaments, tubes or rods or of erect, strap-shaped lobes 2
   Thallus foliose, leafy or squamulose, prostrate, occasionally with ascending margins . . 14
2. Thallus of brown or black, branched, hair-like filaments 3
   Thallus not consisting of hair-like filaments 4
3. Filaments minute, giving a crust-like appearance on soil or mosses usually in rock crevices . . . . . ***Cystocoleus***
   Filaments larger, though occasionally appearing crust-like if growing on rock . . ***Alectoria***
4. Thallus consisting of solid, branched, strap-shaped lobes 5
   Thallus not strap-shaped, solid or hollow. 6
5. Thallus dark brown, glossy, spinulose along margins; in grassland and on moss banks . ***Cetraria***
   Thallus yellow or black, never glossy or spinulose; on rocks 7
6. Thallus yellow, with laminal soredia; on coastal rocks . . . . . ***Ramalina***
   Thallus black, without soredia; on rocks at high altitude . . . . . ***Himantormia***
7. Thallus hollow 8
   Thallus solid 11
8. Thallus variegated black and grey . . . . . ***Hypogymnia***
   Thallus not variegated, never black and grey, usually some shade of green or brown . . 9
9. Thallus glossy, light to dark brown, perforated by numerous small holes . . . . ***Cladia***
   Thallus glossy or matt, shades of green, grey or brown, if perforated only in axils . . 10
10. Thallus glossy, tips of branches spiny . . . . . ***Cornicularia***
    Thallus matt, tips of branches not spiny . . . . . ***Cladonia***
11. Thallus richly branched, variegated yellow and black; on rocks . . . . . ***Usnea***
    Thallus unbranched to richly branched, not variegated yellow and black, usually some shade of white, green or brown; usually on soil and moss banks, occasionally on rocks . 12
12. Thallus bearing scyphi or squamules, occasionally sorediate . . . . . ***Cladonia***
    Thallus not bearing scyphi or squamules, never sorediate 13
13. Thallus bearing phyllocladia, stem "woody" . . . . . ***Stereocaulon***
    Thallus without phyllocladia, stem not "woody" . . . . . ***Sphaerophorus***
    (forms of *Stereocaulon glabrum* may key out here, but see notes under the description of this species)
14. Thallus umbilicate, attached to substratum by one central point on ventral surface . . 15
    Thallus not umbilicate, attached to substratum by most of ventral surface 16

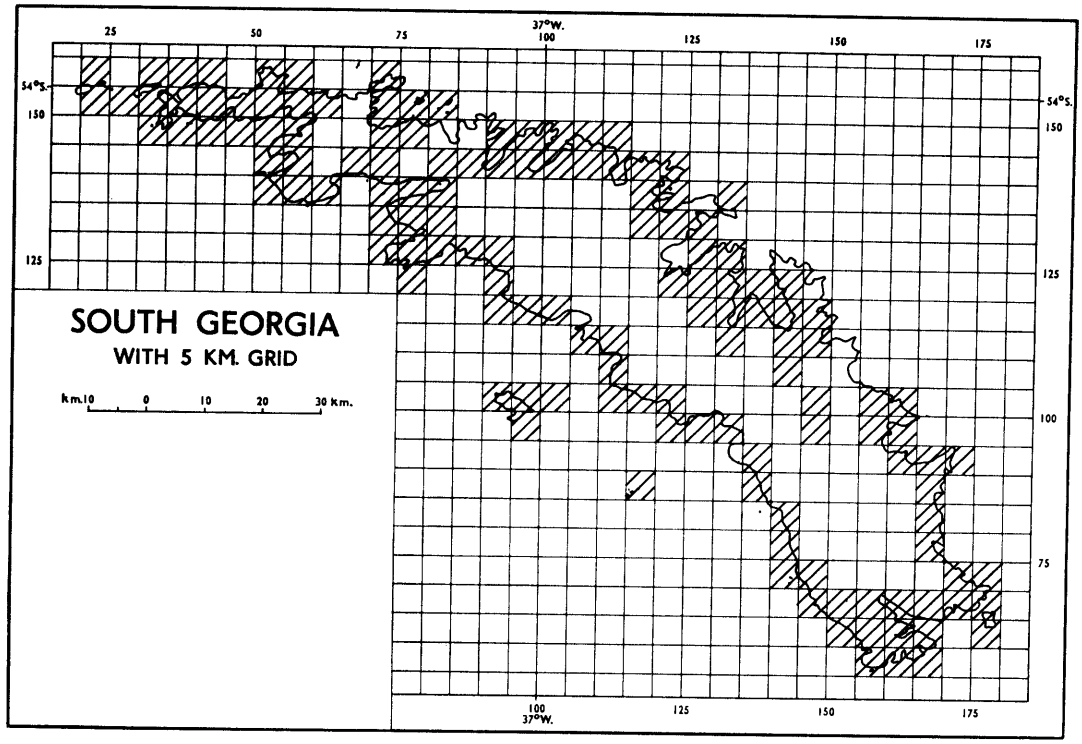


FIGURE 2
5 km. squares from which macrolichens have been collected.

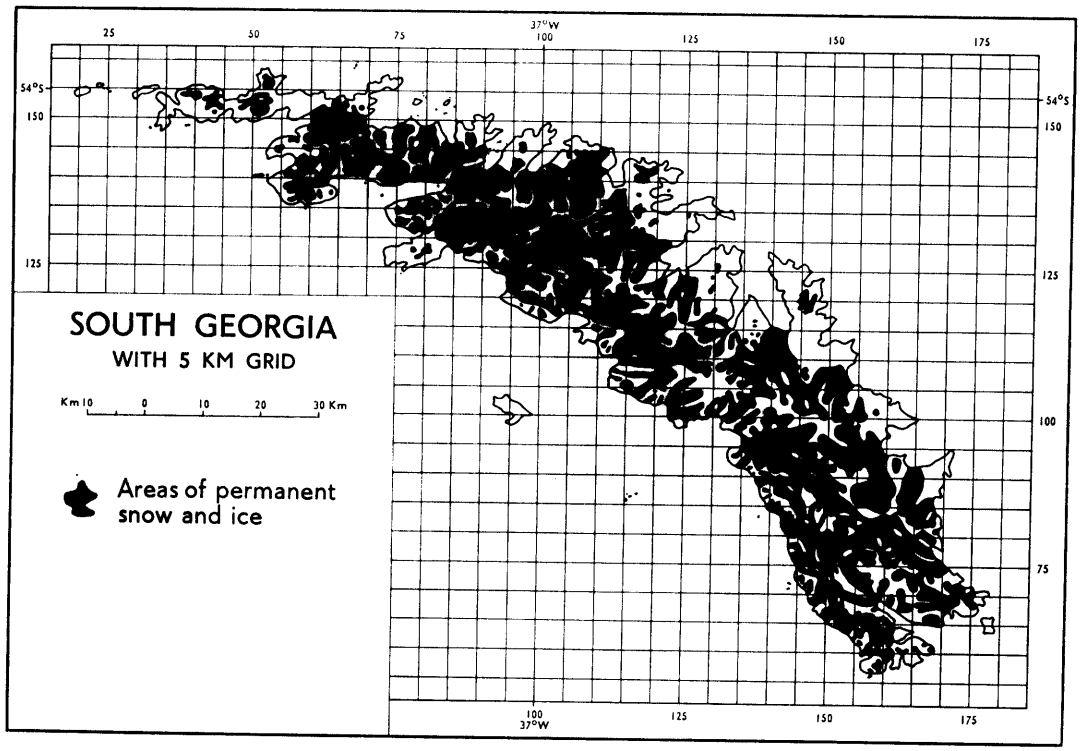


FIGURE 3
Areas of permanent snow and ice on South Georgia.

15. Thallus, when fertile, with minute black perithecia scattered over dorsal surface, ashy grey, pruinose, with down-rolled margins, slightly to strongly wrinkled, ventral surface black, rhizinose, with light grey rhizinae . . . . . ***Dermatocarpon***
Thallus always sterile, not pruinose, brown to black never ashy grey, usually smooth, margins never down-rolled, occasionally ascending, ventral surface black, rhizinae present or absent, with grey tips . . . . . ***Umbilicaria***

16. Thallus hollow 17
Thallus solid 18

17. Thallus variegated black and grey, never sorediate . . . . . ***Hypogymnia***
Thallus greenish yellow, sorediate . . . . . ***Menegazzia***

18. Thallus orange, K+ purple, of small cushions of ascending lobes . . . . ***Xanthoria***
Thallus white, grey, green, brown to black, K−, squamulose or foliose 19

19. Phycobiont blue-green (*Nostoc*) 20
Phycobiont green (Trebouxioid) 29

20. Ventral surface of thallus tomentose, with cyphellae or pseudocyphellae 21
Ventral surface of thallus tomentose or rhizinose, without cyphellae or pseudocyphellae . 22

21. Ventral surface of thallus with cyphellae . . . . . ***Sticta***
Ventral surface of thallus with pseudocyphellae . . . . . ***Pseudocyphellaria***

22. Thallus greenish black to black, dorsal surface smooth, matt to slightly shining, ventral surface lightly tomentose . . . . . ***Leptogium***
Thallus brown, green or bluish, dorsal surface smooth or slightly wrinkled, matt or glossy, ventral surface with veins, tomentum or rhizinae 23

23. Thallus foliose, brown, thick, leathery, dorsal surface matt or glossy, ventral surface with veins or densely tomentose . . . . . ***Peltigera***
Thallus squamulose, not leathery or glossy, ventral surface without veins or dense tomentum 24

24. Thallus with apothecia 25
Thallus sterile 27

25. Ascospores 3-septate . . . . . ***Massalongia***
Ascospores simple or 1-septate 26

26. Apothecia lecideine . . . . . ***Parmeliella***
Apothecia lecanorine . . . . . ***Pannaria***

27. Thallus with bluish tinge, dorsal surface with blackened isidioid warts. . . . ***Parmeliella***
Thallus without bluish tinge, isidia when present not blackened 28

28. Thallus medium to dark brown, with or without globular isidia; on moss cushions . ***Massalongia***
Thallus greenish grey, without isidia; on rock and soil, occasionally spreading on to moss cushions . . . . . ***Pannaria***

29. Thallus squamulose, frequently fertile the apothecia with prominent, crenulate or ciliate, thalline margins. . . . . ***Psoroma***
Thallus foliose, sterile (fertile only in *Mastodia*, which produces perithecia) 30

30. Thallus black, perithecia occasionally present; in enriched habitats on coastal rocks in *Caloplaca* zone or on bird-perching stones inland . . . . . ***Mastodia***
Thallus white, grey, green to brown, sterile; in both enriched and non-enriched habitats on coastal rocks above the *Caloplaca* zone and on inland rocks, on moss banks and wood 31

31. Thallus lobes small, <5 mm. broad, dorsal surface bluish grey, ventral surface grey, rhizinose . . . . . ***Physcia***
Thallus lobes large, >5 mm. broad, dorsal surface off white, grey with brownish tinge, green or brown, ventral surface black, with or without rhizinae 32

32. Rhizinae present on matt ventral surface . . . . . ***Parmelia***
Rhizinae ± absent from glossy ventral surface . . . . . ***Platismatia***

C. Descriptions of Genera and Species

Alectoria Ach.

Thallus filamentous, prostrate, brown to black, filaments 0·4–1·0 mm. in diameter, without axial strand; attached to substratum by small discoid holdfasts. Phycobiont *Trebouxia*.

As yet, none of the Antarctic species has been found fertile.

1. Thallus closely appressed to rock substratum; filaments appearing matted, repeatedly dichotomously branched, flattened towards apices . . . . . ***A. minuscula***
   Thallus never closely appressed to substratum, growing on rock, soil or bryophyte banks; filaments appearing entangled, not flattened towards apices 2
2. Thallus brown, filaments slender, infrequently branched; on soil or bryophyte banks ***A. chalybeiformis***
   Thallus black, more or less robust, filaments frequently branched; on rocks or pebbles ***A. pubescens***

Alectoria chalybeiformis (L.) Gray

Icon. Lamb (1964, pl. VIIIc–d).
Lit. Lamb (1964, p. 25–26).

Thallus prostrate, brown, consisting of irregularly, somewhat infrequently branched filaments up to 10 cm. long and 0·8 mm. in diameter, filaments matt or slightly shining, without soredia (though material from the South Orkney Islands possesses soredia).

An easily recognized species since it forms what appear to be small tufts of brown hair on moss banks.

Habitat. On dry *Polytrichum alpestre* turf, seemingly with preference for a northern aspect; altitudinal range 2–150 m.

Distribution. South Georgia: apparently rare, being known from only three localities (Fig. 4). Bi-polar: South Orkney and South Shetland Islands (Lindsay, 1969*a*); circum-polar arctic, sub-arctic and alpine in Northern Hemisphere (Lamb, 1964).

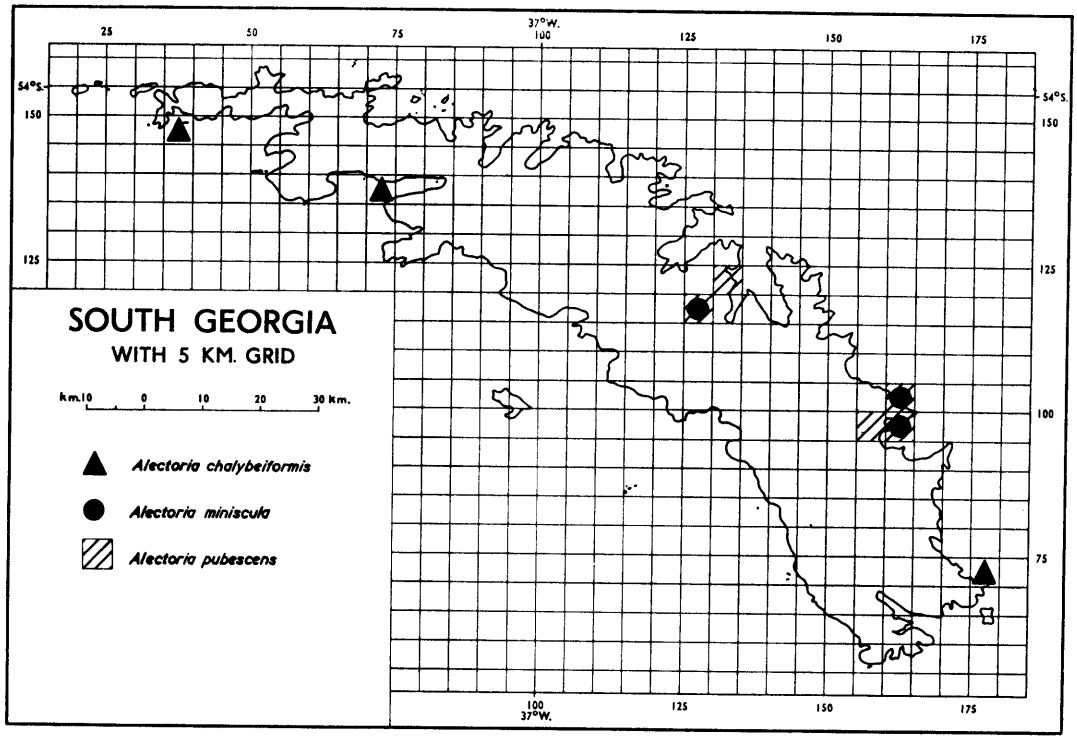


FIGURE 4

The known distribution on South Georgia, by 5 km. squares, of *Alectoria chalybeiformis*, *Alectoria minuscula* and *Alectoria pubescens*, based on the specimens and field records given in Appendix A.

Alectoria minuscula (Nyl. ex Arnold) Degel.

Syn. *Alectoria antarctica* Dodge et Baker.
Alectoria intricata Hue.
Icon. Lamb (1964, pl. VIe and VIIa–d).
Lit. Lamb (1964, p. 27–29).

Thallus black, closely appressed to substratum, forming orbicular rosettes, filaments up to 4 cm. long and 0·7 mm. in diameter, repeatedly dichotomously branched, flattened towards the tips.

This species is similar to *A. pubescens*, but differs in its rosette habit and in being closely appressed to the substratum.

Habitat. On dry, exposed to shaded, non-enriched scree or boulders without regard to aspect; altitudinal range 60–700 m.

Distribution. South Georgia: locally abundant in the Cumberland and Royal Bay areas (Fig. 4). Bi-polar: South Orkney and South Shetland Islands, peninsular and continental Antarctica (Lamb, 1964; Lindsay, 1969*a*), New Zealand (Martin, 1966); circum-polar arctic, sub-arctic and alpine in Northern Hemisphere (Lamb, 1964).

Alectoria pubescens (L.) Howe *jr.*

Syn. *Alectoria nigerrima* Hue.
Icon. Lamb (1964, pl. VIIIa–b).
Lit. Lamb (1964, p. 27).

Thallus black, forming flattened turves up to 8 cm. in diameter, consisting of repeatedly dichotomously branched filaments up to 6 cm. long and 0·9 mm. in diameter, not closely appressed to substratum or forming rosettes.

A. pubescens is similar to *A. minuscula*, but has larger thalli with a more open, less appressed, habit.

Habitat. On dry, exposed or sheltered, non-enriched scree and boulders, without regard to aspect; altitudinal range 60–700 m.

Distribution. South Georgia: apparently an uncommon species known only from the Cumberland Bay and Royal Bay areas (Fig. 4). Bi-polar: Fuegia (Räsänen, 1932), South Orkney and South Shetland Islands, Antarctic Peninsula (Lamb, 1964; Lindsay, 1969*a*), New Zealand (Martin, 1966); Australia (Weber and Wetmore, 1972); circum-polar arctic, sub-arctic and alpine in the Northern Hemisphere (Lamb, 1964).

Cetraria Hoffm.

Thallus foliose or fruticose, dorsiventral in structure, ventral surface with or without sparse rhizinae, with or without pseudocyphellae. Apothecia marginal, lecanorine; ascospores 8 per ascus, hyaline, simple, ellipsoid. Phycobiont *Trebouxia*.

Foliose members of this genus may be confused with species of *Parmelia*, but are distinguished by the marginal apothecia and pycnidia, these structures being laminal in *Parmelia*. The sole South Georgian representative of the genus is fruticose.

Cetraria islandica (L.) Ach.

Icon. Plate Ia; Martin and Child (1972, pl. VIII).
Lit. Lindsay (1973*c*, p. 106–07).

Thallus fruticose, forming tufts up to 25 cm. in diameter and 10 cm. tall, erect, strap-shaped, varying in colour from chestnut at apices of lobes to olivaceous to white towards the base; lobes 1·5–3·5 cm. broad, dichotomously branched, margins crisped and densely spinulose, spines becoming laminal with increase in exposure; lamina pitted and wrinkled, with scattered white pseudocyphellae. Apothecia and pycnidia absent.

A very distinctive plant by virtue of the strap-shaped thallus with spinulose margins, *C. islandica* presents only a very small range of variation on South Georgia, where there is only one chemical strain, i.e. strain 1 of Krog (1968).

Habitat. On dry or slightly damp mineral soil or morainic debris, *Chorisodontium aciphyllum* and *Polytrichum alpestre* banks, with a slight preference for a northerly aspect; altitudinal range 2–300 m.

Distribution. South Georgia: abundant along the north-east and northern end of the south-west coasts and probably to be expected in suitable habitats all around the island (Fig. 5). Widespread in the temperate and polar regions of both hemispheres; Argentina (Grassi, 1950), New Zealand (Martin and Child, 1972), Australia (Weber and Wetmore, 1972).

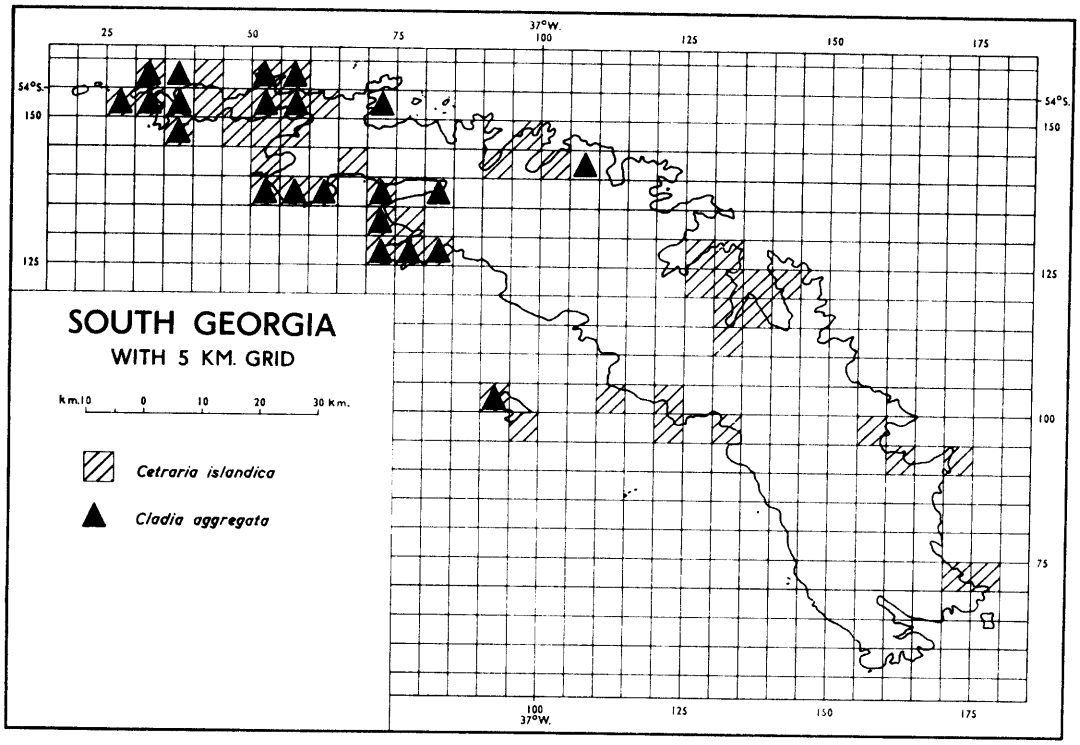


FIGURE 5

The known distribution on South Georgia, by 5 km. squares, of *Cetraria islandica* and *Cladia aggregata*, based on the specimens and field records given in Appendix A.

Cladia Nyl.

Syn. *Cladonia* subgenus *Clathrina* (Müll. Arg.) Vain.
Clathrina Müll. Arg.

Primary thallus crustose, evanescent. Podetia erect, repeatedly branched and variously perforate, ascyphous and esquamulose with cortex of longitudinally arranged conglutinate hyphae, the medulla scarcely developed. Apothecia at tips of ultimate branches, lecideine, peltate; ascospores 8 per ascus, hyaline, ellipsoid, simple. Phycobiont *Trebouxia.*

Cladia aggregata (Sw.) Nyl.

Syn. See Dodge (1948, p. 120–21) for an extensive synonymy list.
Icon. Plate Ib; Martin (1965, pl. III), Asahina (1967, fig. 18), Martin and Child (1972, pl. III).
Lit. Lamb (1958, p. 106), Martin (1958, p. 78–81, 1965, p. 10–11).

Primary thallus absent. Podetia forming open tufts, yellow to brown, 10–30 mm. tall and 1–3 mm. in diameter, dying at base and proliferating at apices, cylindric, clathrate, branching dichotomous, divaricate, axils closed, rarely perforate; outer layers disintegrating into a gel, so that podetia appear glossy, inner layers composed of slender, longitudinally arranged hyphae. Apothecia uncommon, at tips of ultimate branches, up to 1 mm. in diameter, lecideine, peltate, brown; ascospores 8 per ascus, hyaline, ellipsoid, simple, 7–10 by 2–4 μm.

Fertile podetia, which have been found only at the northern end of South Georgia, appear much more robust than sterile podetia, being shorter and thicker and thus deeply embedded in the moss substratum.

This species may be confused with *Cornicularia aculeata* but it can be distinguished by the glossy, perforate podetia.

Habitat. On north-facing, damp, moderately sheltered *Chorisodontium aciphyllum* banks, infrequently on mineral soil or moss on boulders in stable scree; altitudinal range 3–200 m.

Distribution. South Georgia: locally abundant around the northern end of the island (Fig. 5). Extending southward through South America from the West Indies (Dodge, 1948) to Peru (Soukup, 1965), Uruguay (Osorio, 1972), Patagonia and Fuegia (Lamb, 1958), circum-polar sub-Antarctic (Dodge, 1948); Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1958) and Australia (Weber and Wetmore, 1972).

Cladonia [Hill] Hill

Thallus of two types, primary and secondary. Primary thallus evanescent or persistent, crustose, squamulose or foliose. Secondary thallus (podetium) arising from primary thallus, subulate, branched or unbranched, scyphous or ascyphous, hollow; base of podetium persistent or dying, with growth continuing at the apices. Apothecia lecideine; ascospores 8 per ascus, hyaline, ellipsoid, simple. Phycobiont *Trebouxia*.

This is, perhaps, the most common and widespread genus on South Georgia, its constituent species being recognized easily by the cylindrical podetia which may or may not bear cups (scyphi) at their apices. Representatives of the following two subgenera occur:

1. Podetia unbranched or sparsely branched, often squamulose, often with persistent squamulose primary thallus at base . . . . . subgenus ***Cladonia***
   Podetia intricately branched, dying off at base, never squamulose, never with persistent squamulose primary thallus . . . . . subgenus ***Cladina***

Subgenus *Cladonia*

Primary thallus squamulose, evanescent or persistent. Podetia simple or sparingly branched, scyphous or ascyphous, often squamulose, sorediose or isidiose.

So far, ten species of *Cladonia* subgenus *Cladonia* are known from South Georgia and they may be distinguished as follows:

1. Apothecia red, K+ purple 2
   Apothecia alutaceous to dark brown, K−, or absent 4
2. Podetium ascyphous, scyphi obliterated by large apothecia up to 6 mm. in diameter, P+ red . . . . . ***C. bellidiflora***
   Podetia scyphous, apothecia small, up to 2 mm. in diameter, not obliterating scyphi, P− . 3
3. Podetia sorediate . . . . . ***C. pleurota***
   Podetia esorediate . . . . . ***C. coccifera***
4. Axils and scyphi perforate, opening into interior of podetium 5
   Axils and scyphi not perforate, not opening into interior of podetium 6
5. Podetia light to dark brown, papillose, granulose or lightly squamulose . . . ***C. furcata***
   Podetia grey, never with brownish tinge, more or less densely squamulose . . . ***C. squamosa***
6. Podetia > 3 cm. tall, subulate; scyphi, when present, of same diameter as podetium . ***C. gracilis***
   Podetia <3 cm. tall, turbinate; scyphi almost always present, of greater diameter than podetium 7
7. Podetia sorediate 8
   Podetia not sorediate 9
8. Podetia yellow, P−, apothecia alutaceous . . . . . ***C. carneola***
   Podetia grey to green, P+ red, apothecia dark brown. . . . . ***C. balfourii***
9. Scyphi shallow irregular, often squamulose with irregular marginal proliferations; podetia dying off at base, without persistent primary thallus . . . . . ***C. phyllophora***
   Scyphi deep, regular (goblet-shaped), never squamulose, rarely with simple marginal proliferations; podetia not dying off at base, primary thallus persistent, squamulose . ***C. pyxidata***

Cladonia balfourii Cromb.
f. *chlorophaeoides* (Vain.) Evans

Syn. *Cladonia chlorophaeoides* (Vain.) C. W. Dodge.
Cladonia boryana f. *chlorophaeoides* Vain.
Icon. Plate Ic, Thomson (1968, pl. XIV, fig. 71 as f. *balfourii*).
Lit. Thomson (1968, p. 115).

Primary thallus persistent, squamules 2–4 mm. long, and 1–3 mm. broad, lobed, ascending, esorediate. Podetia up to 20 mm. tall, arising from lamina of squamules, scyphous, light greyish green, sorediate throughout; lower part of podetium with isidioid warts or granules, infrequently squamulose; scyphi 2–8 mm. in diameter, imperforate, gradually expanding from the base, covered with light grey green granulose soredia, margins of scyphi proliferous, bearing one or occasionally two tiers of secondary scyphi. Apothecia dark brown, asci and acospores not differentiated.

C. balfourii f. *chlorophaeoides* is very similar to *C. chlorophaea* (Flörke ex Sommerf.) Spreng., which has been reported from South Georgia by Darbishire (1912) and Zahlbruckner (1917) as *C. pyxidata* var. *chlorophaea*. Thomson (1968) considered that the best method of distinguishing the two taxa is by the presence of isidioid warts towards the base of the podetium in *C. balfourii* and the absence of such warts in *C. chlorophaea*. This feature may be difficult to observe, however, especially in old weathered specimens. Moore (1968, p. 205) remarked "the best distinction between these species [i.e. *C. balfourii* and *C. chlorophaea*] is the presence of marginal proliferations on the cups of *C. balfourii* and the absence of such proliferations in *C. chlorophaea*. However, it must be admitted that it is sometimes impossible to determine to which species a particular specimen belongs". Since South Georgian material is usually proliferous from the margins of the scyphi, which are narrow and never broad, shallow and flared as in European material of *C. chlorophaea*, all specimens have been referred to *C. balfourii* f. *chlorophaeoides*.

Habitat. On dry *Chorisodontium aciphyllum* and *Polytrichum alpestre* banks, amongst dry *Tortula robusta* turf, on soil in *Festuca erecta* grassland, on morainic debris and, infrequently, decaying plant material, without regard to aspect or exposure; altitudinal range 2–500 m., but most frequent at low altitudes.

Distribution. South Georgia: widespread and locally abundant throughout the island (Fig. 6). Bi-polar: Fuegia (Müller [Argoviensis], 1888*b* as *C. boryana* f. *chlorophaeoides*), Falkland Islands (Zahlbruckner, 1917, New Zealand (Martin, 1966), Arctic North America (Thomson, 1968).

Cladonia bellidiflora (Ach.) Schaer.
var. *austrogeorgica* D. C. Lindsay

Icon. Plate Id; Galløe (1954, pl. LXIV–LXVI as var. *bellidiflora*), Thomson (1968, pl. 2, fig. 7 as var. *bellidiflora*).
Lit. Lamb (1958, p. 107 as var. *bellidiflora*), Thomson (1968, p. 66 as var. *bellidiflora*).

Primary thallus absent in South Georgian material. Podetia up to 7 cm. tall, turbinate, 0·9–1·6 mm. in diameter at base to 3–6 mm. in diameter at apex, yellow, densely squamulose; squamules 2–5 mm. long, crenate to strongly laciniate, ascending, yellow above, white below, esorediate; usually unbranched, occasionally once or twice furcate, dying off at base. Apothecia common, on margins of narrow scyphi, up to 6 mm. in diameter, scarlet, the larger apothecia obliterating the scyphus; asci and ascospores not differentiated.

The South Georgian populations of this species have been separated as var. *austrogeorgica* by Lindsay (1972*c*, p. 41) since they contain fumarprotocetraric acid in addition to usnic and squamatic acids, whereas Northern Hemisphere material (var. *bellidiflora*) contains usnic and squamatic acids and bellidiflorin (Thomson, 1968).

Habitat. On dry or damp *Chorisodontium aciphyllum* or *Polytrichum* banks, on soil in *Festuca* grassland, on peat under tussock, occasionally on morainic debris, usually in habitats with a northerly aspect; altitudinal range 3–300 m.

Distribution: South Georgia: widespread and locally abundant around the island (Fig. 6). Fuegia and Falkland Islands (personal communication from H. A. Imshaug, for both areas).

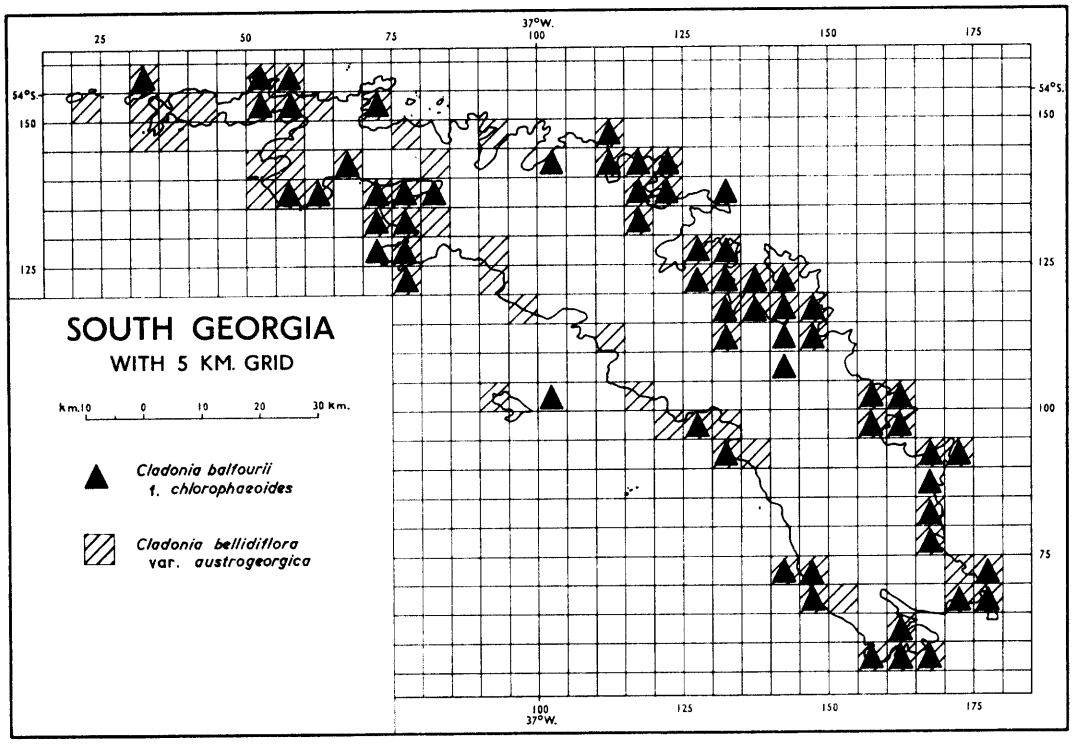


FIGURE 6
The known distribution on South Georgia, by 5 km. squares, of *Cladonia balfourii* f. *chlorophaeoides* and *Cladonia bellidiflora* var. *austrogeorgica*, based on the specimens and field records given in Appendix A.

Cladonia carneola (Fr.) Fr.

Icon. Galløe (1954, pl. CLXXXVIII–CXCII), Thomson (1968, pl. V, fig. 26).
Lit. Lamb (1958, p. 108), Thomson (1968, p. 80–81).

Primary thallus evanescent, squamulose, squamules up to 13 mm. long and 10 mm. broad, lobed or laciniate, ascending, dorsal surface yellowish glaucescent, ventral surface white. Podetia arising from lamina of primary squamules, up to 4·5 cm. tall, yellow, scyphous, sorediate, base usually corticate, upper part densely covered with yellow, farinose soredia; scyphi expanding to 8–10 mm. in diameter, occasionally proliferous along margins or appearing ragged due to development of small stipes bearing apothecia. Apothecia infrequent, on margins of scyphi, pale yellowish brown, up to 2 mm. in diameter; asci and ascospores not differentiated.

This species is distinguished by the dull yellow podetia and pale yellowish brown apothecia. It has been reported elsewhere (Lindsay, 1972*b*, p. 43) that Darbishire's (1912) record of *Cladonia deformis* Hoffm. was based on a specimen of *C. carneola*.

Habitat. Mainly on dry *Chorisodontium* or *Polytrichum* banks, occasionally on soil and decaying plant material in *Festuca* grassland, without regard to aspect, but more frequent in somewhat sheltered situations; altitudinal range 1–300 m.

Distribution. South Georgia: locally abundant around the island (Fig. 7). Bi-polar: Peru (Soukup, 1965), Fuegia (specimens in BM and H), New Zealand (Martin, 1966), northern circum-boreal in the Northern Hemisphere (Laundon, 1958; Thomson, 1968).

Cladonia coccifera (L.) Willd.

Icon. Thomson (1968, pl. I, fig. 5), Martin and Child (1972, pl. XXIV).
Lit. Thomson (1968, p. 65).

Primary thallus persistent, squamulose, squamules up to 12 mm. long and 8 mm. broad, lobed to crenulate, occasionally ascending, dorsal surface yellow, ventral surface white, esorediate. Podetia arising from lamina of squamules, up to 2·5 cm. tall, yellow, scyphous, esorediate, corticate throughout; scyphi

up to 9 mm. in diameter, shallow, somewhat flared, with short marginal stipes bearing apothecia. Apothecia uncommon, scarlet, up to 2 mm. in diameter; asci and ascospores not differentiated.

This species is easily distinguished by the esorediate yellow, scyphous podetia and scarlet apothecia.

Habitat. On damp, sheltered, shaded *Chorisodontium* or *Polytrichum* banks with a northerly aspect; altitudinal range 10–150 m.

Distribution. South Georgia: probably widespread although infrequently collected (Fig. 7). Bi-polar: Argentina (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963), Australia (Weber and Wetmore, 1972), circum-polar in the Northern Hemisphere (Thomson, 1968).

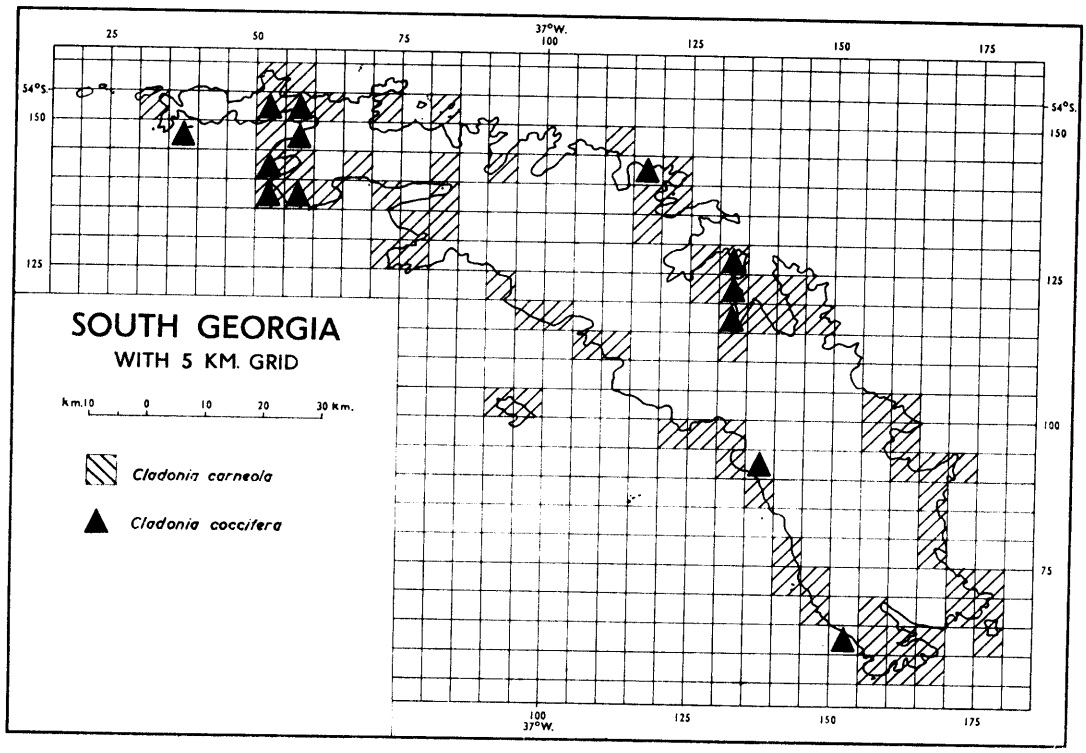


FIGURE 7
The known distribution on South Georgia, by 5 km. squares, of *Cladonia carneola* and *Cladonia coccifera*, based on the specimens and field records given in Appendix A.

Cladonia furcata (Huds.) Schrad.

Syn. *Cladonia subrangiformis* Sandst.
Icon. Galløe (1954, pl. LXXIV–LXXIX), Taylor (1968, fig. 137), Thomson (1968, pl. XVI, figs. b–e).
Lit. Taylor (1968, p. 181), Thomson (1968, p. 118–20).

Primary thallus evanescent, squamules up to 5 mm. long and 2 mm. broad, irregularly lobed, ascending, esorediate, dorsal surface olive, ventral surface white. Podetia arising from lamina of squamules, up to 5 cm. tall, 0·5–0·8 mm. in diameter, tapering gradually towards the apex, usually dying off at base, infrequently branched, ascyphous, branching anisotomous dichotomy, axils perforate; corticate, cortex continuous or areolate, areolae plane or becoming warted and/or blackened towards base, occasionally developing into small squamules. Apothecia absent.

A variable species on South Georgia, where it is represented by two varieties, var. *furcata* and var. *subpungens* Müll. Arg. The latter variety was described from South Georgia by Müller [Argoviensis] (1886, 1890) and is distinguished from var. *furcata* by its warted squamulose podetia. It appears that these features may be due to environmental factors, var. *subpungens* so far having been found at relatively high latitudes in exposed situations.

Habitat. Var. *furcata*, on dry to damp, occasionally wet habitats, mainly on *Chorisodontium* or *Polytrichum* banks, in dry *Tortula robusta* turf and on soil in *Festuca* grassland, occasionally on mineral soil, without regard to aspect; altitudinal range 3–300 m. Var. *subpungens*, on exposed, dry, north-facing *Chorisodontium* banks; altitudinal range 150–500 m.

Distribution. Var. *furcata* South Georgia: widespread and abundant (Fig. 8). Cosmopolitan, having been reported from all continents (Thomson, 1968); Fuegia (Räsänen, 1932), Falkland Islands, South Orkney Islands, South Shetland Islands (specimens from these three areas in AAS), New Zealand (Martin, 1966). Var. *subpungens* South Georgia: known from only three scattered localities (Fig. 8). Although var. *subpungens* has not been reported from elsewhere, ecological variants that appear similar have been reported from Europe (Galløe, 1954).

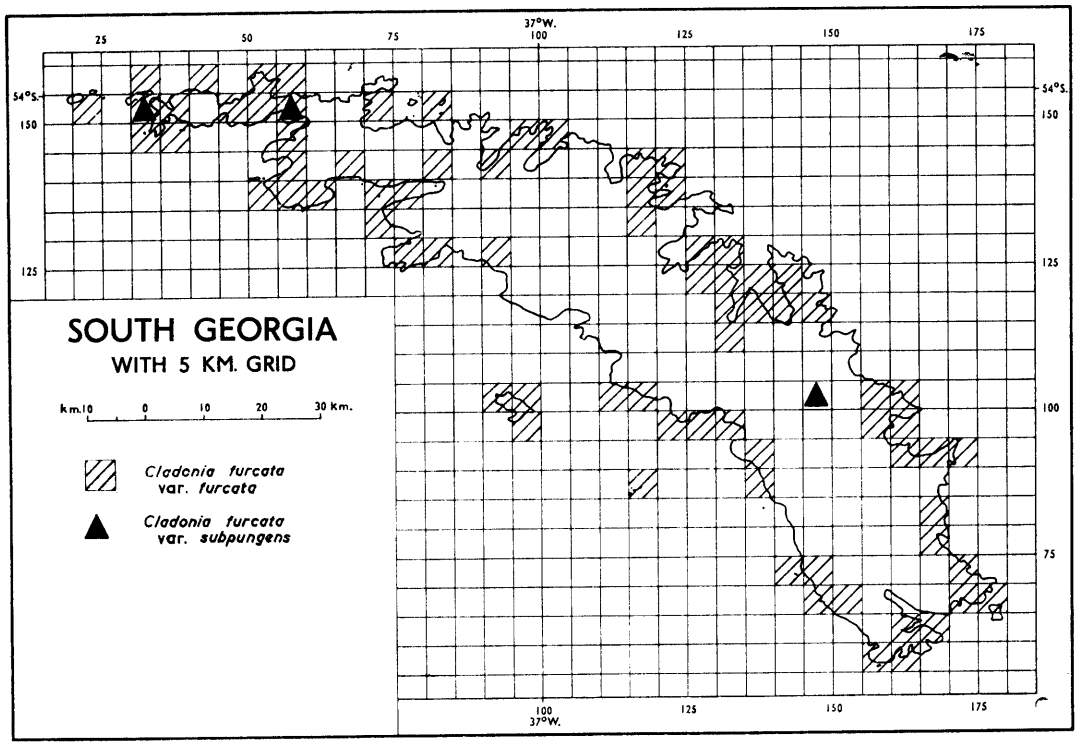


FIGURE 8

The known distribution on South Georgia, by 5 km. squares, of *Cladonia furcata* var. *furcata* and *Cladonia furcata* var. *subpungens*, based on the specimens and field records given in Appendix A.

Cladonia gracilis (L.) Willd.

Icon. Plate Ie and f; Galløe (1954, pl. CXXXIX and CXLVII), Thomson (1968, pl. IX, fig. 47a–c).
Lit. Lamb (1958, p. 110–11), Thomson (1968, p. 95–96).

Primary thallus absent in South Georgian material. Podetia up to 15 cm. tall and 1·2–3·0 mm. in diameter, greenish glaucescent, greyish to olivaceous brown, subulate, scyphi present or absent, unbranched to infrequently branched, esorediate, esquamulose, corticate; cortex of contiguous to dispersed areolae, separated by very slight white tomentum, smooth to slightly or moderately exasperate towards base; branching dichotomous, axils imperforate, frequently fissured, though this may be a result of drying; scyphi 0·3–0·6 mm. in diameter, shallow, imperforate, usually regular, though with occasional marginal proliferations up to 3·5 mm. long which bear secondary scyphi. Apothecia infrequent, on margins of scyphi, brown, up to 2·5 mm. in diameter; asci and ascospores not differentiated.

Two subspecies are present on South Georgia, subsp. *gracilis* (= *C. gracilis* var. *chordalis* (Flörke) Schaer.) and subsp. *elongata* (Jacq.) Ahti (= *C. elongata* (Jacq.) Hoffm.). Subsp. *gracilis* is distinguished from subsp. *elongata* by the smaller narrower podetia, up to 8 cm. tall and 0·6–1·4 mm. in diameter, instead of up to 15 cm. tall and 1·2–3·0 mm. diameter, greater frequency of branching and presence of

scyphi, these being absent in subsp. *elongata*. This latter subspecies appears to be merely a large form of subsp. *gracilis*, being found only on deep, possibly sheltered, *Chorisodontium* banks.

Both subspecies may superficially resemble *C. furcata* var. *furcata*, but can be distinguished by the imperforate axils and esquamulose podetia.

Habitat. Subsp. *gracilis*: on *Chorisodontium* and *Polytrichum* banks, especially on soil in *Festuca* grassland, infrequently in *Tortula robusta* turf and morainic debris, in dry, sheltered to exposed situations regardless of aspect; altitudinal range 2–470 m. Subsp. *elongata*: on deep *Chorisodontium* banks in sheltered to exposed situations apparently without preference for aspect; altitudinal range 8–80 m.

Distribution. Subsp. *gracilis* South Georgia: widespread and very common along the central part of the north-east coast (Fig. 9). Cosmopolitan (Thomson, 1968); Fuegia (Räsänen, 1932), Falkland Islands (specimens in AAS), Antarctic Peninsula (Vainio, 1903), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963) and Australia (Weber and Wetmore, 1972). Subsp. *elongata* South Georgia: apparently rare, but may have a wide distribution, being known from the Royal Bay area and northern part of the island (Fig. 9). Fuegia (Räsänen, 1932), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966). Apparently restricted to the Southern Hemisphere, reports from the Northern Hemisphere, e.g. by McVean (1962), have proved to be misidentifications of similar species.

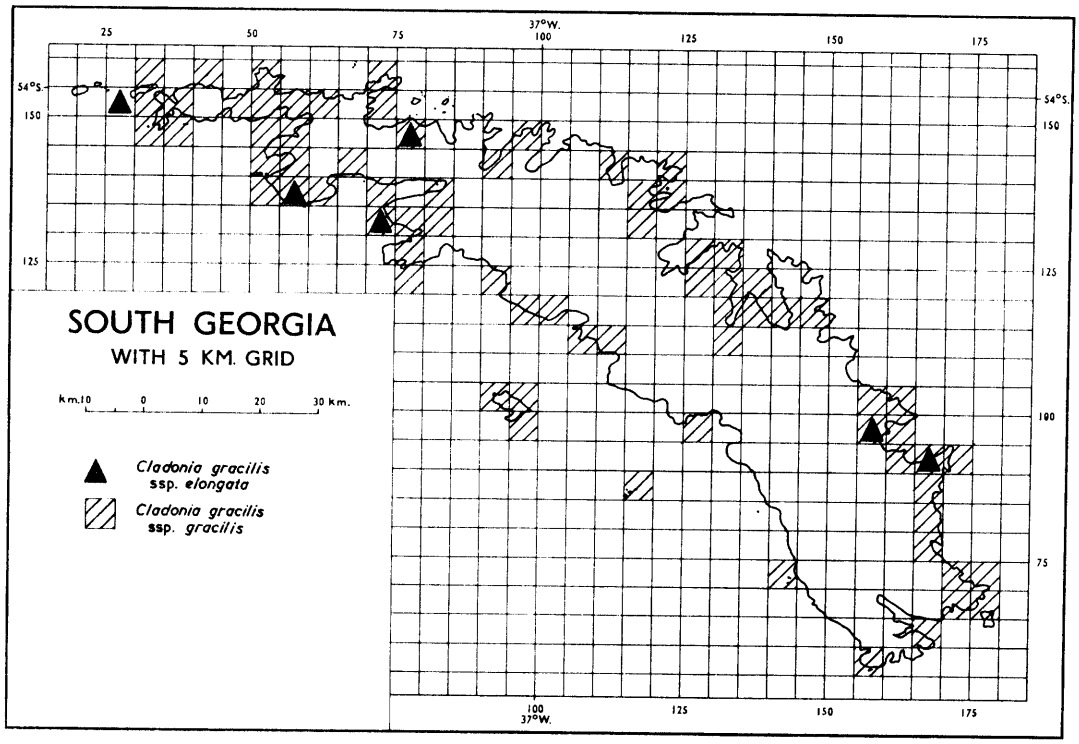


FIGURE 9
The known distribution on South Georgia, by 5 km. squares, of *Cladonia gracilis* ssp. *elongata* and *Cladonia gracilis* ssp. *gracilis*, based on the specimens and field records given in Appendix A.

Cladonia phyllophora Hoffm. non (Tayl. ex Hook. et Tayl.) Cromb.

Syn. *Cladonia degenerans* (Flörke) Spreng.
Cladonia austrogeorgica C. W. Dodge.
Icon. Galløe (1954, pl. CXXXV–CXXXVIII as *C. degenerans*), Thomson (1968, pl. IX, fig. 45).
Lit. Thomson (1968, p. 93–94), Dodge (1970, p. 496–97 as *C. austrogeorgica*).

Primary thallus absent in South Georgian material. Podetia up to 5 cm. tall and 1–4 mm. in diameter, scyphous, esorediate, covered with laciniate squamules or granulose areolae, dying off at blackened base, greyish green above, occasionally branched; branching isotomous, dichotomous or trichotomous, axils imperforate; scyphi regular or irregular, infundibuliform, margins proliferous, bearing secondary or

tertiary scyphi. Apothecia infrequent, at tips of marginal proliferations of scyphi, brown, up to 1 mm. in diameter; asci and ascospores not differentiated.

Specimens of this species may be confused with extensively squamulose forms of *C. furcata*, but they are always greyish green and never with the brown tinge typical of the latter species.

First recorded by Darbishire (1912) as *C. degenerans* from material collected by Skottsberg in 1901–03, the same material was redescribed by Dodge (1970, p. 496) as a new species, *C. austrogeorgica* C. W. Dodge, who suggested a relationship with *C. crispata* (Ach.) Th. Fr. However, the type of Dodge's species examined by the author (S, South Georgia, Cumberland [West] Bay, Jason Harbour, Skottsberg 15) is identical to material of *C. phyllophora*, for example, from Japan (BM, Kurokawa Lichenes rariores et critici exsiccatae No. 58). Dodge (1948, p. 132–34) reported *C. phyllophora* (Tayl.) C. W. Dodge from Iles Kerguelen, but this combination was superfluous, since *Cenomyce phyllophora* Tayl. had already been transferred to *Cladonia* by Crombie (1877, p. 102). However, *C. phyllophora* (Tayl. ex Hook. et Tayl.) Cromb. appears to have no relation to *C. phyllophora* Hoffm. and, from Dodge's (1948) description, seems to be related to *C. balfourii*.

Habitat. On *Chorisodontium* banks, on soil in *Festuca* grassland and occasionally on morainic debris, in sheltered to exposed situations without regard to aspect; altitudinal range 3–300 m.

Distribution. South Georgia: widely distributed along the north-east and north-west coasts, but rarely prominent (Fig. 10). Bi-polar: Argentina (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966), northern circum-polar in the Northern Hemisphere (Thomson, 1968).

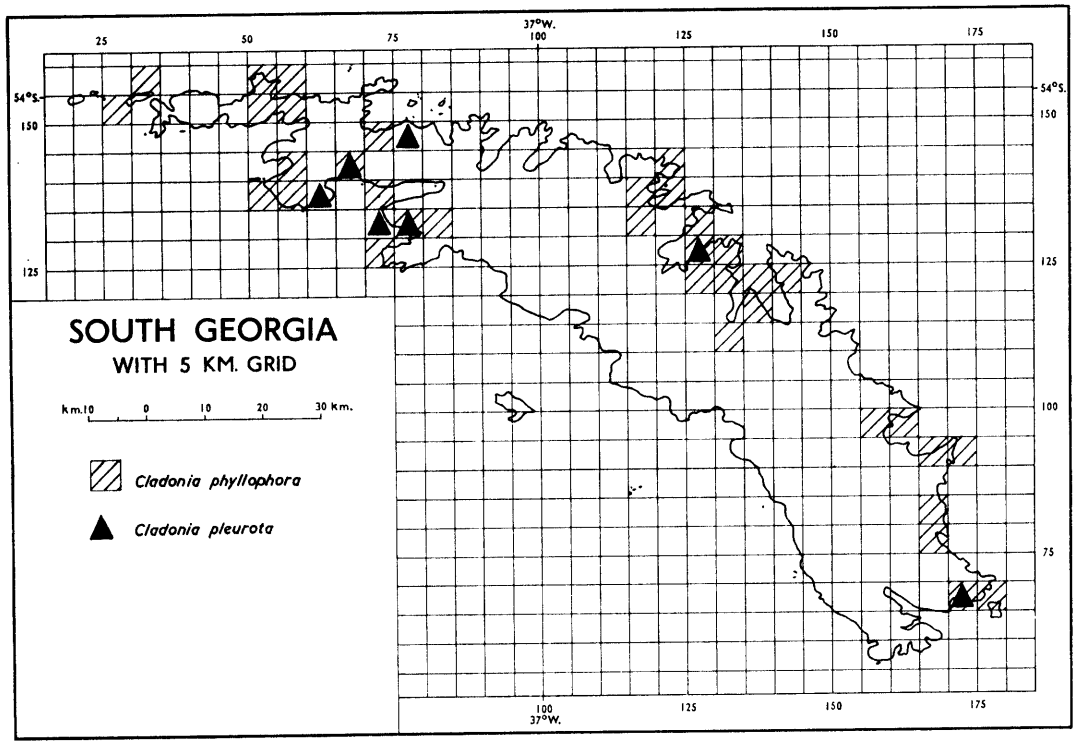


FIGURE 10

The known distribution on South Georgia, by 5 km. squares, of *Cladonia phyllophora* and *Cladonia pleurota*, based on the specimens and field records given in Appendix A.

Cladonia pleurota (Flörke) Schaer.

Syn. *Cladonia coccifera* subsp. *pleurota* (Flörke) Cromb.
Cladonia coccifera var. *pleurota* (Flörke) Schaer.
Cladonia cornucopioides var. *pleurota* (Flörke) Nyl.
Icon. Taylor (1968, fig. 146), Thomson (1968, pl. II, fig. 11).
Lit. Taylor (1968, p. 190), Thomson (1968, p. 68–69).

Primary thallus of persistent squamules, squamules 1–7 mm. long and up to 5 mm. broad, irregularly lobed, esorediate, dorsal surface yellow, ventral surface white. Podetia up to 4 cm. tall, scyphous, sorediate, upper part covered with granulose yellow, soredia, lower part corticate with a continuous or areolate cortex; scyphi deep, usually regular, occasionally with marginal proliferations which often bear apothecia or secondary scyphi. Apothecia on margins or scyphi, scarlet, 1–3 mm. in diameter; asci and ascospores not differentiated.

When sterile this species may be confused with *C. carneola*, but that species has farinose soredia and lacks zeorin, which occurs in *C. pleurota*.

Habitat. On damp moss cushions or on soil in rock crevices, apparently without regard to aspect; altitudinal range 3–150 m.

Distribution. South Georgia: a rare species scattered around the island (Fig. 10). Bi-polar: Fuegia (Räsänen, 1932), Falkland Islands (Zahlbruckner, 1917), Antarctic Peninsula (Vainio, 1903; Hue, 1915), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963), Australia (Weber and Wetmore, 1972), circumpolar and circum-boreal in the Northern Hemisphere (Thomson, 1968).

Cladonia pyxidata (L.) Hoffm.

Icon. Taylor (1968, fig. 147), Thomson (1968, pl. XII, fig. 58b).
Lit. Lamb (1958, p. 115), Taylor (1968, p. 190), Thomson (1968, p. 104).

Primary thallus of persistent squamules, squamules 2–4 mm. long and 3–4 mm. broad, lobed, esorediate, dorsal surface glaucescent, ventral surface white. Podetia arising from lamina of squamules, up to 1·5 cm. tall, scyphous, brown, esorediate, esquamulose, corticate; cortex of coarse warted granules which have a slight tendency to become flattened at the base, resembling juvenile squamules; scyphi regular or irregular with short marginal proliferations, deep, expanding gradually from the base, up to 6 mm. in diameter. Apothecia on short stipes on margins of scyphi, brown, up to 0·5 mm. in diameter; asci and ascospores not differentiated.

This species is easily recognizable by its brown, warted-granular, esorediate, scyphous podetia.

Habitat. On living or decaying *Chorisodontium* and *Polytrichum* banks and occasionally on small tufts of acrocarpus mosses in rock crevices, in dry to wet, sheltered to exposed situations without regard to aspect; altitudinal range 8–300 m.

Distribution. South Georgia: widespread but occurring only sparsely at each locality (Fig. 11). Cosmopolitan (Thomson, 1968): Peru (Soukup, 1965), Uruguay (Osorio, 1972), Fuegia (Räsänen, 1932), Falkland Islands (Zahlbruckner, 1917), South Shetland Islands (Redon, 1969), Antarctic Peninsula (Vainio, 1903), Marion Island (specimen in BM), Campbell Island (Nylander, 1876), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972).

Cladonia squamosa (Scop.) Hoffm.

Syn. *Cladonia subsquamosa* (Nyl. ex Leight.) Nyl. ex Cromb.
Icon. Galløe (1954, pl. XCVIII–CI), Taylor (1968, fig. 151), Thomson (1968, pl. XIX, fig. 89a–f, pl. XX, fig. 90).
Lit. Thomson (1968, p. 128–30).

Primary thallus evanescent or persistent, consisting of squamules 1–4 mm. long and 1–3 mm. broad, squamules ascending, lobed, esorediate, dorsal surface glaucescent, ventral surface white. Podetia arising from lamina of squamules, up to 5 cm. tall and 1·5–2·0 mm. in diameter, esorediate, scyphous, squamulose or esquamulose, corticate, occasionally fissured and appearing clathrate, infrequently branched; branching anisotomous dichotomy, axils perforate; podetial squamules light green to glaucous on dorsal surface, ventral surface white, incised to laciniate, up to 2 mm. long; scyphi occurring at tips of podetia, irregular,

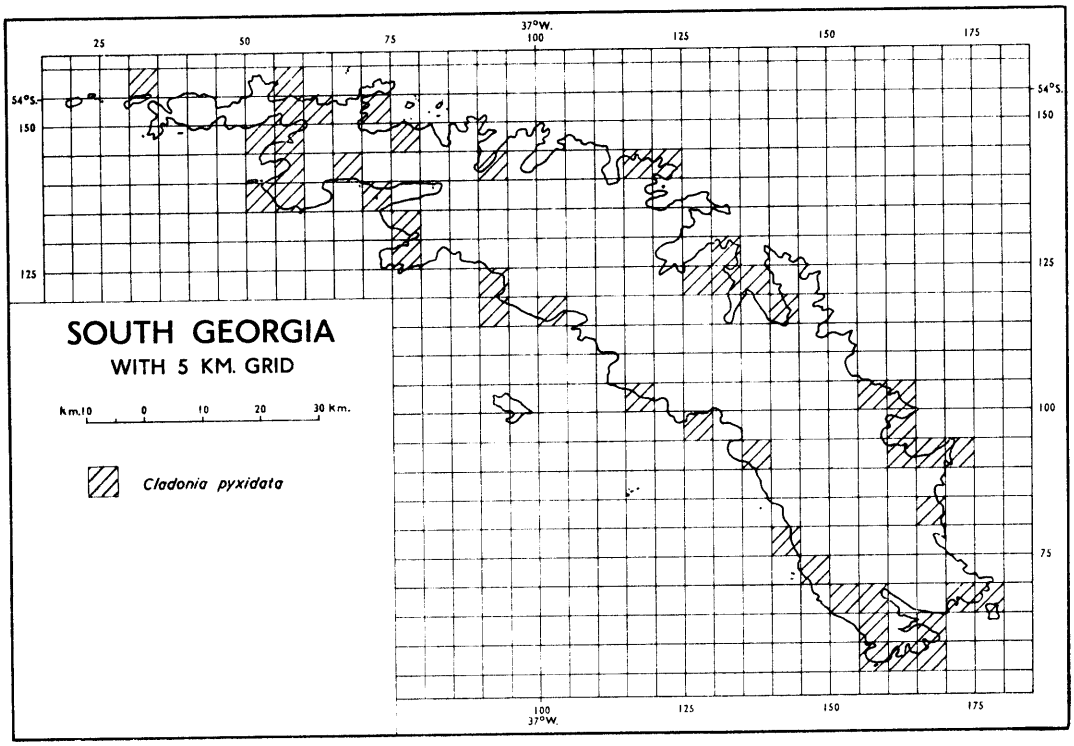


FIGURE 11

The known distribution on South Georgia, by 5 km. squares, of *Cladonia pyxidata*, based on the specimens and field records given in Appendix A.

1–3 mm. in diameter, bearing several, usually 3–5, marginal proliferations up to 10 mm. long which may bear secondary scyphi. Apothecia occurring on margins of scyphi, brown, 0·5–0·9 mm. in diameter; asci and ascospores not differentiated.

Two varieties have so far been found on South Georgia, both morphologically identical but distinguishable by chemical characters. Var. *squamosa* reacts K− and P− and contains squamatic and usnic acids whereas var. *allosquamosa* reacts K+ yellow and P+ yellow and contains thamnolic acid.

C. squamosa may be confused with squamulose forms of *C. furcata*, as was done by Darbishire (1912), but it never has the brown tinge typical of that species. It may also be confused with *C. phyllophora*, but can easily be distinguished by the chemical reactions, which in that species are K− and P+ red.

Habitat. Var. *squamosa*: on dry *Chorisodontium* banks, on peat under tussock or on soil in *Festuca* grassland, in dry, sheltered to moderately exposed situations without preference for aspect; altitudinal range 5–300 m. Var. *allosquamosa*: mainly on damp *Chorisodontium* and *Polytrichum* banks, also in *Tortula robusta* turf, on decaying tussock or morainic debris, in moderately sheltered habitats but without preference for aspect; altitudinal range 5–340 m.

Distribution. Var. *squamosa* South Georgia: infrequently encountered along the north-east coast, but probably more widespread than the records indicate (Fig. 12). Bi-polar: Argentina (Grassi, 1950), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963) and Australia (Weber and Wetmore, 1972), circum-polar in the Northern Hemisphere (Thomson, 1968). Var. *allosquamosa* South Georgia: widespread but never in any abundance (Fig. 12). Bi-polar: Argentina (Grassi, 1950), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963) and Australia (Weber and Wetmore, 1972), circum-polar in the Northern Hemisphere (Thomson, 1968).

Subgenus *Cladina* (Nyl.) Leight. emend. Vain.

Primary thallus crustose, evanescent. Podetia slender, repeatedly and more or less intricately branched, without scyphi, squamules or soredia.

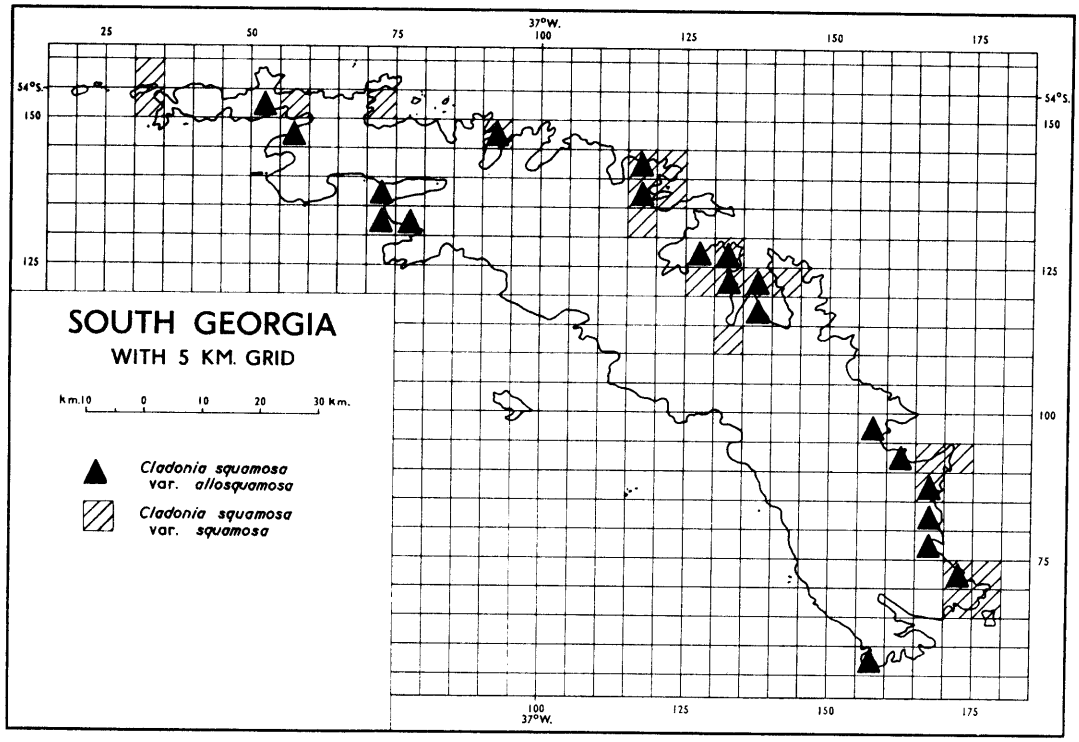


FIGURE 12

The known distribution on South Georgia, by 5 km. squares, of *Cladonia squamosa* var. *allosquamosa* and *Cladonia squamosa* var. *squamosa*, based on the specimens and field records given in Appendix A.

Only three species of this widely distributed subgenus have yet been found on South Georgia.

1. Podetia grey, ashy, often with strong purple tinge towards apices, secondary branches reflexed, mostly in one direction . . . . . ***C. rangiferina***
   Podetia yellow or yellowish grey, never with purple tinge, secondary branches reflexed or not 2
2. Podetia dull yellow, smooth, secondary branches not or only slightly reflexed, diverging in all directions . . . . . ***C. pycnoclada***
   Podetia yellowish grey, appearing warted, secondary branches reflexed in one direction . ***C. mitis***

Cladonia mitis Sandst.

Syn. *Cladina mitis* (Sandst.) Hale et Culb.
Cladonia arbuscula subsp. *arbuscula* Ahti (chemical strain II).
Icon. Ahti (1961, pl. XLI), Thomson (1968, pl. XXV, fig. 113).
Lit. Ahti (1961, p. 116–25).

Podetia up to 4 cm. tall, terete, frequently dichotomously branched; branching occasionally trichotomous near tips, axils perforate, dull yellow towards apices with exposed medulla becoming blackened towards the base, or blackened along whole length of podetium, or only at the tips; non-blackened parts arachnoid; tips of podetia reflexed, appearing withered.

The effect of yellow corticate areolae on a blackened medulla gives the podetium a warted appearance. This species is easily distinguished by its P− reaction from the two other Cladinae on South Georgia, which both react P+ red.

Habitat. On *Polytrichum alpestre* bank at *c.* 15 m. a.s.l.

Distribution. South Georgia: at present known only from one locality, near Leith Harbour (Fig. 13). Argentina (Ahti, 1961), Antarctic Peninsula (Ahti, 1961), New Zealand (Ahti, 1961), circum-polar in the Northern Hemisphere (Ahti, 1961).

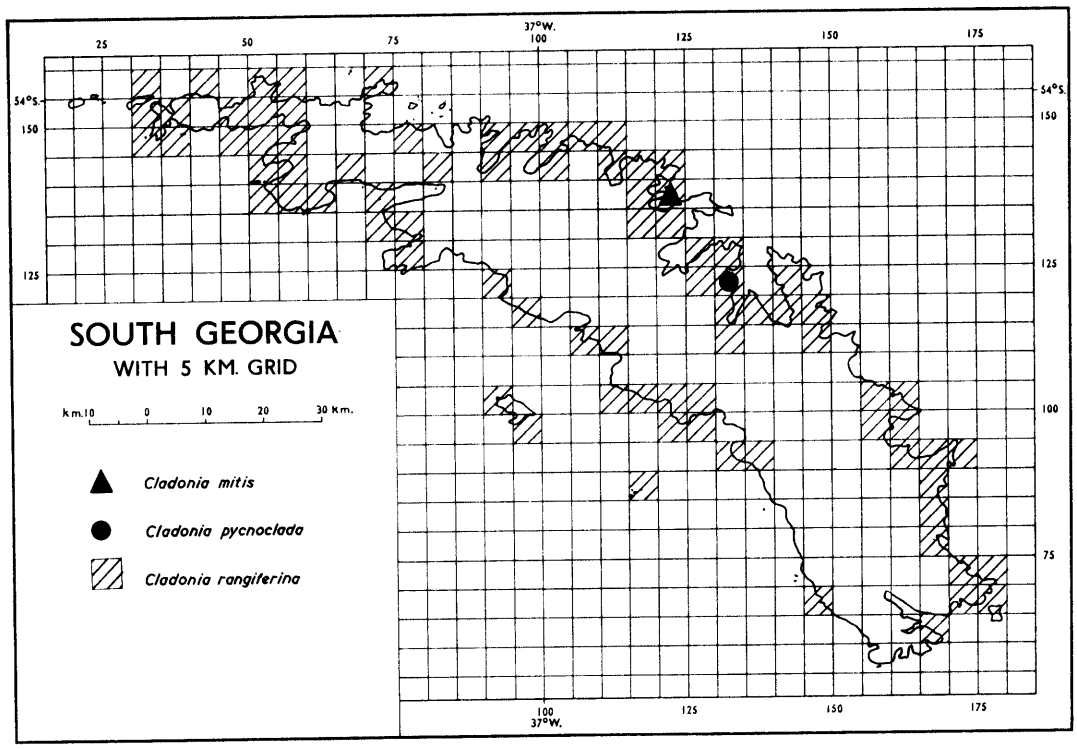


FIGURE 13

The known distribution on South Georgia, by 5 km. squares, of *Cladonia mitis*, *Cladonia pycnoclada* and *Cladonia rangiferina*, based on the specimens and field records given in Appendix A.

Cladonia pycnoclada (Pers. ex Gaudich.) Nyl.

Icon. Ahti (1961, pl. III).
Lit. Ahti (1961, p. 31–34).

Podetia up to 5 cm. tall, dull yellow, terete, repeatedly branched; branching predominantly anisotomous dichotomy, axils perforate; side branches up to 5 mm. long, ramifying in all directions but some, especially towards base of podetium, reflexed slightly, corticate; cortex of inconspicuous areolae which are usually hidden in white tomentum in upper parts of the podetium.

A distinctive species which can be recognized by the dull yellow podetia with a P+ red reaction.

Habitat. On soil and moss turves in *Festuca* grassland at an altitude of 10 m. a.s.l.

Distribution. South Georgia: so far known only from one locality on Hestesletten (Cumberland East Bay), where it is abundant (Fig. 13). Peru (Soukup, 1965), Fuegia, Falkland Islands (specimens from both areas in BM).

Cladonia rangiferina (L.) Web.

Icon. Ahti (1961, pl. XXXI, South Georgian specimen).
Lit. Ahti (1961, p. 86–94).

Podetia up to 7 cm. tall, light grey, dark ashy grey to brownish purple, repeatedly branched; branching predominantly isotomous trichotomy or tetrachotomy, axils perforate; side branches up to 23 mm. long, usually orientated in one plane and reflexed at tips, corticate; cortex of crowded areolae which are usually hidden in a loose cottony tomentum covering most of the podetium.

This species, the "reindeer moss" of the Northern Hemisphere, is the most widespread taxon of the subgenus *Cladina* on South Georgia and is recognized by the grey podetia which often have a purple tinge, especially towards the tips. According to Ahti (1961), the South Georgian material in Stockholm (S), referred to *Cladonia sylvatica* by Darbishire (1912), is *C. rangiferina*.

Habitat. Prominent in *Festuca* grassland where, occasionally, it becomes co-dominant with the grass, on dry *Chorisodontium* or *Polytrichum* banks, occasionally in *Rostkovia* bog and on morainic debris, usually in dry, sheltered to moderately exposed habitats with regard to aspect; altitudinal range 5–300 m.

Distribution. South Georgia: widespread but particularly abundant in the sheltered valleys along the north-east coast (Fig. 13). Bi-polar: Fuegia (Räsänen, 1932), Tasmania (Wetmore, 1963), circum-polar in the Northern Hemisphere (Ahti, 1961).

Cornicularia (Schreb.) Ach.

Thallus fruticose, forming small clumps, consisting of erect, richly branched, cylindrical lobes, colour varying from light greyish brown to very dark brown depending on exposure. Apothecia unknown in Antarctic material. Phycobiont trebouxioid.

1. Thallus with short, spiky side branches; fasciculate isidioid branchlets absent . . ***C. aculeata***
   Thallus without spiky side branches; fasciculate branchlets present . . . ***C. epiphorella***

Cornicularia aculeata (Schreb.) Ach.

Syn. *Cornicularia tenuissima* (L.) Zahlbr.
Icon. Lamb (1964, pl. IXb).
Lit. Lamb (1964, p. 30).

Thallus erect, shrubby, forming loose clumps up to 10 cm. high and 20 cm. in diameter, repeatedly irregularly branched; branches up to 3 mm. in diameter, varying from light to dark brown depending on exposure, shiny, cylindrical, occasionally impressed and slightly angular, hollow, imperforate, with small spiny tips and short spiky side branchlets.

Light-coloured thalli of this species may be confused with *Cladia aggregata*, but they can be distinguished from thalli of that species by the totally imperforate branches.

Habitat. On damp to dry *Chorisodontium* and *Polytrichum* banks with a northerly aspect; altitudinal range 10–200 m.

Distribution. South Georgia: locally abundant but restricted to the north-western end of the island (Fig. 14). Bi-polar: Fuegia, Falkland Islands, South Orkney and South Shetland Islands, Antarctic Peninsula (Lamb, 1964), New Zealand (Martin, 1966), temperate to arctic in the Northern Hemisphere.

Cornicularia epiphorella (Nyl.) Du Rietz

Syn. *Cetraria gracilenta* (Kremp.) Vain.
Icon. None.
Lit. Lamb (1964, p. 30–31).

Thallus erect, shrubby, forming very small clumps up to 2·5 cm. tall and 3 cm. in diameter, infrequently irregularly branched; branches up to 1 mm. in diameter, light to dark brown, depending on exposure, shiny, cylindrical, hollow, imperforate, bearing numerous small fascicles of small isidioid branchlets, each branchlet *c.* 1·5 mm. long and 0·4 mm. in diameter.

This species may be quite easily recognized by its erect, brown thallus bearing clusters of isidioid branchlets.

Habitat. On damp to dry *Chorisodontium* and *Polytrichum* banks, occasionally on other mosses and hepatics, apparently without preference for aspect; altitudinal range 70–180 m.

Distribution. South Georgia: similar in distribution to *C. aculeata*, i.e. restricted to the north-western end of the island where, although rarely in abundance, it is widespread (Fig. 14). Patagonia, Fuegia, Falkland Islands (Lamb, 1964), South Orkney and South Shetland Islands, Antarctic Peninsula (Lindsay, 1969*a*).

Cystocoleus Thwait.

Thallus filamentous, black, filaments minute, ecorticate, fungal hyphae brown, contorted. Phycobiont *Trentepohlia*.

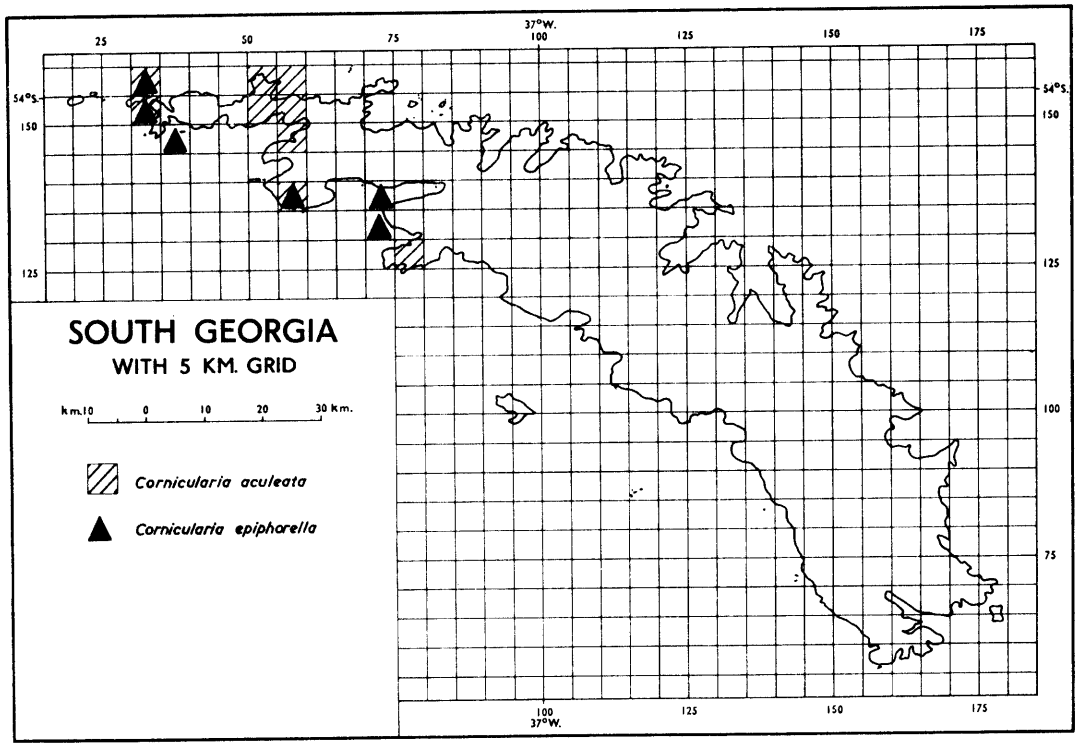


FIGURE 14

The known distribution on South Georgia, by 5 km. squares, of *Cornicularia aculeata* and *Cornicularia epiphorella*, based on the specimens and field records given in Appendix A.

Cystocoleus niger (Huds.) Hariot

Syn. *Coenogonium nigrum* (Huds.) A. Zahlbr.
Cystocoleus ebeneus (Dillw.) Thwait.
Icon. None.
Lit. Lindsay (1971*c*, p. 119–20).

Thallus forming small pulvinate clumps up to 1·5 cm. in diameter and 5 mm. thick, black, consisting of numerous densely interwoven, slender black filaments which can only just be distinguished by eye.

This species appears as slender black filaments forming a felt over moss cushions and rock, its black colour and small size rendering it very inconspicuous.

Habitat. On moss and soil in damp rock crevices and hollows, occasionally on *Chorisodontium* or *Polytrichum* banks in exposed situations; altitudinal range 15–300 m.

Distribution. South Georgia: widespread but never in any quantity (Fig. 15). Chile (Follmann and Redon, 1972), South Orkney Islands, Antarctic Peninsula (Lindsay, 1971*c*), New Zealand (Martin, 1966), temperate and arctic-alpine in the Northern Hemisphere (Poelt, 1969).

Dermatocarpon Eschw.

Thallus foliose, attached to the substratum by a central umbilicus or rhizinae. Ascocarps perithecia; ascospores 8 per ascus, hyaline, simple. Phycobiont *Hyalococcus* or *Myrmecia* (Ahmadjian, 1967).

Although four species have been recorded from the maritime Antarctic, two by Lamb (1948*a*) and two by Dodge (1968), only one has so far been found on South Georgia.

Dermatocarpon intestiniforme (Körb.) Hasse

Syn. *Dermatocarpon polyphyllum* (Wulf.) Dalla Torre et Sarnth.
Icon. Plate IIa.
Lit. Lamb (1948*a*, p. 26).

Thallus foliose, up to 3 cm. in diameter, ± polyphyllous, attached to substratum by a central umbilicus, lobes convex, with down-rolled margins; dorsal surface smooth, matt brown underneath greyish white pruina, ventral surface light to dark brown, wrinkled, densely rhizinose, rhizinae up to 2 mm. long,

unbranched, cinereous. Perithecia infrequent, immersed in dorsal surface of thallus, appearing as minute black dots, up to 0·3 mm. in diameter; ascospores 8 per ascus, hyaline, simple, ellipsoid, 10–13 μm. by 5–7 μm.

D. intestiniforme superficially resembles species of *Umbilicaria* by possessing an umbilicus, but may easily be separated, when fertile, by the presence of perithecia. When sterile, the down-rolled margins of the lobes are distinctive. Of the other species of *Dermatocarpon* reported from the maritime Antarctic, *D. lachneum* (Ach.) A. L. Sm. and *D. racovitzae* C. W. Dodge possess a squamulose thallus without central umbilicus, while *D. antarcticum* C. W. Dodge has a foliose thallus lacking a central umbilicus.

Habitat. On dry, north-facing, non-enriched boulders; altitudinal range 10–50 m.

Distribution. South Georgia: so far known from only two localities, one in Moltke Harbour (Royal Bay), and the other in Leith Harbour (Stromness Bay), where it was locally abundant (Fig. 15). Bi-polar: South Orkney Islands (specimens in AAS), Antarctic Peninsula (Lamb, 1948*a*), arctic-alpine in the Northern Hemisphere (Lamb, 1948*a*).

Himantormia M. Lamb

Thallus fruticose, erect, blackened, consisting of branched, flattened, strap-shaped branches. Apothecia laminal, sessile, lecanorine; ascospores 6–8 per ascus, hyaline, simple, ellipsoid. Phycobiont *Trebouxia.*

This genus can be recognized immediately by the burnt appearance of the thallus, well-developed material often resembling strips of burnt cardboard.

Himantormia lugubris (Hue) M. Lamb

Syn. *Ramalina lugubris* Hue.
Icon. Lamb (1964, pl. VIa–d).
Lit. Lamb (1964, p. 18–22).

Thallus fruticose, erect, up to 5 cm. tall, consisting of flattened, strap-shaped branches up to 3 cm. long, 2 mm. broad, and 0·5 mm. thick; branches black, covered with an isabelline thallus mantle towards the base, matt to slightly shining, longitudinally striate, branched once or twice dichotomously in one plane. Apothecia infrequent, laminal, lecanorine, poorly developed; asci and ascospores not differentiated.

The black, flattened thallus will distinguish this species from all other South Georgian lichens. Species of *Usnea* subgenus *Neuropogon* may rarely possess an entirely black thallus but they always have cylindrical branches.

Habitat. Steep frost-shattered slope facing north, at *c.* 800 m. a.s.l.

Distribution. South Georgia: so far known from only one locality at Ross Pass between Royal Bay and Undine South Harbour (Fig. 16). South Orkney and South Shetland Islands, Antarctic Peninsula (Lamb, 1964; Lindsay, 1969*a*).

Hypogymnia (Nyl.) Nyl.

Thallus foliose, ascending or fruticose, hollow, attached to substratum by adhesive discs or directly by the lower cortex. Apothecia lecanorine, sessile; ascospores 8 per ascus, hyaline, ellipsoid, simple. Phycobiont *Trebouxia.*

Hypogymnia lugubris (Pers.) Krog

Syn. *Parmelia lugubris* Pers.
Icon. Plate IIb; Krog (1968, fig. 21).
Lit. Lamb (1958, p. 130), Krog (1968, p. 99–100).

Thallus fruticose or ascending, forming tufts up to 15 cm. in diameter and 7 cm. tall, loosely attached to substratum by lower cortex, lobes hollow, more or less cylindrical, dichotomously branched; dorsal surface of lobes pale olivaceous grey to greyish sepia, variegated with black, smooth, slightly shining, ventral surface fuscous black, becoming alutaceous at the lobe tips, matt, heavily wrinkled, without rhizinae. Apothecia absent; pycnidia abundant, appearing as small black dots scattered unevenly over the dorsal surface of the thallus, the pycnoconidia cylindrical, hyaline 3–4 μm. by 0·8–1·0 μm.

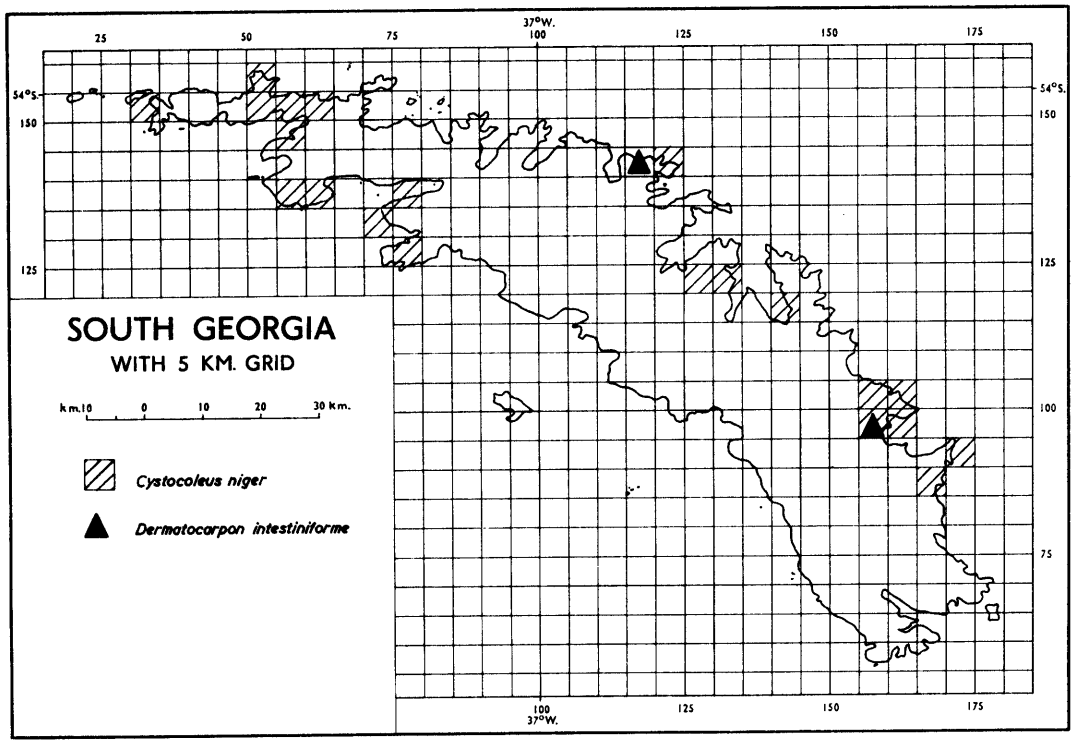


FIGURE 15

The known distribution on South Georgia, by 5 km. squares, of *Cystocoleus niger* and *Dermatocarpon intestiniforme*, based on the specimens and field records given in Appendix A.

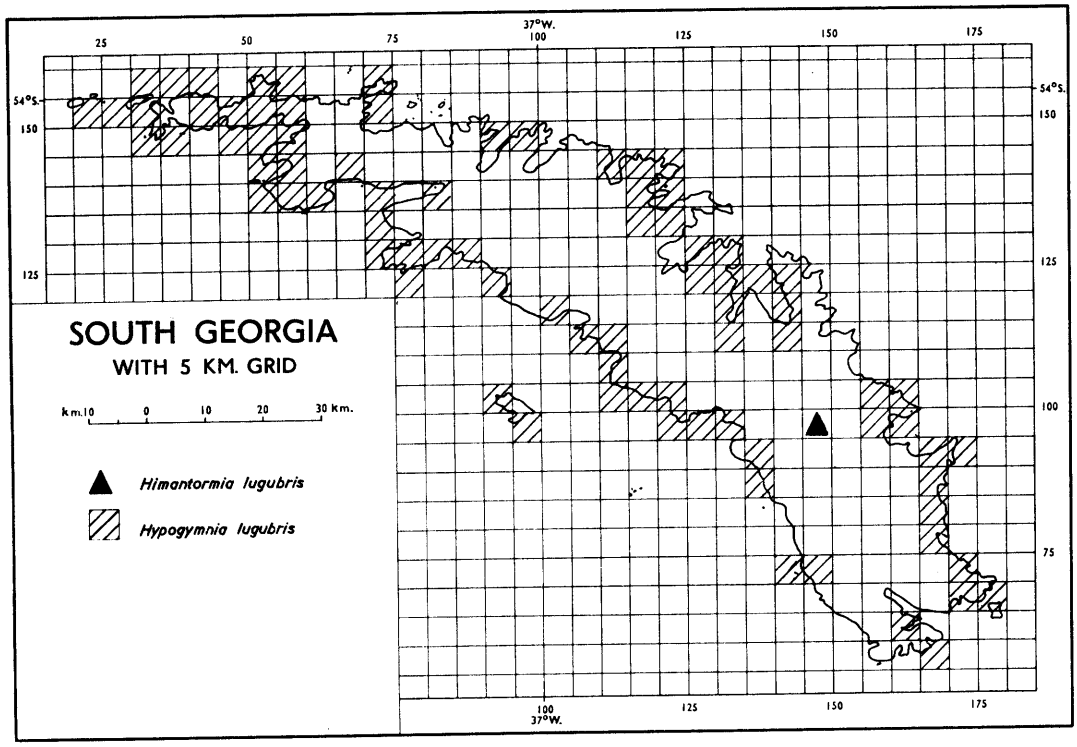


FIGURE 16

The known distribution on South Georgia, by 5 km. squares, of *Himantormia lugubris* and *Hypogymnia lugubris*, based on the specimens and field records given in Appendix A.

H. lugubris is readily recognized by the hollow, variegated thallus. *Menegazzia sanguinascens* also has a hollow thallus but is yellow-green in colour. Krog's (1968, fig. 21) illustration shows the growth form typical of the South Georgian material.

Habitat. On dry rock and mineral soil, on *Andreaea* cushions, *Chorisodontium* and *Polytrichum* banks, common on bird-perching stones but also frequent in non-enriched situations where it may be co-dominant with *Sphaerophorus globosus*, with no apparent preference for aspect; altitudinal range 2–300 m.

Distribution. South Georgia: widespread and very common (Fig. 16). Bi-polar: Fuegia (Krog, 1968), Falkland Islands (Zahlbruckner, 1917), Australia (Weber and Wetmore, 1972), Alaska (Krog, 1968), Asia (Krog, 1968).

Leptogium (Ach.) Gray

Thallus foliose, with both upper and lower cortex, ventral surface tomentose or nude. Apothecia lecanorine; ascospores 8 per ascus, hyaline, 3-septate to muriform. Phycobiont *Nostoc*.

Leptogium tremelloides (L. f.) Gray has been reported from South Georgia by Darbishire (1912) and Taylor (1914). Darbishire's record is *L. menziesii* as noted below, while Taylor's is considered to be *Mastodia tesselata*. Sierk (1964) has shown that *L. tremelloides* is a European species and that records of it from North America are misidentifications. On these grounds, Taylor's record is rejected but, since the material has not been located, a re-identification cannot be made.

1. Plant distinctly hydrophilous, growing in wet moss turves or carpets, ventral surface heavily tomentose . . . . . ***L. menziesii***
   Plants not hydrophilous, growing on dry rock, ventral surface not or only slightly tomentose . . . . . ***L. puberulum***

Leptogium menziesii Mont.

Icon. None.
Lit. Lamb (1958, p. 47–48).

Thallus foliose, thin, 2–15 cm. in diameter, and up to 0·1 mm. thick, metallic black when wet, olivaceous when dry, irregularly lobed, lobe tips ascending; dorsal surface smooth, slightly shining, ventral surface lightly to heavily tomentose. Apothecia occasional, lecanorine, sessile to shortly stipitate, up to 3 mm. in diameter; disc reddish brown, smooth, plane or slightly concave; thalline margin concolorous with thallus, thin, smooth; ascospores 8 per ascus, hyaline, thin-walled, 3-septate, fusiform, 14–18 μm. by 5–7 μm.

P. M. Jørgensen (personal communication) has noted that as the South Georgian material is stunted the identification may be suspect. Darbishire's (1912) record of *Leptogium tremelloides* is referrable to this species.

Habitat. Typically in wet *Tortula robusta* turf, but occasionally in damp hollows in *Chorisodontium* and *Polytrichum* banks and on wet soil on moraines, without regard to aspect; altitudinal range 5–700 m.

Distribution. South Georgia: widespread and abundant (Fig. 17). Fuegia (Räsänen, 1932), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972).

Leptogium puberulum Hue

Icon. None.
Lit. Hue (1915, p. 14–15), Dodge (1966, p. 3–4).

Thallus foliose, thin, up to 0·1 mm. thick and up to 4 cm. in diameter, brown when wet, dark olivaceous when dry, irregularly lobed, lobes heavily crisped, tips appressed to substratum or ascending; dorsal surface smooth, slightly shining, ventral surface smooth nude or with faint tomentum, slightly shining. Sterile.

Although the South Georgian specimens are very stunted and sterile, P. M. Jørgensen has suggested the above determination, which agrees with published descriptions of *L. puberulum*, as far as these features are discernible.

Habitat. On dry cliffs, scree or fluvio-glacial gravel beds in non-enriched habitats apparently with preference for a northerly aspect; altitudinal range 10–300 m.

Distribution. South Georgia: known only from three localities (Fig. 17). South Orkney Islands (Smith, 1972), South Shetland Islands (Dodge, 1966), Antarctic Peninsula (Hue, 1915).

Massalongia Müll. Arg.

Thallus squamulose, with or without hypothallus, attached to substratum by rhizinae. Apothecia lecideine; ascospores 8 per ascus, hyaline to pale brown, ellipsoid to fusiform, simple or septate. Phycobiont *Nostoc.*

Massalongia carnosa (Dicks.) Körb.

Icon. Henssen (1963, pl. I, fig. 14).
Lit. Lamb (1958, p. 55), Henssen (1963, p. 1339).

Thallus squamulose, of various shades of brown, the squamules small, up to 2·5 mm. long and 2 mm. broad, with incised-lobate margins; dorsal surface faintly striate, the striations running more or less centrifugally, isidiate, the isidia globular to cylindrical, simple, clustered along margins of squamules, occasionally becoming laminal; ventral surface white, with small, sparse, white rhizinae. Apothecia infrequent, lecideine, laminal, sub-sessile, up to 1 mm. in diameter, the margin becoming excluded, disc black, plane; ascospores 8 per ascus, hyaline, ellipsoid, 3-septate, thin-walled, 16–25 μm. by 5–7 μm.

This may, possibly, be confused with *Parmeliella cronia* but it never has the bluish tinge typical of that species. The presence of isidia separates it from sterile squamules of species of *Cladonia.*

Habitat. On small acrocarpous moss cushions on damp, sheltered, north-facing slopes; altitudinal range 10–100 m.

Distribution. South Georgia: known only from three localities (Fig. 18). Bi-polar: Argentina (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), South Orkney Islands (specimens in AAS), New Zealand. (Martin, 1966).

Mastodia Hook. f. et Harv.

Thallus foliose, homoiomerous. Ascocarps perithecia; ascospores 8 per ascus, hyaline, simple, ellipsoid Phycobiont *Prasiola.*

Mastodia tesselata (Hook. f. et Harv.) Hook. f. et Harv.

Syn. *Dermatomeris georgica* Reinsch.
Mastodia georgica (Reinsch) C. W. Dodge.
Prasiola tesselata Kütz.
Ulvella tesselata Hook. f. et Harv.
Icon. Vainio (1903, pl. IV, figs. 33 and 34), Lamb (1948*a*, pl. III, fig. 1, pl. IV, fig. 1).
Lit. Vainio (1903, p. 36).

Thallus foliose, up to 2 cm. in diameter and up to 0·5 mm. thick, olivaceous black, irregularly lobed, lobe tips crisped, ascending; dorsal surface smooth, appearing warted when perithecia are present; ventral surface smooth, without rhizinae, attached to substratum by central umbilicus or by hyphae spread over most of surface. Perithecia common, appearing as warts in the dorsal surface of the thallus, concolorous with thallus, up to 1 mm. in diameter; ascospores 8 per ascus, hyaline, simple, ellipsoid, 12–16 μm. by 4–6 μm.

M. tesselata is quite distinctive but it may, possibly, be confused only with *Leptogium puberulum* from which it is distinguished by the presence of perithecia and the green (*Prasiola*) instead of blue-green (*Nostoc*) phycobiont.

Taylor's (1914) record of *Leptogium tremelloides* may refer to this species, his material being described as halophilous and saxicolous, a habitat occupied by *Mastodia*, never by *Leptogium*, on South Georgia.

Habitat. On dry boulders near high-tide level, in the uppermost part of the splash zone, or on dry bird-perching stones, occasionally in nitrogenous melt-water channels, without preference for aspect; altitudinal range 1–150 m.

Distribution. South Georgia: widespread and locally abundant in coastal areas (Fig. 18). Bi-polar: Fuegia (Lamb, 1948*a*), South Sandwich, South Orkney and South Shetland Islands (specimens from three areas in AAS), Antarctic Peninsula (Lamb, 1948*a*), Iles Kerguelen (Dodge, 1948), Siberia (Lamb, 1948*a*).

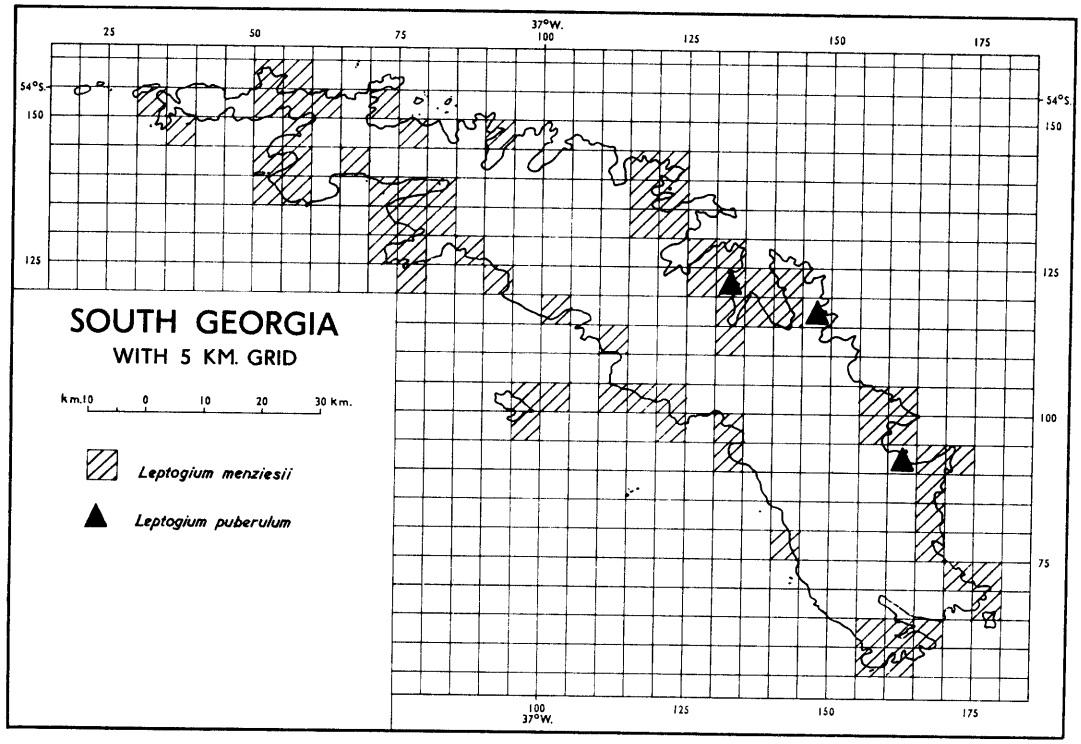


FIGURE 17

The known distribution on South Georgia, by 5 km. squares, of *Leptogium menziesii* and *Leptogium puberulum*, based on the specimens and field records given in Appendix A.

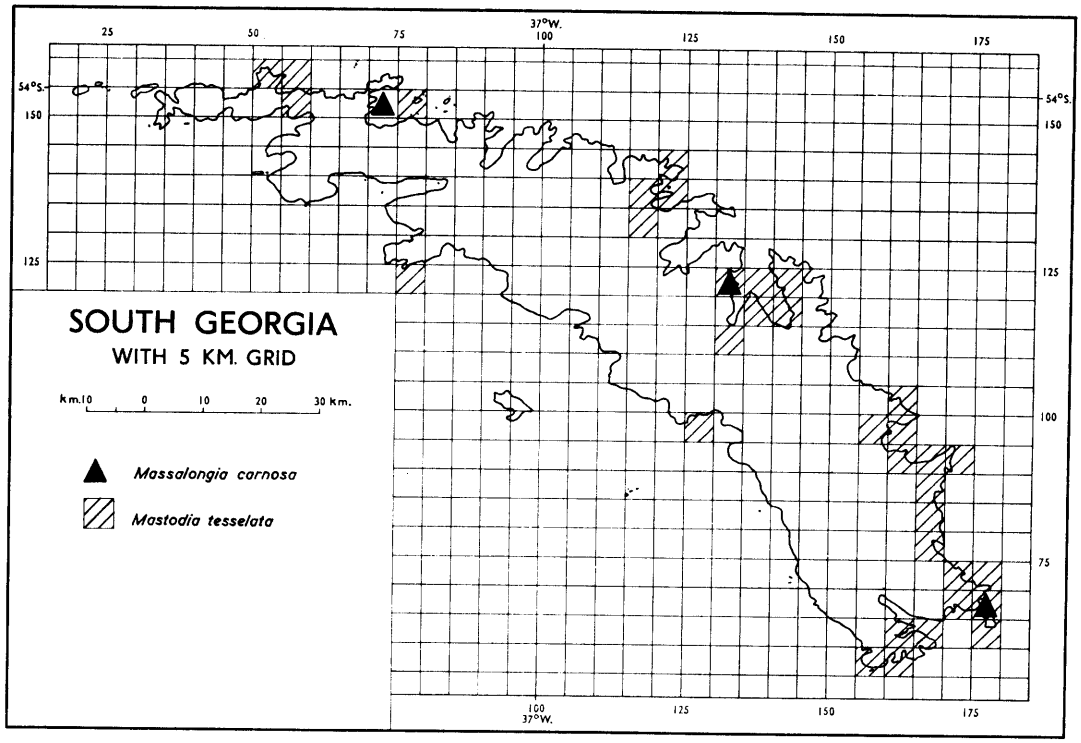


FIGURE 18

The known distribution on South Georgia, by 5 km. squares, of *Massalongia carnosa* and *Mastodia tesselata*, based on the specimens and field records given in Appendix A.

Menegazzia Massal.

Thallus foliose, hollow, attached to substratum by adhesive discs or directly by the lower cortex, dorsal surface perforated by numerous small holes. Apothecia lecanorine, sessile; ascospores 2 to 8 per ascus, hyaline, simple, ellipsoid. Phycobiont *Trebouxia*.

Menegazzia sanguinascens (Räs.) R. Sant.

Syn. *Parmelia sanguinascens* Räs.
Parmelia dispora var. *alboffii* Zahlbr.
Icon. Plate IIc.
Lit. Santesson (1942, p. 13), Lamb (1958, p. 139), Lindsay (1973*c*, p. 108–09).

Thallus foliose, hollow, appressed to substratum, forming rosettes up to 8 cm. in diameter, lobes radiating, dichotomously branched; dorsal surface perforated by numerous holes 0·3–0·7 mm. in diameter, greyish yellow-green, smooth or wrinkled, slightly shining, with a faint network of pale patches towards lobe tips, sorediate, soralia globose, up to 1·3 mm. in diameter, concolorous with and scattered irregularly over dorsal surface; ventral surface violaceous black, becoming alutaceous at the lobe tips, heavily wrinkled, slightly shining, without rhizinae. Apothecia absent; pycnidia abundant, appearing as irregular black dots up to 0·1 mm. in diameter and scattered unevenly over dorsal surface, pycnoconidia cylindrical, hyaline, 4·0 μm. by 0·3–0·4 μm.

An easily recognizable species by means of the hollow thallus with perforations in the dorsal surface.

Habitat. On dry, non-enriched boulders and cliffs, also on *Colobanthus subulatus* cushions, apparently without regard to aspect; altitudinal range 5–150 m.

Distribution. South Georgia: rather scattered but with two main areas in Cumberland Bay and the northern end of the south-west coast (Fig. 19). Bi-centric in the Southern Hemisphere: Fuegia (Santesson, 1942), New Zealand (Martin, 1966).

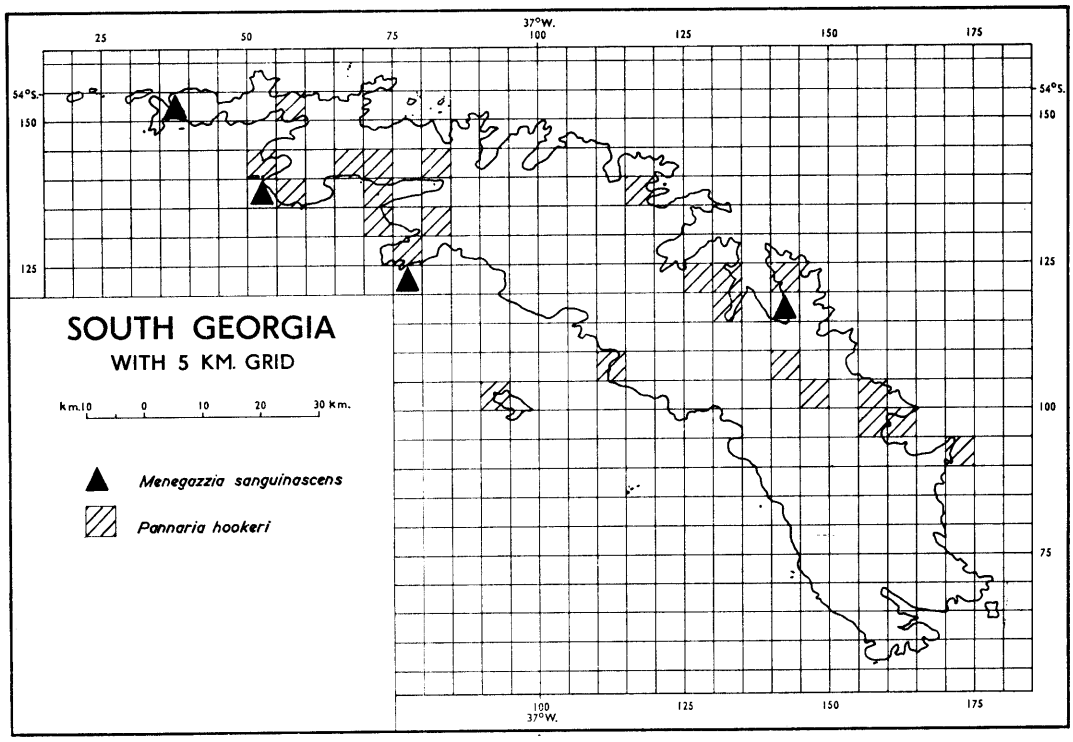


FIGURE 19

The known distribution on South Georgia, by 5 km. squares, of *Menegazzia sanguinascens* and *Pannaria hookeri*, based on the specimens and field records given in Appendix A.

Pannaria Del.

Thallus squamulose, greenish grey, on rock, soil or moss cushions. Apothecia lecanorine, conspicuous; ascospores 8 per ascus, hyaline, simple. Phycobiont *Nostoc*.

The genus is almost identical to *Psoroma*, and differs only in the possession of a blue-green phycobiont.

Pannaria hookeri (Borr. ex Sm.) Nyl.

Icon. Plate IIIa.
Lit. Poelt (1969, p. 436).

Thallus squamulose, greenish grey, streaked with white towards tips of squamules which are radiate-plicate at margin. Apothecia lecanorine, conspicuous, up to 5 mm. in diameter, margin crenulate, disc concave, some shade of brown; ascospores 8 per ascus, hyaline, ellipsoid, simple, 14–16 μm. by 7–8 μm.

This species may be confused with the species of *Parmeliella* and *Massalongia*, but *Parmeliella cronia* always has a bluish tinge to the thallus, which is absent in *Pannaria hookeri*, while *Massalongia carnosa* has 3-septate spores and isidia, both of which are absent in *P. hookeri*.

Habitat. On cliffs or boulders, occasionally dry acrocarpous moss cushions in non-enriched, exposed habitats without preference for aspect; altitudinal range 30–300 m.

Distribution. South Georgia: widely distributed along the north-east coast and the northern end of the south-west coast, but rarely abundant (Fig. 19). Bi-polar: arctic-alpine in the Northern Hemisphere (Poelt, 1969), but in the Southern Hemisphere apparently known only from South Georgia.

Parmelia Ach.

Thallus foliose, attached to substratum by rhizinae. Apothecia lecanorine; ascospores 2–8 per ascus, hyaline, ellipsoid. Phycobiont *Trebouxia*.

Some species of this genus may be confused with *Physcia*, but can be distinguished by the colour of the ventral surface of the thallus, which is black in *Parmelia* and alutaceous in *Physcia*. Four species are at present recorded from South Georgia, *P. austrogeorgica* C. W. Dodge being regarded as a synonym of *Physcia caesia* (Lindsay, 1973*c*), while Darbishire's (1912) record of *Parmelia enteromorpha* refers to *Hypogymnia lugubris* (Lindsay, 1974).

1. Thallus dark brown, dorasl surface densely covered with isidia . . . . . ***P. ushuaiensis***
   Thallus white, grey with a slight brownish tinge or primrose, sorediate or isidiate 2
2. Thallus primrose yellow, dorsal surface without reticulations, sorediate. . . . . ***P. gerlachei***
   Thallus white to grey with brownish tinge, dorsal surface with reticulations, sorediate or isidiate 3
3. Thallus sorediate . . . . . ***P. sulcata***
   Thallus slightly to densely isidiate . . . . . ***P. saxatilis***

Parmelia gerlachei Zahlbr.

Syn. *Parmelia antarctica* Vain. non Bitt. (Bitter, 1901, p. 248).
Icon. Plate IId.
Lit. Vainio (1903, p. 13–14 as *P. antarctica* Vain.), Lamb (1958, p. 133).

Thallus foliose, forming rosettes up to 10 cm. in diameter, appressed to substratum, primrose yellow, matt or slightly shining, occasionally eroded so that white medulla is exposed; lobes radiating, dichotomously branched, sorediate towards centre of thallus; soredia in globose soralia, granular, concolorous with thallus; ventral surface fuscous black, becoming chestnut towards lobe tips, shining, densely rhizinose, rhizinae black, cylindrical, occasionally dichotomously branched. Apothecia absent; pycnidia frequent, appearing as small black dots *c.* 240 μm. in diameter scattered over dorsal surface of thallus, pycnoconidia cylindrical, hyaline, 2–3·5 μm. by 0·8–1·0 μm.

Additional morphological details about this species were given by Lindsay (1973*c*). *P. gerlachei* is quite distinctive amongst the South Georgian macrolichens, being recognized by the sorediate, primrose yellow, rosette-forming thallus.

Habitat. On dry enriched or non-enriched cliff faces, boulders and bird-perching stones, especially at the peripheries of bird rookeries, without regard to aspect; altitudinal range 3–45 m.

Distribution. South Georgia: locally abundant in the Cumberland Bay and Royal Bay areas, but so far not recorded from elsewhere on the island (Fig. 20). Argentina (Grassi, 1950), Chile (Räsänen, 1932), Antarctic Peninsula (Lindsay, 1973*c*).

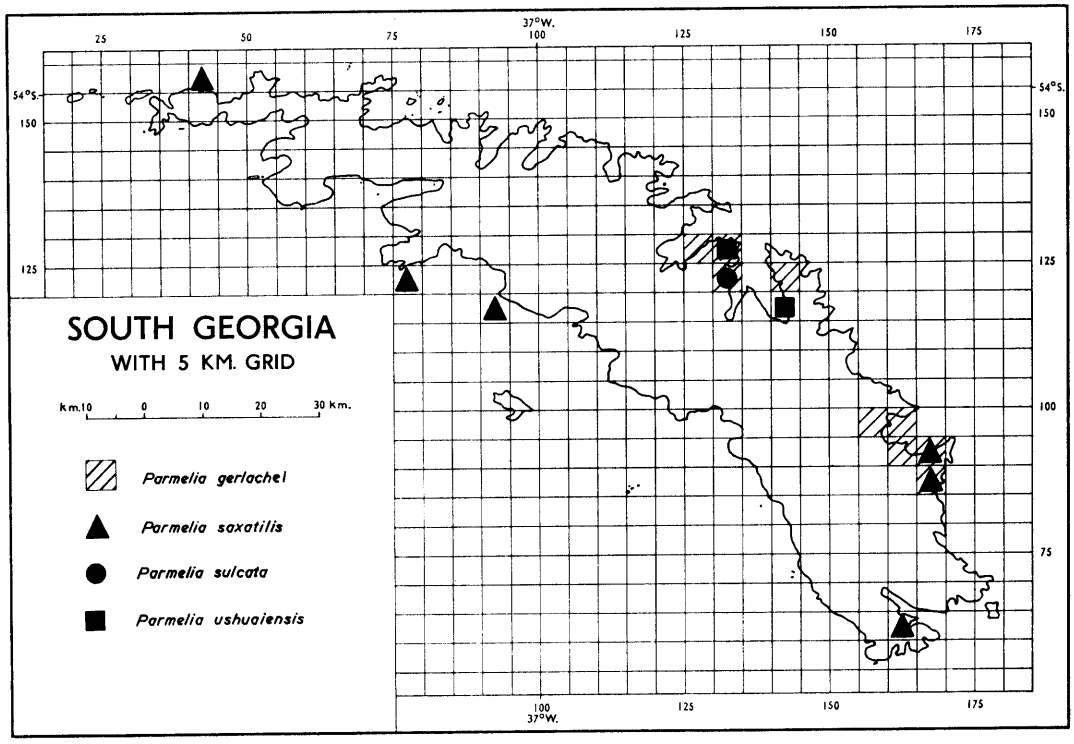


FIGURE 20

The known distribution on South Georgia, by 5 km. squares, of *Parmelia gerlachei*, *Parmelia saxatilis*, *Parmelia sulcata* and *Parmelia ushuaiensis*, based on the specimens and field records given in Appendix A.

Parmelia saxatilis (L.) Ach.

Syn. *Parmelia acervata* Hue.
Parmelia saxatilis f. *acervata* (Hue) M. Lamb.
Icon. Taylor (1967, fig. 75).
Lit. Lamb (1958, p. 134), Taylor (1967, p. 92).

Thallus foliose, up to 15 cm. in diameter, not appressed to substratum, white to grey with a brownish tinge, normally matt though occasionally slightly shining towards lobe tips; lobes irregularly branched, radiating or imbricate, with incised, ascending margins; dorsal surface smooth to wrinkled, covered with a network of white lines, isidiate; isidia infrequent to abundant, coralloid, concolorous with thallus; ventral surface fuscous black, shining, occasionally becoming chestnut towards lobe tips, rhizinae abundant, black, irregularly branched, cylindrical to subterete. Apothecia and pycnidia absent.

For further details and comments on the variability of this species, see Lindsay (1973*c*). Like *Xanthoria elegans*, it is widespread in the maritime Antarctic and is highly susceptible to modification by environmental factors. It appears to be less frequent on South Georgia than farther south, though this may be due to undercollecting. It may be separated easily from other foliose lichens by the network of fine lines and isidia on the dorsal surface of the thallus.

Habitat. On dry boulders near the shore and near penguin rookeries, apparently without regard to aspect; altitudinal range 3–10 m.

Distribution. South Georgia: infrequently collected and so with a scattered distribution (Fig. 20). Cosmopolitan: Argentina (Grassi, 1950; Lamb, 1958), Falkland Islands (Zahlbruckner, 1917), South Orkney and South Shetland Islands, Antarctic Peninsula to approx. lat. 65° S. (Lindsay, 1973*c*), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963), Australia (Weber and Wetmore, 1972).

Parmelia sulcata Tayl.

Syn. *Parmelia cruenta* Darb.
Icon. Taylor (1967, fig. 81).
Lit. Lamb (1958, p. 134–35), Taylor (1967, p. 98).

Thallus foliose, up to 5 cm. in diameter, appressed to substratum, white to very pale isabelline; lobes dichotomously branched, dorsal surface matt, with reticulate pattern, cracked, cracks dissolving into soredia towards centre of thallus; ventral surface fuscous black, becoming chestnut towards lobe tips, shining, densely rhizinose, rhizinae black, cylindrical, occasionally dichotomously branched. Apothecia and pycnidia absent.

This species may be distinguished easily by the reticulate, slightly cracked, sorediate thallus.

Parmelia cruenta Darb. was described by Darbishire (1912) from material collected by Skottsberg on Isla Navarino (Tierra del Fuego), which is typical of *P. sulcata*, according to the type specimen in Stockholm (S). Zahlbruckner (1917, p. 41), probably misled by Darbishire's (1912) remarks about the similarity between his new species and *P. saxatilis*, cited *P. cruenta* as a synonym of the latter. In view of the specialized habitat, the author has concluded (Lindsay, 1973*a*) that the species has been introduced to the island.

Habitat. Wooden deck planks of the hulk *Louise*, at an altitude of *c.* 5 m.

Distribution. South Georgia: currently known from a single locality at Grytviken whaling station (Fig. 20). Cosmopolitan: Peru (Soukup, 1965), Argentina (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963).

Parmelia ushuaiensis Zahlbr.

Syn. *Parmelia roivainenii* Räs.
Icon. Räsänen (1932, pl. II, fig. 5 as *P. roivainenii*).
Lit. Zahlbruckner (1917, p. 42), Lindsay (1973*c*, p. 112).

Thallus foliose, up to 6 cm. in diameter, sepia, chestnut to fuscous black, occasionally eroded so that white medulla is exposed; lobes appressed to substratum, branched unequally, with incised margins; dorsal surface of thallus matt or slightly shining towards lobe tips, moderately to densely isidiate towards centre of thallus, isidia cylindrical, frequently sub-dichotomously branched; ventral surface black becoming sepia towards lobe tips, shining, moderately rhizinose, rhizinae, black, cylindrical or subterete, unbranched. Apothecia and pycnidia absent.

This species can be identified easily by its dark brown, isidiate thallus with rhizinae on the ventral surface.

Habitat. On timber and in some abundance on dry coastal rocks; altitudinal range 5–100 m.

Distribution. South Georgia: at present only known from two localities in Cumberland East Bay (Fig. 20.) Fuegia (Zahlbruckner, 1917), South Orkney Islands (Lindsay, 1973*c*).

Parmeliella Müll. Arg.

Thallus squamulose, with pronounced bluish tinge. Apothecia lecideine; ascospores 8 per ascus, hyaline, ellipsoid, simple. Phycobiont *Nostoc*.

Parmeliella cronia Tuck.

Syn. *Coccocarpia cronia* (Tuck.) Vain.
Icon. Martin and Child (1972, pl. VIII).
Lit. Martin and Child (1972, p. 63).

Thallus squamulose, up to 5 cm. in diameter, brownish green with pronounced bluish tinge; upper surface sparsely or densely covered by isidioid warts which are blackened at the tips, this dark coloration rarely spreading to other parts of the thallus, lower surface tan, devoid of tomentum. Apothecia small, lecideine, 1–2 mm. in diameter, disc black, plane; spores hyaline, ellipsoid, simple 14–16 μm. by 6–8 μm.

This squamulose species may be distinguished easily by the pronounced bluish tinge of the thallus, unknown in other South Georgian macrolichens, except *Physcia caesia*, which is sorediate.

Habitat. On soil or on small acrocarpous mosses, halophobous and nitrophobous; altitudinal range 10–100 m.

Distribution. South Georgia: known from only three collections from the Cumberland Bay and Royal Bay areas (Fig. 21). Primarily tropical and sub-tropical in both the Northern and Southern Hemispheres (Hale, 1961): New Zealand (Martin, 1966).

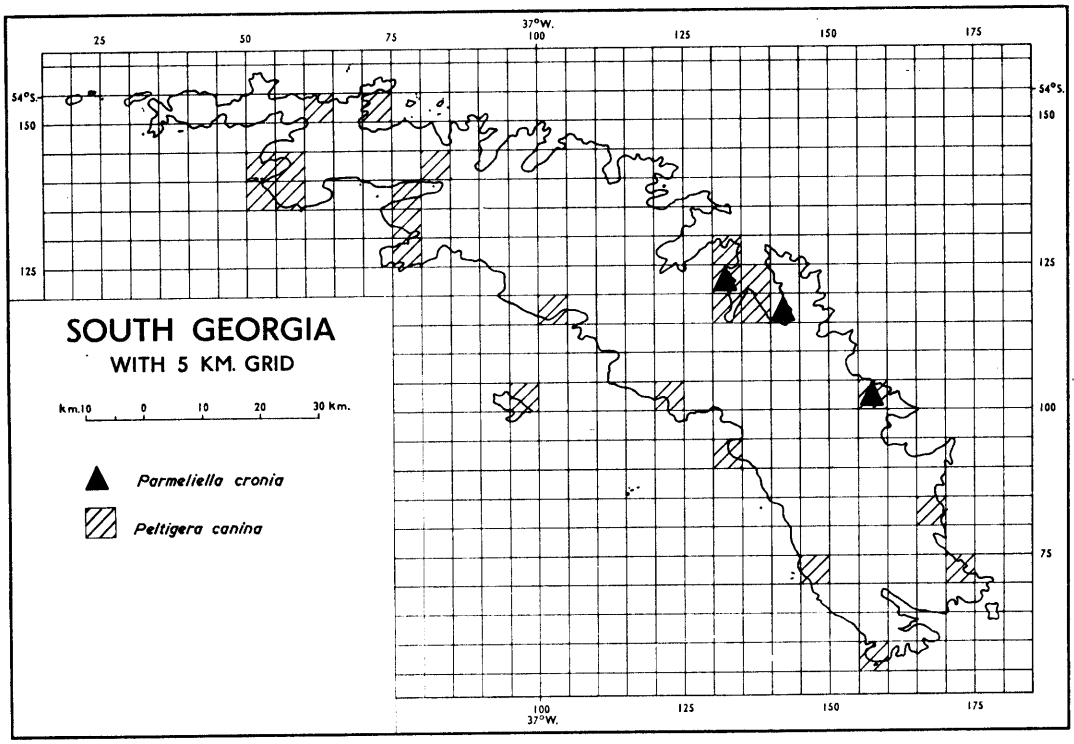


FIGURE 21

The known distribution on South Georgia, by 5 km. squares, of *Parmeliella cronia* and *Peltigera canina*, based on the specimens and field records given in Appendix A.

Peltigera Willd.

Thallus foliose, thick, ventral surface arachnoid, occasionally veined. Apothecia lecanorine, marginal on the dorsal surface; ascospores hyaline to light brown, fusiform, 3- to multi-septate. Phycobiont *Coccomyxa* or *Nostoc.*

A key to Antarctic species, with notes on their ecology and distribution, has been given by Lindsay (1971*b*), but since then two further species, *P. canina* and *P. spuria*, have been found on South Georgia. A total of five species of *Peltigera* are now known from South Georgia.

1. Thallus without veins on ventral surface, which is entirely arachnoid . . . . ***P. zahlbruckneri***
   Thallus with veins on ventral surface, which is not entirely arachnoid 2
2. Soredia present in ± eroded soralia on dorsal surface. . . . . ***P. spuria***
   Soredia absent 3
3. Dorsal surface smooth and shiny, without any trace of tomentum . . . ***P. horizontalis***
   Dorsal surface tomentose, at least towards margins, matt or shiny in patches . . . 4
4. Thallus bullate, ± heavily tomentose, dorsal surface matt, never shiny . . . . ***P. canina***
   Thallus smooth, lightly tomentose towards margins, dorsal surface shiny in patches . ***P. rufescens***

Peltigera canina (L.) Willd.

Icon. Plate IIe; Lindahl (1953, figs. 3, 4 and 8), Taylor (1967, fig. 87).
Lit. Lindahl (1953, p. 104), Taylor (1967, p. 107).

Thallus forming circular patches up to 10 cm. in diameter, brown when wet, becoming greyish when dry, thick, lobed; lobes up to 4 cm. long and 3 cm. broad, dorsal surface tomentose, bullate, margins

± down-rolled, ventral surface with light brown, anastomosing veins and rhizinae, rhizinae white, terete, up to 2 mm. long and 0·6 mm. in diameter. Sterile.

This species may be distinguished by the relatively large leathery thallus with tomentose dorsal surface and veined ventral surface.

Habitat. On *Chorisodontium* banks and *Andreaea* cushions, in *Tortula robusta* turf and in *Rostkovia* bog or on morainic debris, in damp to dry, sheltered to exposed habitats without preference for aspect; altitudinal range 15–400 m.

Distribution. South Georgia: widely distributed around the island (Fig. 21). Cosmopolitan and probably circum-polar sub-Antarctic, but not penetrating into the Antarctic botanical zone (Murray, 1960*c*) Patagonia (Lamb, 1958), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966).

Peltigera horizontalis (Huds.) Baumg.

Icon. Taylor (1967, fig. 89).
Lit. Taylor (1967, p. 109).

Thallus forming irregularly orbicular patches up to 7 cm. in diameter, greenish brown when wet, becoming greyish when dry, thick, lobed; lobes up to 3 cm. long and 1·5 cm. broad, dorsal surface smooth, shiny, without tomentum, ventral surface arachnoid, brown, veined, veins anastomosing, without rhizinae. Apothecia infrequent, marginal on dorsal surface, ellipsoid, up to 13 mm. by 9 mm., thalline margin thick or thin, depending on degree of exposure, disc plane, smooth, reddish brown; asci and ascospores immature.

P. horizontalis can be distinguished by its leathery thallus, with shiny dorsal and veined ventral surface as well as by the ± horizontal apothecia borne on the lobe tips.

Habitat. On east-facing rocks at an altitude of *c.* 30 m. a.s.l.

Distribution. South Georgia: known from only one collection from Holmestrand (Fig. 22). Cosmopolitan and probably circum-polar sub-Antarctic but not penetrating into the Antarctic botanical zone (Murray, 1960*c*).

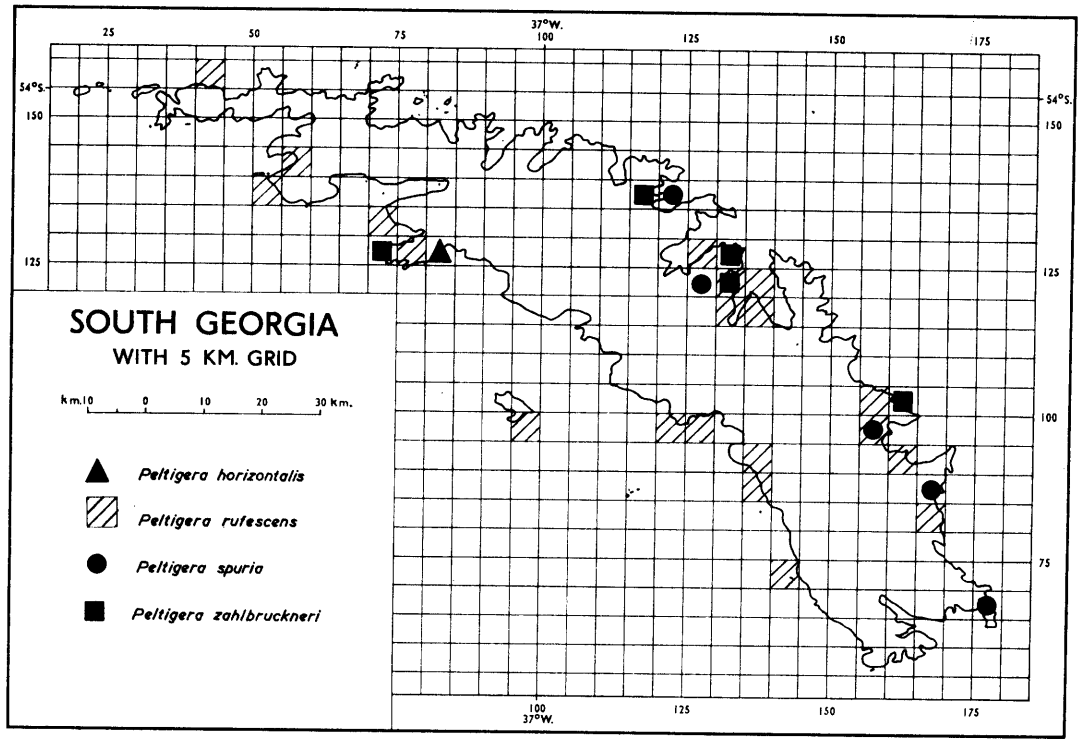


FIGURE 22

The known distribution on South Georgia, by 5 km. squares, of *Peltigera horizontalis*, *Peltigera rufescens*, *Peltigera spuria* and *Peltigera zahlbruckneri*, based on the specimens and field records given in Appendix A.

Peltigera rufescens (Weiss) Humb.

Syn. *Peltigera canina* var. *rufescens* (Weiss) Mudd.
Icon. Lindahl (1953, figs. 2 and 8), Martin and Child (1972, pl. XXVII as *P. canina* var. *rufescens*).
Lit. Lindahl (1953, p. 144), Lamb (1958, p. 84 as *P. canina* var. *rufescens*).

Thallus forming irregularly orbicular patches up to 9 cm. in diameter, reddish brown when wet and dry, thick, lobed; lobes up to 3·5 cm. long and 2 cm. broad, dorsal surface smooth, shiny in patches, tomentose towards the margins, infrequently mottled with small black patches, ventral surface arachnoid, with light to dark brown anastomosing veins and white rhizinae. Sterile.

The leathery thallus of this species may be confused with *P. canina* but it can be separated by the presence of shiny patches on the dorsal surface.

Dodge (1968) has re-determined Skottsberg's material from Cumberland Bay, identified by Darbishire (1912) as *P. rufescens*, as the Antarctic endemic *P. antarctica* C. W. Dodge. Examination of Skottsberg's material in Stockholm (S) by the author has shown it to be *P. rufescens*, of which *P. antarctica* may prove to be a synonym.

Habitat. On *Chorisodontium* banks, in *Tortula robusta* turf, occasionally in *Rostkovia* bog and on morainic debris, usually in somewhat sheltered situations but without preference to aspect; altitudinal range 20–250 m.

Distribution. South Georgia: fairly common around the island, although never in any abundance (Fig. 22). Cosmopolitan: Falkland Islands (Zahlbruckner, 1917), South Orkney Islands, Antarctic Peninsula (Lindsay, 1971*b*).

Peltigera spuria (Ach.) DC.

Syn. *Peltigera canina* var. *spuria* (Ach.) Schaer.
Peltigera erumpens (Tayl.) Vain.
Icon. Lamb (1958, pl. VI, fig. 17), Taylor (1967, fig. 92).
Lit. Lamb (1958, p. 85), Taylor (1967, p. 112).

Thallus forming small irregular patches up to 5 cm. in diameter, brown when wet and dry, thick lobed; lobes cochleate, up to 2·5 cm. long and broad, dorsal surface smooth and tomentose in patches, with soredia in more or less eroded soralia, ventral surface arachnoid, brown, with anastomosing veins and small white rhizinae. Sterile.

P. spuria may, at times, resemble small forms of *P. canina* but it can be distinguished by the presence of soredia on the dorsal surface.

Habitat. On dry or damp moss banks or cushions, morainic debris, in somewhat sheltered situations but without regard to aspect; altitudinal range 15–300 m.

Distribution. South Georgia: apparently restricted to the north-east coast between Stromness Bay and Cooper Island, where it is locally abundant (Fig. 22). Cosmopolitan: Falkland Islands (Zahlbruckner, 1917), South Shetland Islands, Antarctic Peninsula (Lindsay, 1971*b*).

Peltigera zahlbruckneri Gyeln.

Icon. None.
Lit. des Abbayes (1962, p. 241).

Thallus forming irregular patches up to 8 cm. in diameter, brown when wet and dry, thick, lobed; lobes up to 3 cm. long and 2 cm. broad, dorsal surface smooth, shiny, without trace of tomentum, ventral surface entirely arachnoid, without trace of veins or rhizinae. Sterile.

This species may be distinguished easily from other species of the genus on South Georgia by the total absence of veins on the ventral surface.

Habitat. Mainly on soil in *Festuca–Acaena* communities, but occasionally in *Rostkovia* bogs, with some sites moderately exposed, although the species itself apparently shows no preference for aspect; altitudinal range 3–150 m.

Distribution. South Georgia: scattered at several localities on the north-east coast and at one on the south-west coast, and apparently relatively abundant at each (Fig. 22). Probably widespread in the Southern Hemisphere where it may have been misidentified as *Peltigera malacea* (Ach.) Funck; Fuegia, Himalayas and central Africa (des Abbayes, 1962).

Physcia Ach.

Thallus foliose, attached to substratum by rhizinae on ventral surface. Apothecia lecanorine although none have yet been seen on South Georgian material; ascospores 8 per ascus, brown, 1-septate to ± polarilocular. Phycobiont *Trebouxia*.

Species of this genus may resemble those of *Parmelia*, but they may be distinguished by the smaller thallus, up to 3 cm. in diameter, with white to alutaceous ventral surface, the species of *Parmelia* being usually larger than 3 cm. in diameter and always with a black ventral surface.

1. Soralia laminal, capitate . . . . . ***P. caesia***
   Soralia marginal, labriform . . . . . ***P.*** cf. ***wainioi***

Physcia caesia (Hoffm.) Hampe

Syn. *Parmelia austrogeorgica* C. W. Dodge (Lindsay, 1973*c*).
Icon. Plate IIf; Thomson (1963, pl. IX, fig. 19), Martin and Child (1972, pl. XXXV).
Lit. Thomson (1963, p. 74–75).

Thallus foliose, forming rosettes up to 3 cm. in diameter, grey with a blue tinge, lobes not imbricate, dorsal surface matt, slightly warted with subglobose to capitate soralia and numerous small white pseudocyphellae; soredia granular, concolorous with thallus or blackened; ventral surface alutaceous, smooth, slightly shining, with numerous irregularly arranged brown to black rhizinae. Apothecia absent; pycnidia occurring as small black spots *c.* 100 μm. in diameter, scattered irregularly over dorsal surface, pycnoconidia cylindrical, hyaline, 4–5 μm. by 0·5 μm.

P. caesia is readily distinguished by its grey thallus with blue tinge and subglobose to capitate soralia. *P.* cf. *wainioi* is very similar, but differs in the marginal, labriform soralia.

Habitat. Typically on dry bird-perching stones, occasionally on cliffs and soil in enriched situations, in sheltered to exposed habitats without regard to aspect; altitudinal range 2–150 m.

Distribution. South Georgia: very common and locally abundant along the southern part of the north-east coast from Cumberland Bay to Cooper Island (Fig. 23). Cosmopolitan: Argentina (Grassi, 1950), South Orkney and South Shetland Islands, Antarctic Peninsula (specimens from three areas in AAS), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972).

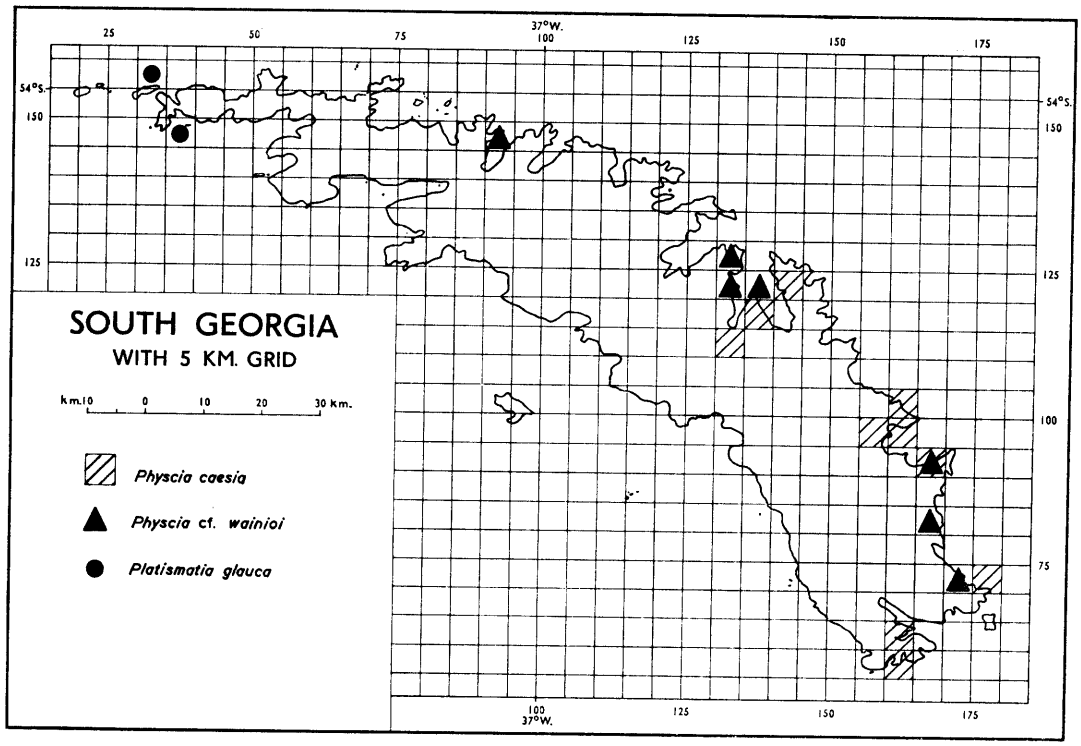


FIGURE 23
The known distribution on South Georgia, by 5 km. squares, of *Physcia caesia*, *Physcia* cf. *wainioi* and *Platismatia glauca*, based on the specimens and field records given in Appendix A.

Physcia cf. *wainioi* Räs.

Syn. *Physcia caesiella* (B. de Lesd.) Suza.
Icon. Thomson (1963, pl. XII, fig. 24).
Lit. Thomson (1963, p. 87–88).

Thallus foliose, forming rosettes, up to 3 cm. in diameter, grey with a blue tinge, lobes subimbricate; dorsal surface smooth to slightly warted with numerous small white pseudocyphellae; soralia marginal, labriform; soredia concolorous with thallus or blackened; ventral surface alutaceous, smooth, slightly shining with numerous irregularly scattered brown to black rhizinae. Medulla K+ yellow. Apothecia absent; pycnidia infrequent, occurring as small black spots *c.* 100 μm. in diameter, towards the lobe tips, pycnoconidia cylindrical, hyaline, 4·0 μm. by 0·5 μm.

This species can be separated from the similar *P. caesia* by the presence of marginal labriform, not laminal capitate, soralia. Since all of the material seen from South Georgia is depauperate, a more definite identification cannot be made.

Habitat. On dry or wet boulders and cliffs in enriched situations, on whale bones on the beach and especially bird-perching stones, in sheltered to moderately exposed sites without regard to aspect; altitudinal range 2–20 m.

Distribution. South Georgia: locally abundant along the north-east coast from Prince Olav Harbour to Cooper Island (Fig. 23). Apparently new to the Southern Hemisphere; Scandinavia, North America (Thomson, 1963).

Platismatia Culb. et Culb.

Thallus foliose, up to 8 cm. broad, appressed to substratum, glaucous, deeply lobed; marginal lobes without pseudocyphellae, ventral surface sparsely rhizinose, black. Apothecia lecanorine; ascospores 8 per ascus, subglobose to ellipsoid. Phycobiont *Trebouxia*.

This genus is a segregate from *Cetraria* Ach. and, as in that genus, the pycnidia are marginal, thus distinguishing it from *Parmelia*.

Platismatia glauca (L.) Culb. et Culb.

Syn. *Cetraria glauca* (L.) Ach.
Platysma glaucum (L.) Frege.
Icon. Culberson and Culberson (1968, pl. XXII).
Lit. Culberson and Culberson (1968, p. 530–37).

Thallus foliose, up to 8 cm. broad, appressed to substratum, glaucous, deeply lobed; marginal lobes inrolled, branching sub-dichotomously, ascending, up to 3 cm. tall and 8 mm. broad, dorsal surface glaucous with greenish or greyish tinge, matt, strongly reticulately wrinkled, margins ragged; ventral surface fuscous black, shining; isidia coralloid, marginal; rhizinae rare, occurring singly on and concolorous with, ventral surface. Apothecia and pycnidia absent.

P. glauca can be distinguished from other moderately large foliose lichens on South Georgia by the presence of marginal isidia and a sparsely rhizinose ventral surface.

Habitat. On dry rock or dry *Chorisodontium* banks with a westerly aspect and in moderately sheltered to exposed situations; altitudinal range 60–180 m.

Distribution. South Georgia: restricted to two localities at the northern end of the island, where it occurs in small quantity (Fig. 23). Patagonia, Fuegia (Culberson and Culberson, 1968), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972), Europe, Greenland, North America, Africa (Culberson and Culberson, 1968).

Pseudocyphellaria Vain.

Thallus foliose, ventral surface tomentose with pseudocyphellae. Apothecia lecanorine, marginal or laminal; ascospores hyaline to brown, fusiform, 1–3-septate, 8 per ascus. Phycobiont *Palmella* or *Nostoc*.

1. Medulla and pseudocyphellae white . . . . . ***Ps. freycinetii***
   Medulla and pseudocyphellae yellow. . . . . ***Ps. endochrysea***

Pseudocyphellaria endochrysea (Del.) Vain.

Syn. *Sticta endochrysea* Del.
Icon. Martin and Child (1972, pl. XXIX).
Lit. Vainio (1903, p. 28).

Thallus 7–10 cm. in diameter, less commonly up to 30 cm., lobed; lobes up to 8·5 cm. long and 4 cm. broad, margins smooth or sinuate, dorsal surface faintly rimose-areolate, faintly tomentose, bluish white; ventral surface white to brown, tomentose, tomentum interrupted by numerous pseudocyphellae up to 1 mm. in diameter, pseudocyphellae and medulla yellow. Apothecia infrequent, laminal, sessile, lecanorine, up to 1 cm. in diameter, thalline margin white, ciliate, thick, smooth to crenulate, disc concave to plane, black, slightly shining; ascospores not developed.

This species is easily distinguished by the bluish white dorsal surface and the yellow medulla.

Habitat. On *Chorisodontium* and *Polytrichum* banks, in *Tortula robusta* turf, on soil in *Festuca–Acaena* communities or on morainic debris, in dry to damp habitats without regard to aspect, but usually where there is some degree of shelter; altitudinal range 8–250 m. In very sheltered localities, e.g. on Dartmouth and Will Points, this species becomes co-dominant in a distinct community with *Festuca erecta* and *Pseudocyphellaria freycinetii*.

Distribution. South Georgia: widespread and locally abundant all around the island (Fig. 24). Bi-centric in the Southern Hemisphere; Argentina (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966). Vainio (1903, p. 28) reported *Ps. endochrysea* in error from the Danco Coast, Antarctic Peninsula.

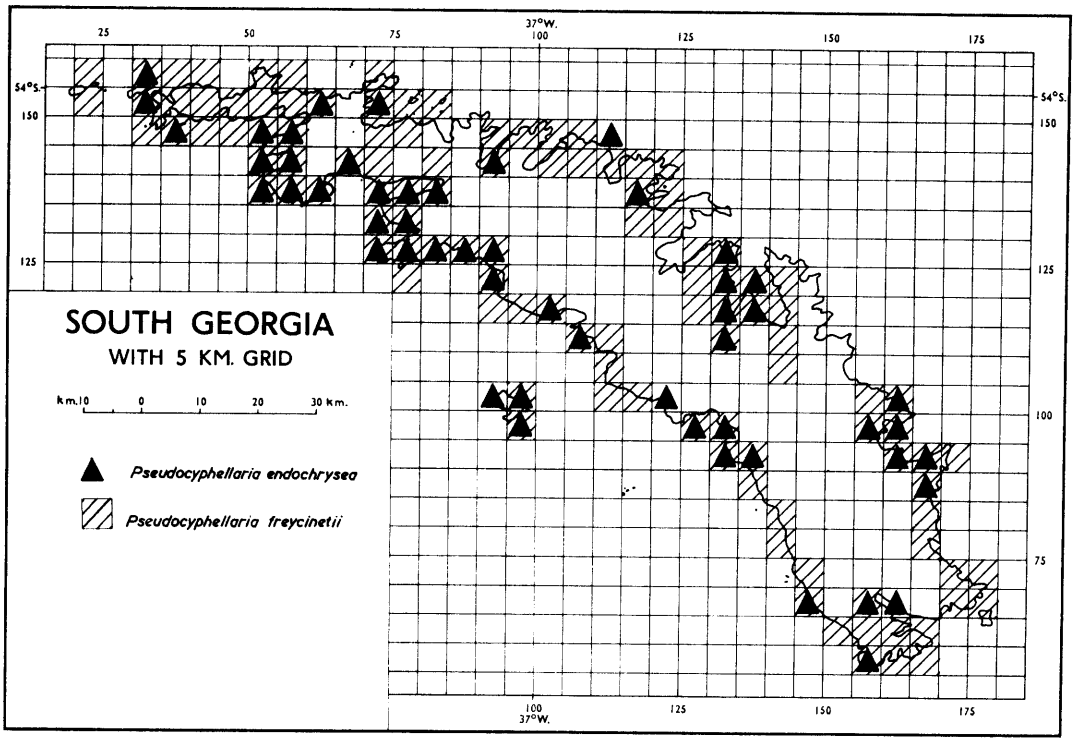


FIGURE 24
The known distribution on South Georgia, by 5 km. squares, of *Pseudocyphellaria endochrysea* and *Pseudocyphellaria freycinetii*, based on the specimens and field records given in Appendix A.

Pseudocyphellaria freycinetii (Del.) Malme emend Du Rietz

Syn. *Sticta freycinetii* Del.
For further but incomplete synonymy see Du Rietz (1924, p. 52).
Icon. Plate IIIb; Lamb (1958, pl. V, fig. 14), Martin and Child (1972, pl. XXXVIII).
Lit. Räsänen (1932, p. 35), Lamb (1958, p. 67).

Thallus 8–12 cm. in diameter, less commonly up to 25 cm., thick, lobed; lobes up to 9 cm. long and 5 cm. broad, margins smooth to crisped, infrequently laciniate, ascending, dorsal surface smooth to wrinkled, shining, green; ventral surface tomentose, brown, interrupted by numerous pseudocyphellae up to 1·5 mm. in diameter, pseudocyphellae and medulla white. Apothecia rare, laminal, sessile, lecanorine, up to 1 cm. in diameter, thalline margin greenish white, thick, smooth or crenulate tomentose, disc concave to plane, dark brown, slightly shining; ascospores not developed.

Large forms of this species may bear a superficial resemblance to lettuce (*Lactuca*) but they can be distinguished easily by the combination of a green dorsal surface and a ventral surface which is brown speckled with white.

Habitat. In a wide range of habitats, e.g. on *Chorisodontium* and *Polytrichum* banks, in *Tortula robusta* turf, on soil in *Festuca–Acaena* communities, on moss peat amongst tussock and on morainic debris, usually in dry situations but occasionally in wet flushes in *Tortula robusta* turf; altitudinal range 3–300 m. In sheltered localities, such as at Dartmouth Point (Cumberland East Bay) and Will Point (Royal Bay), it forms a distinct community co-dominant with *Festuca erecta* and *Pseudocyphellaria endochrysea*. In other areas, such as on Barff Peninsula and the north side of Royal Bay, it has suffered considerably from the effects of grazing and trampling by reindeer (Lindsay, 1973*b*); here it is now becoming rare and increasingly confined to rock ledges and other situations inaccessible to the reindeer.

Distribution. South Georgia: perhaps the most abundant and widespread lichen on the island (Fig. 24). Bi-centric in the Southern Hemisphere, but possibly circum-polar sub-Antarctic; Argentina (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand shelf islands (Dodge, 1948), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972).

Psoroma (Ach.) Ach. ex Michaux

Thallus squamulose, grey, green or brown. Apothecia lecanorine, conspicuous, disc concave, thalline margin prominent; ascospores 8 per ascus, hyaline, ellipsoid, simple. Phycobiont green.

The three species so far recorded from South Georgia appear to intergrade to some extent, *Ps. ciliatum* being the well-developed form from very sheltered habitats while *Ps. cinnamomeum* is the form from exposed sites. Further collections are required before a satisfactory judgment can be made of the situation.

1. Apothecial margins covered by numerous white cilia; on soil in very sheltered habitats . ***Ps. ciliatum***
   Apothecial margins without cilia 2
2. Thallus reddish brown, apothecia uncommon; on mosses in moderately to very exposed habitats . . . . . ***Ps. cinnamomeum***
   Thallus greyish green, apothecia abundant; on mosses and soil in moderately sheltered to moderately exposed habitats . . . . . ***Ps. hypnorum***

Psoroma ciliatum (Ach. ex Fr.) Nyl. ex Hue

Syn. *Psoroma paleaceum* (Fr.) Nyl.
Icon. Plate IIIc.
Lit. Kristinsson (1972, p. 47–48).

Thallus squamulose, up to 3 cm. in diameter, light greyish green, squamules to 5 mm. long and 3 mm. broad, with slightly crenulate margins. Apothecia abundant, sessile, cupuliform, up to 5 mm. in diameter, the outer surface covered with numerous short, white cilia, disc concave, light reddish brown; ascospores not developed.

This species is the only South Georgian lichen that has white cilia around the apothecial margin.

Habitat. On damp, sheltered moss banks and morainic debris apparently with preference for a northerly aspect; altitudinal range 15–35 m.

Distribution. South Georgia: so far known only from three scattered localities (Fig. 25). Bi-polar: bi-centric sub-Antarctic, Fuegia (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972), Iceland (Kristinsson, 1972), Scandinavia (Poelt, 1969).

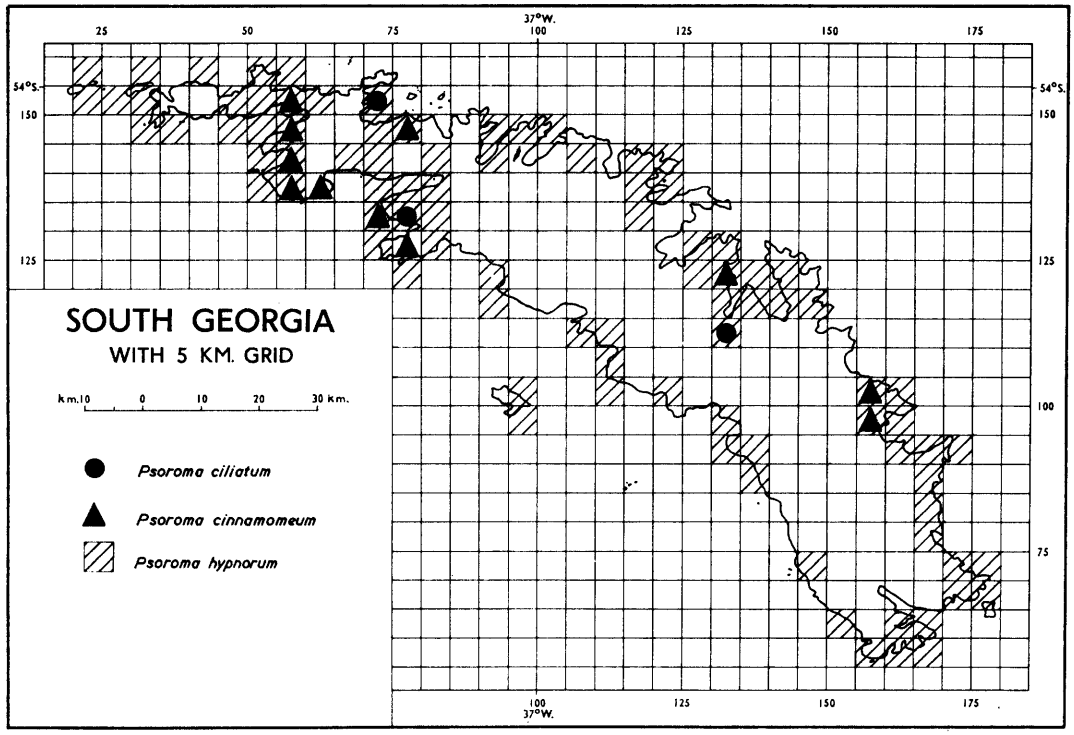


FIGURE 25

The known distribution on South Georgia, by 5 km. squares, of *Psoroma ciliatum*, *Psoroma cinnamomeum* and *Psoroma hypnorum*, based on the specimens and field records given in Appendix A.

Psoroma cinnamomeum Malme

Icon. None.
Lit. Malme (1925, p. 11), Räsänen (1932, p. 44).

Thallus squamulose, with squamules up to 4 mm. long and 2·5 mm. broad of various shades of brown, depending on the degree of exposure, packed together to form a continuous crust up to 3·5 cm. in diameter, with crenulate margins. Apothecia immersed in squamules, infrequent, up to 3 mm. in diameter, margin without cilia, warted, disc slightly concave, reddish brown; ascospores not developed.

Ps. cinnamomeum has the appearance of a reduced *Ps. hypnorum*, differing mainly in the reddish brown, not greyish green thallus colour, a feature that may be due to exposure. As yet, no intermediates have been found between the two species on South Georgia.

Habitat. On dry, exposed *Chorisodontium* and *Polytrichum* banks and on *Andreaea* cushions, without regard to aspect; altitudinal range 8–250 m.

Distribution. South Georgia: known from a number of scattered localities on both north-east and south-west coasts, this species rarely occurs in any abundance (Fig. 25). Patagonia, Fuegia (Malme, 1925).

Psoroma hypnorum (Vahl) Gray

Syn. *Pannaria hypnorum* (Vahl) Körb.
Icon. Plate IIId.
Lit. Räsänen (1932, p. 44).

Thallus squamulose, up to 7 cm. in diameter, greyish green, tinged with brown from the more exposed habitats, squamules up to 6 mm. long and 3·5 mm. broad, with crenulate margins. Apothecia cupuliform, sessile, up to 6 mm. in diameter, thalline margin warted to squamulose rarely with a few short white cilia, disc strongly concave, light reddish brown to very dark brown, appearing almost black; ascospores formed occasionally, 8 per ascus, hyaline, ellipsoid, moderately thick-walled, 17–19 μm. by 8–10 μm.

This species may be recognized easily by the cupuliform apothecia with brown disc and warted-squamulose thalline margin. A few specimens from moderately sheltered habitats show the development of white cilia on the thalline margins of the apothecia, a feature which may suggest that *Ps. ciliatum* represents an extreme variant of *Ps. hypnorum* from very sheltered habitats. Poelt (1969), for instance, regarded *Ps. ciliatum* as a variety of *Ps. hypnorum*, treating it as the var. *paleaceum* (Fr.) Rostr.

Habitat. On *Chorisodontium* and *Polytrichum* banks, on *Andreaea* cushions, in *Tortula robusta* turf, on soil in *Festuca–Acaena* communities, on peat, morainic debris or decaying plant material, in dry to wet, sheltered to moderately exposed situations without regard to aspect; altitudinal range 1·5–300 m.

Distribution. South Georgia: widely distributed but rarely occurring in any abundance (Fig. 25). Bi-polar: Argentina (Grassi, 1950), Fuegia (Räsänen, 1932), Falkland Islands (Zahlbruckner, 1917), South Sandwich, South Orkney and South Shetland Islands, Antarctic Peninsula (specimens for four areas in AAS), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972), widespread throughout the Arctic and alpine regions of the Northern Hemisphere.

Ramalina Ach.

Thallus fruticose, strap-shaped, attached to substratum by small undifferentiated holdfast, cortex present on both surfaces. Apothecia lecanorine; ascospores 8 per ascus, hyaline, simple or 1-septate, ellipsoid to fusiform. Phycobiont *Trebouxia*.

Ramalina terebrata Hook. f. et Tayl.

Syn. *Evernia de gasperii* Ceng. Samb.
Ramalina laevigata var. *terebrata* (Hook. f. et Tayl.) Müll. Arg.
Icon. Lamb (1964, pl. Vb–d).
Lit. Lamb (1964, p. 15, 17).

Thallus erect, much branched, consisting of many flat laciniae arising from a single holdfast, laciniae up to 7 cm. long, 5 cm. wide and 1 mm. thick, light yellow when fresh, becoming buff after drying, simple or sub-dichotomously branched, pseudocyphellate, pseudocyphellae developing granulose soredia, thallus becoming perforated where soredia have fallen away. Sterile, but a description of apothecial characters will be found in Lamb (1964).

This species may be recognized readily by means of its strap-shaped yellow thallus.

Habitat. On dry, enriched coastal rocks; altitudinal range *c.* 5–10 m.

Distribution. South Georgia: apparently rare and local, at present known from only two widely separated areas (Fig. 26). Patagonia, Fuegia (Lamb, 1964), Falkland Islands (Zahlbruckner, 1917), South Orkney and South Shetland Islands, Antarctic Peninsula (Lamb, 1964; Lindsay, 1969*a*).

Sphaerophorus Pers.

Thallus fruticose, erect, terete or compressed, branched, corticate. Apothecia terminal, globose; ascospores 8 per ascus, globose, simple, hyaline, forming mazaedium due to disintegration of asci. Phycobiont trebouxioid.

Only two of the species from the Scotia Ridge–Antarctic Peninsula region discussed by Lindsay (1972*a*) have so far been collected on South Georgia.

1. Medulla I+ blue . . . . . ***S. globosus***
   Medulla I− . . . . . ***S. melanocarpus***

Sphaerophorus globosus (Huds.) Vain.

Syn. *Sphaerophorus coralloides* Pers.
Icon. Plate IIIe; Dahl and Krog (1973, fig. 36a).
Lit. Lindsay (1972*a*, p. 44).

Thallus fruticose, forming clumps up to 20 cm. in diameter, and 10 cm. tall, much branched, branching sympodial, main axes up to 2 mm. in diameter, smooth, terete, white to dark brown depending on the degree of exposure; medulla I+ blue, K− and P− or K+ yellow and P+ yellow. Apothecia rare, terminal, globose, up to 2 mm. in diameter, thalline margin irregularly torn; asci disintegrated, leaving mazaedium of globose, simple, ascospores, with brown epispore, 10–12 μm. in diameter.

The range of variation that may be shown by this species on South Georgia has been discussed by Lindsay (1972*a*, p. 44). Apothecia are only known from a single specimen from Rosita Harbour. Two chemical strains occur, the first reacting K – and P – containing squamatic acid (strain I), and the second reacting K + yellow and P + yellow containing thamnolic acid (strain II). Although strain I appears to be more southerly in its distribution than strain II, which is absent from the Antarctic Peninsula (Lindsay, 1972*a*), there appears to be no difference in their distribution on South Georgia.

Habitat. On *Chorisodontium* and *Polytrichum* banks, on *Andreaea* cushions, on soil under *Festuca–Acaena* communities or on morainic debris, in dry, sheltered to exposed situations without regard to aspect; altitudinal range 3–300 m.

Distribution. South Georgia: common to locally abundant on both north-east and south-west coasts, but apparently much more abundant on the former (Fig. 27). Cosmopolitan: Fuegia (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), South Orkney and South Shetland Islands, Antarctic Peninsula (Lindsay, 1972*a*), New Zealand (Martin, 1966), widespread in Europe, Greenland and North America (Poelt, 1969).

Sphaerophorus melanocarpus (Sw.) DC.

Syn. *Sphaerophoron compresson* Ach.
Pleurocybe patagonica C. W. Dodge.
Icon. Dodge and Vareschi (1956, fig. 1), Murray (1960*a*, pl. XII, figs. 2–6, pl. XIII, figs. 7–10).
Lit. Murray (1960*a*, p. 188–92), Lindsay (1972*a*, p. 45–46).

Thallus fruticose, forming compact clumps up to 3 cm. in diameter and 5 cm. tall, much branched, branching di- or trichotomous, branches up to 2 mm. in diameter, smooth, flattened, frequently appearing terete towards the base, white to brown depending on the degree of exposure, medulla I –, K – and P –. Sterile.

S. melanocarpus may be confused with *S. globosus*, especially when the branches are ± terete, but it may always be distinguished by the I – reaction of the medulla.

Habitat. On moss banks in damp, sheltered habitats without regard to aspect; altitudinal range 5–160 m.

Distribution. South Georgia: an apparently rare species with a scattered distribution on both north-east and south-west coasts (Fig. 27). Cosmopolitan: Peru (Soukup, 1965), Fuegia (Grassi, 1950), Falkland Islands (Zahlbruckner, 1917), New Zealand (Martin, 1966), Australia (Weber and Wetmore, 1972), widespread in Europe, Greenland and North America (Poelt, 1969).

Stereocaulon Schreb.

Thallus consisting of erect or decumbent, branched, "woody" pseudopodetia, bearing cephalodia and phyllocladia; growing on moss cushions, moss banks, soil and rock.

So far, only *St. glabrum* has been found fertile on South Georgia.

1. Pseudopodetia covered wholly or in part by thick grey, spongy tomentum . . . . ***St. alpinum*** (and ***St.*** cf. ***rivulorum***)
   Pseudopodetia with faint white tomentum, or tomentum lacking, occasionally appearing pruinose 2
2. Pseudopodetia richly sub-dichotomously branched; cephalodia pink, 1–3 mm. in diameter . . . . . ***St. ramulosum***
   Pseudopodetia infrequently anisotomously branched, cephalodia dark grey, up to 1 mm. in diameter . . . . . ***St. glabrum***

Stereocaulon alpinum Laur.

Syn. *St. paschale* (L.) Fr. var. *alpinum* (Laur.) Mudd.
Icon. Dahl and Krog (1973, fig. 49).
Lit. Lamb (1958, p. 98 as *St. paschale* var. *alpinum*).

Pseudopodetia erect or decumbent, up to 5 cm. tall, sparsely anisotomously branched, white, covered wholly or in part by loosely attached, thick, grey, spongy tomentum, cephalodia small, subspherical, up to 1 mm. in diameter, dark grey, partially or totally immersed in tomentum; phyllocladia white, verruciform to coralloid, K + yellow, P + yellow, containing atranorin and lobaric acid.

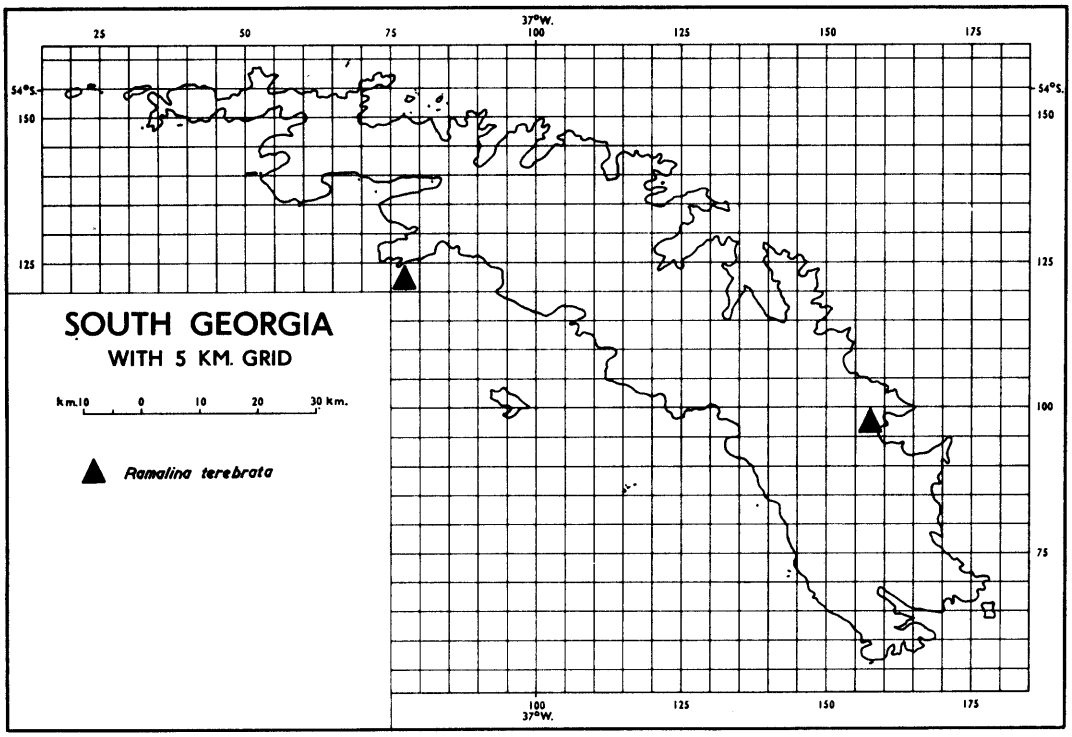


FIGURE 26

The known distribution on South Georgia, by 5 km. squares, of *Ramalina terebrata*, based on the specimens and field records given in Appendix A.

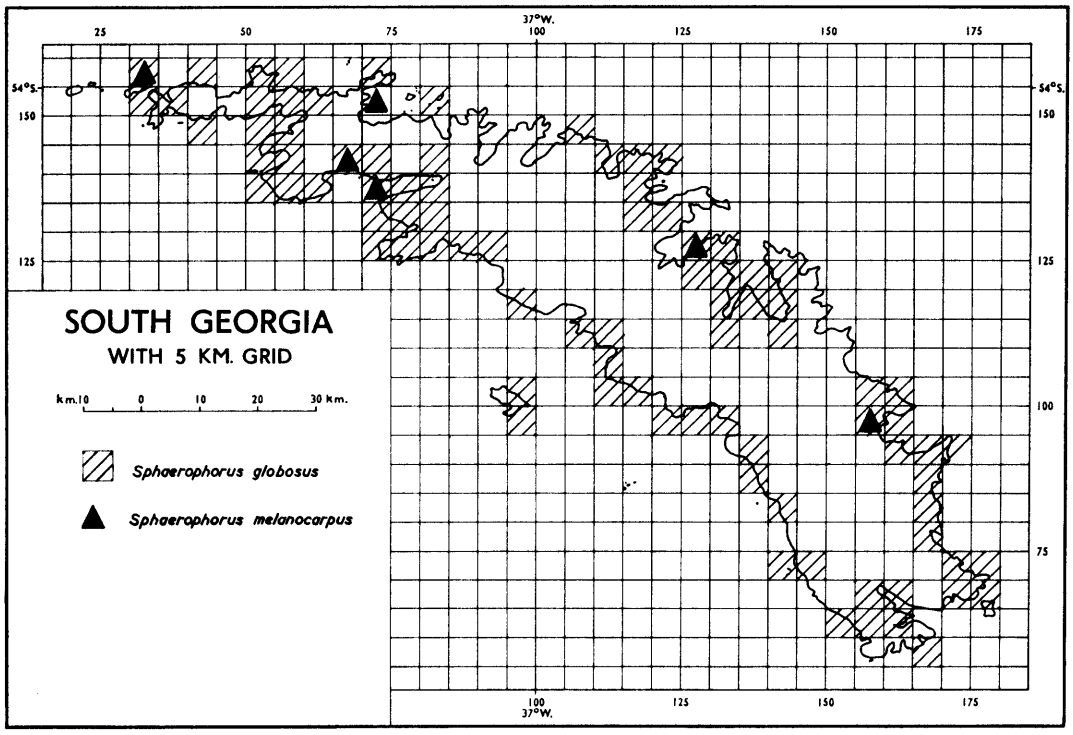


FIGURE 27

The known distribution on South Georgia, by 5 km. squares, of *Sphaerophorus globosus* and *Sphaerophorus melanocarpus*, based on the specimens and field records given in Appendix A.

This species resembles *St.* cf. *rivulorum* (see below), from which it is often difficult to separate with certainty. A record by Müller [Argoviensis] (1890) of *St. magellanicum* Th. Fr. is considered by the author to refer to material of the present species. Similarly, Darbishire's (1912) record of *St. tomentosum* and Zahlbruckner's (1917) record of *St. tomentosum* var. *magellanicum* refer to *St. alpinum*.

Habitat. On *Chorisodontium* banks, on *Andreaea* cushions and occasionally other mosses, in *Rostkovia* bog and on morainic debris, in dry to damp, sheltered to exposed situations without regard to aspect; altitudinal range 5–300 m.

Distribution. South Georgia: frequent along the length of the north-east coast with, as yet, only two known localities on the south-west coast (Fig. 28). Bi-polar: Fuegia (Grassi, 1950), New Zealand (Martin, 1966), circum-polar in the Northern Hemisphere (Poelt, 1969).

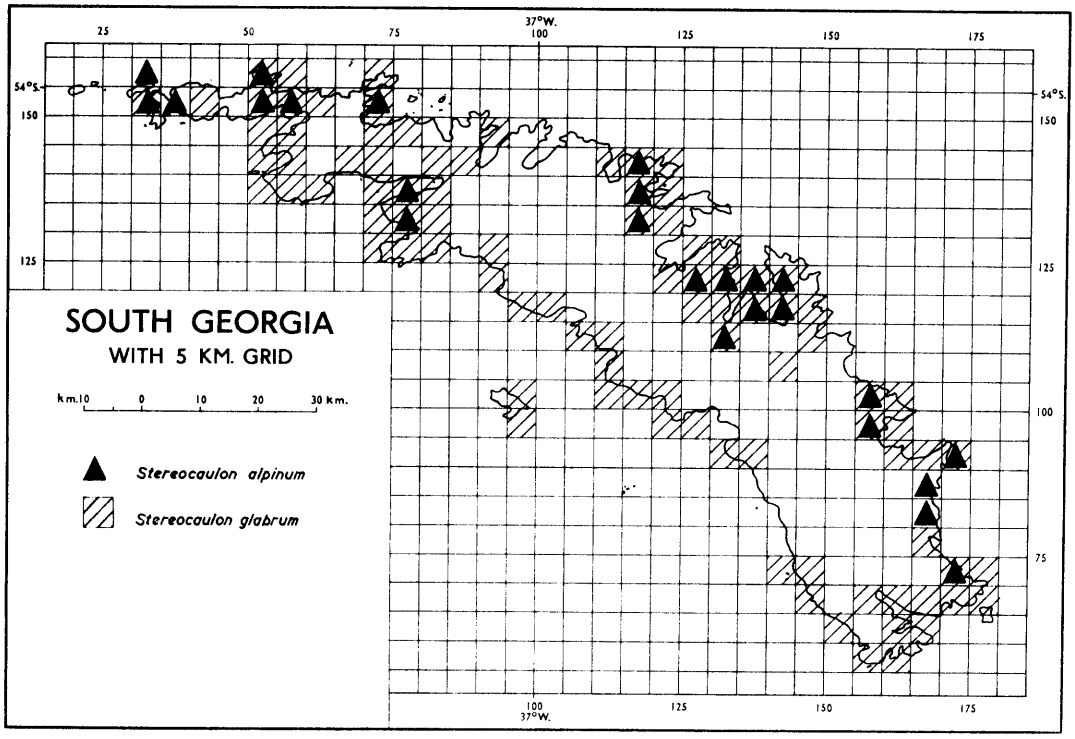


FIGURE 28

The known distribution on South Georgia, by 5 km. squares, of *Stereocaulon alpinum* and *Stereocaulon glabrum*, based on the specimens and field records given in Appendix A.

Stereocaulon glabrum (Müll. Arg.) Vain.

Syn. *Stereocaulon patagonicum* M. Lamb.
St. patagonicum f. *reagens* (Räs.) M. Lamb.
Pilophoron colensoi Räs. (fide Lamb, 1958).
Icon. Plate IIIf; Vainio (1903, pl. II, fig. 8), Lamb (1955, fig. 21 as *St. patagonicum*), Asahina (1967, fig. 8).
Lit. Vainio (1903, p. 16), Lamb (1955, p. 454–56 as *St. patagonicum*).

Pseudopodetia erect or decumbent, up to 6 cm. tall, sparsely anisotomously branched, white to greyish green or brown, occasionally dark red towards the base due to decomposition of lichen acids, with faint white tomentum, or tomentum absent, then occasionally appearing pruinose; cephalodia small, subspherical, up to 1 mm. in diameter, light to dark greyish brown; phyllocladia white to green or brown, squamiform to granulose, absent in forms growing directly on rock, K+ yellow, P+ yellow-orange-red, containing atranorin and stictic or norstictic acid. Apothecia frequent, 2–5 mm. in diameter, on short side branches, lecanorine but margin becoming excluded, disc reddish brown, plane at first, becoming strongly convex; ascospores not developed.

St. glabrum is a very variable plant on South Georgia. The form growing directly on rock, which may resemble a small *Sphaerophorus*, has been described as *Pilophoron colensoi* from New Zealand (Räsänen, 1932) and as *St. patagonicum* f. *reagens* from Patagonia (Lamb, 1958). In this form the pseudopodetia are short, less than 1 cm. tall, erect, sparsely branched, without phyllocladia or tomentum, and are aggregated into small pulvinate clumps. *St. patagonicum* f. *patagonicum* (Lamb, 1958) is, according to Lamb (personal communication), the optimally developed condition of *St. glabrum*. Both the normal form of *St. glabrum* and *St. patagonicum* f. *reagens* are widely distributed on South Georgia, *St. patagonicum* f. *patagonicum* having been found only once, on Nuñez Peninsula, with *Menegazzia sanguinascens* and *Sticta gaudichaudii*. Du Rietz's (1926) record of *St. fastigiatum* was a misidentification of material of *St. glabrum*.

Habitat. On *Chorisodontium* and *Polytrichum* banks, in dry *Tortula robusta* turf, on *Andreaea* cushions, on soil in *Festuca–Acaena* communities, on morainic debris and boulders and scree in non-enriched situations, in dry to damp, moderately sheltered to very exposed habitats; altitudinal range 3–1,200 m.

Distribution. South Georgia: widespread all around the island (Fig. 28). Chile (Räsänen, 1932), Argentina (Lamb, 1958), Antarctic Peninsula (specimens in AAS), New Zealand (Martin, 1966 as *Pilophoron colensoi*).

Stereocaulon ramulosum (Sw.) Räusch. var. *pulvinare* (C. W. Dodge) M. Lamb

Syn. *St. pulvinare* C. W. Dodge.
Icon. Martin and Child (1972, pl. VIII, fig. 27).
Lit. Lamb (1958, p. 93).

Pseudopodetia up to 5 cm. tall, white to green, richly sub-dichotomously branched, glabrous, tomentum absent; cephalodia large, 1–3 mm. in diameter, pink, foveolate; phylocladia digitiform, white to grey or green, K+ yellow, P+ yellow, containing atranorin, divaricatic and norstictic acids.

The large pink cephalodia, especially prominent towards the tips of the pseudopodetia, readily distinguish this species.

Habitat. On rock and mineral soil, occasionally on cushions of small acrocarpous mosses, in dry to wet, non-enriched habitats without regard to aspect; altitudinal range 8–250 m.

Distribution. South Georgia: scattered and often locally abundant along the north-east coast and at either end of the island (Fig. 29). Patagonia and Fuegia (Lamb, 1958), New Zealand shelf islands (Dodge, 1948), New Zealand (Dodge, 1948; Martin, 1966).

Stereocaulon cf. *rivulorum* H. Magn.

Icon. None.
Lit. Dahl and Krog (1973, p. 141).

Pseudopodetia erect, up to 3 cm. tall, light olivaceous, sparsely anisotomously branched, wholly covered by a thick, dark grey, spongy tomentum; cephalodia small, up to 1 mm. in diameter, subspherical, immersed in tomentum; phyllocladia light olivaceous, granulose, K+ yellow and P+ yellow, containing atranorin and lobaric acid.

In the field it is almost impossible to distinguish between material of this species and of *St. alpinum*, while Imshaug (1957) has commented upon a similar difficulty in alpine areas of the United States, due to stunting. Lamb (personal communication), who identified the material, has stated that the single South Georgian specimen agrees in most respects with that from the Northern Hemisphere, but it is stunted and poorly developed, so that a definite identification cannot be made.

Habitat. On soil under *Acaena* at an altitude of *c.* 150 m.

Distribution. South Georgia: so far only known from one specimen collected on Brown Mountain (Cumberland East Bay) (Fig. 29). Not previously reported from the Southern Hemisphere; boreal in the Northern Hemisphere (Imshaug, 1957).

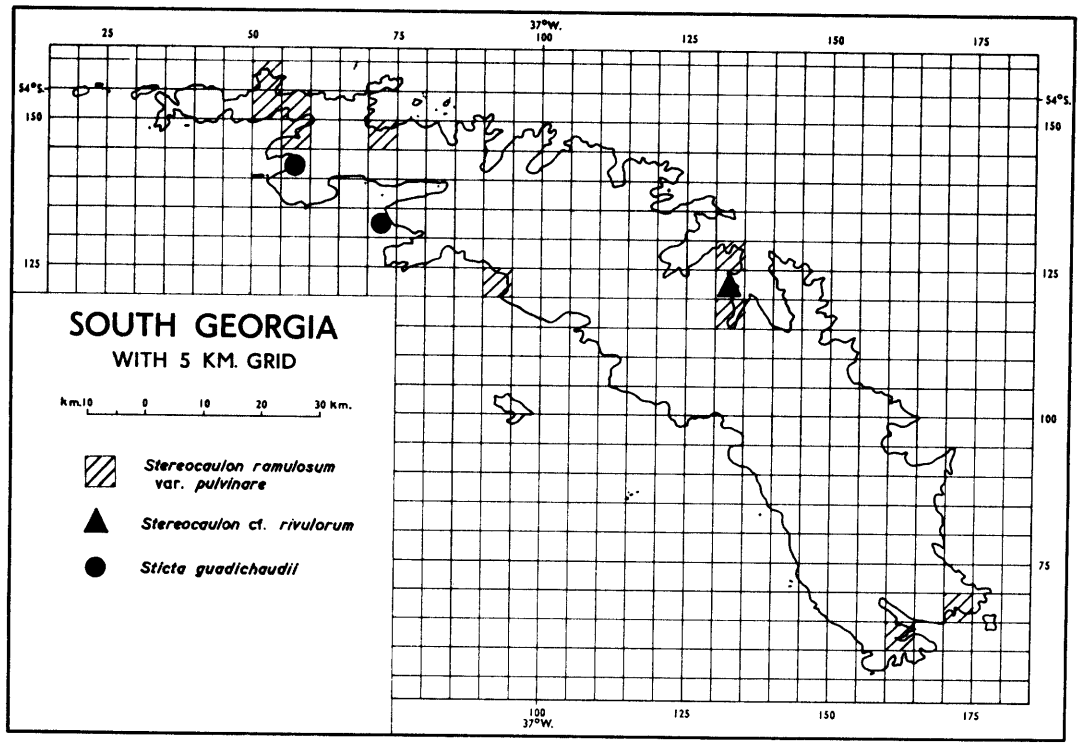


FIGURE 29

The known distribution on South Georgia, by 5 km. squares, of *Stereocaulon ramulosum*, *Stereocaulon* cf. *rivulorum* and *Sticta gaudichaudii*, based on the specimens and field records given in Appendix A.

Sticta Schreb.

Thallus foliose, ventral surface tomentose and cyphellate. Apothecia lecanorine; ascospores 8 per ascus, hyaline to brown, fusiform, 1–3-septate. Phycobiont *Palmella* or *Nostoc*.

Sticta gaudichaudii (Mont.) Nyl.

Syn. *Sticta gaudichaldia* Del.
Stictina gaudichaldia (Del.) Nyl.
Sticta gaudichaudiana Pers.
Sticta malovina Fr.
Icon. None.
Lit. Räsänen (1932, p. 43 as *Sticta gaudichaldia*).

Thallus foliose, up to 7 cm. in diameter, ± monophyllous, with several large lobes; dorsal surface dark brown, smooth, shiny, with scattered clumps of small coralloid isidia; ventral surface dark brown, matt, arachnoid, with numerous white cyphellae. Sterile.

This species may be distinguished from species of *Pseudocyphellaria*, *Parmelia* and *Peltigera*, which it resembles superficially, by the presence of cyphellae on the ventral surface.

Habitat. On *Chorisodontium* and *Polytrichum* banks; altitudinal range 15–60 m.

Distribution. South Georgia: known from only two localities on the south-west coast (Fig. 29). Patagonia (Zahlbruckner, 1917), Fuegia (Räsänen, 1932), Falkland Islands (Grassi, 1950).

Umbilicaria Hoffm.

Thallus foliose, attached to the substratum by an umbilicus. Apothecia absent in Antarctic material, lecideine, with smooth or gyrose disc; ascospores 1–8 per ascus, hyaline or brown, simple to muriform. Phycobiont *Trebouxia*.

In a review of the *Umbilicariae* of the maritime Antarctic, Lindsay (1969*b*) followed the generic concepts of Llano (1950) and accepted the genera *Omphalodiscus* Schol. and *Umbilicaria* Hoffm. As Henssen (1970) has shown by ontogenetic studies that the various types of apothecia on which these genera were separated

are developmental stages of a single form, *Omphalodiscus* Schol. is considered synonymous with *Umbilicaria* Hoffm. A key to the maritime Antarctic species of *Umbilicaria* has been given by Lindsay (1969*b*, p. 61–62).

1. Thallus ± monophyllous, ventral surface rhizinose, dorsal surface grey-brown . . ***U. antarctica***
   Thallus ± polyphyllous, ventral surface without rhizinae, dorsal surface black . . ***U. polyphylla***

Umbilicaria antarctica Frey et Lamb

Syn. *Omphalodiscus antarcticus* (Frey et Lamb) Llano.
Icon. Frey and Lamb (1939, pl. XVIII, figs. 1 and 2, pl. XIX, fig. 1), Llano (1950, pl. XV, figs. 1–3 as *Omphalodiscus antarcticus*), Filson (1966, pl. 33c and d).
Lit. Frey and Lamb (1939, p. 270–71), Llano (1950, p. 76–78 as *Omphalodiscus antarcticus*).

Thallus foliose, ± monophyllous, up to 15 cm. in diameter, attached to substratum by central umbilicus; dorsal surface grey to brown, smooth, faintly rimose-areolate; ventral surface matt black, densely rhizinose, rhizinae simple or once-branched, up to 2 mm. long, black at base becoming cinereous towards tips. Sterile.

The umbilicate thallus of this species may cause confusion with *Dermatocarpon intestiniforme* but that species, when fertile, has perithecia. In the sterile state *U. antarctica* may be distinguished from *D. intestiniforme* by the persistently down-rolled thallus margins of the latter species.

Thalli of this species in the South Orkney and South Shetland Islands (Lindsay, 1969*b*, p. 62) can appear to be fertile due to the presence of apothecia of a fungal parasite (*Scutula* sp.), a state which has not been observed on South Georgia.

Habitat. On dry, non-enriched, exposed rocks and screes that receive no direct sunshine; altitudinal range 35–600 m.

Distribution. South Georgia: at present known only from two localities in the Cumberland East Bay area (Fig. 30). Circum-polar Antarctic (Llano, 1950): South Orkney and South Shetland Islands, Antarctic Peninsula (Lindsay, 1969*b*).

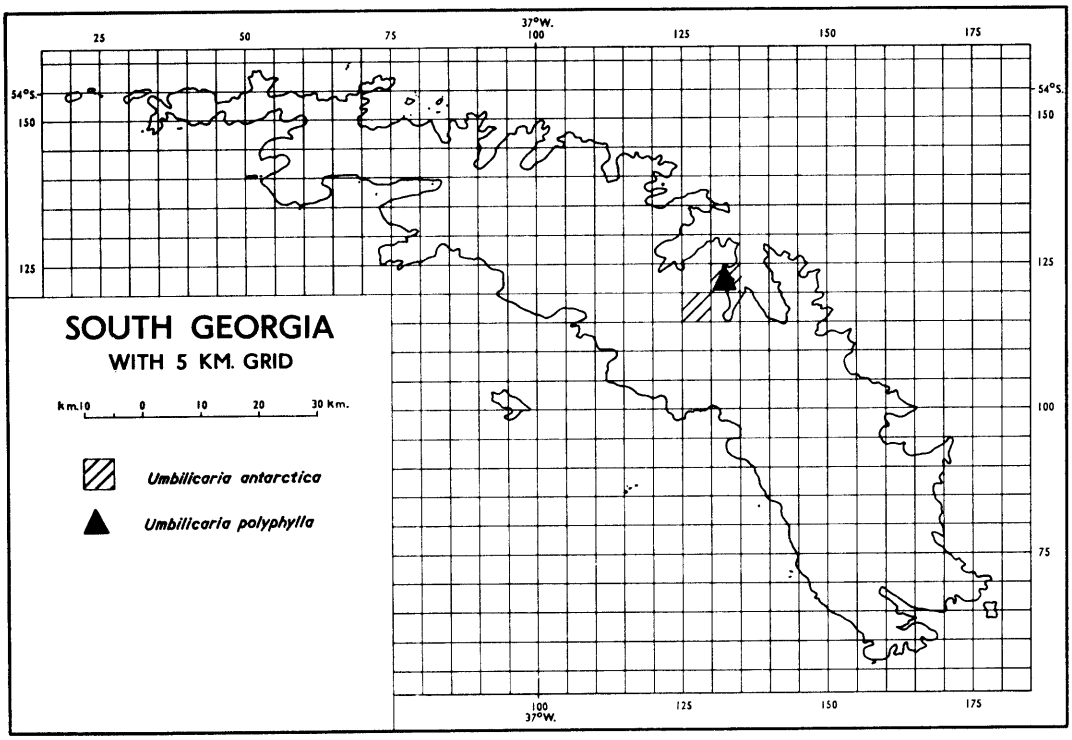


FIGURE 30

The known distribution on South Georgia, by 5 km. squares, of *Umbilicaria antarctica* and *Umbilicaria polyphylla*, based on the specimens and field records given in Appendix A.

Umbilicaria polyphylla (L.) Baumg.

Syn. *Gyrophora polyphylla* (L.) Funck.
Icon. Llano (1950, pl. XXI, fig. 6).
Lit. Llano (1950, p. 154).

Thallus ± polyphyllous, up to 2 cm. in diameter, attached to substratum by central umbilicus; dorsal surface matt black, smooth; ventral surface matt black, without rhizinae. Sterile.

The black umbilicate thallus of this species is quite distinctive.

In view of the specialized habitat, the author (Lindsay, 1973*b*) has concluded that the species has been introduced to the island.

Habitat. Wooden deck planks of the hulk *Louise*, at an altitude of *c.* 5 m.

Distribution. South Georgia: currently known from a single locality at the Grytviken whaling station (Fig. 30). Bi-polar: Fuegia, Falkland Islands and New Zealand (Llano, 1950), Australia (Weber and Wetmore, 1972), arctic-alpine in the Northern Hemisphere (Poelt, 1969).

Usnea P. Br. ex Adans.

Thallus fruticose, branched, branches radial in structure, consisting of central chondroid axis, medulla and cortex. Apothecia lecanorine, terminal or lateral on branches, disc yellow, brown to black; ascospores 8 per ascus, hyaline, ellipsoid, simple. Phycobiont *Trebouxia*, but see Lamb (1964, p. 7).

So far, four species are known from South Georgia, three in subgenus *Neuropogon* (*U. antarctica*, *U. aurantiacoatra* and *U. fasciata*) and one in subgenus *Usnea* (*U. igniaria*), and they can be distinguished as follows:

1. Thallus entirely yellow, never variegated . . . . . ***U. igniaria***
   Thallus variegated yellow and black 2
2. Soredia present, plant usually sterile . . . . . ***U. antarctica***
   Soredia absent, plant usually abundantly fertile 3
3. Medulla K− and P− or K+ brown and P+ red . . . . . ***U. fasciata***
   Medulla K+ yellow and P+ yellow-orange . . . . . ***U. aurantiacoatra***

Usnea antarctica Du Rietz

Syn. *Neuropogon antarcticus* (Du Rietz) M. Lamb.
For further synonymy see Lamb (1964, p. 5).
Icon. Lamb (1964, pl. IIa and c, IIIa).
Lit. Lamb (1964, p. 5–8).

Thallus fruticose, up to 10 cm. tall, much branched, variegated yellow and black towards the tips of branches, branches smooth to papillate, soredia abundant towards tips of branches, whitish yellow, occasionally blackened, granulose, soralia eroded, becoming concave. Apothecia rare, apparently terminal, up to 1·5 cm. in diameter, disc black.

This species may be easily recognized by the possession of soredia. It is frequently parasitized by a species of *Lecidea* (p. 89), described as galls by Lamb (1964, p. 11). In the absence of a specimen, Taylor's (1914) record of *U. sulphurea* (Koenig) Th. Fr. from the Bay of Isles is not accepted, the author considering that his report probably refers to the present species.

Habitat. Mainly on boulders, cliffs and stable scree in dry, non-enriched situations, but occasionally on bird-perching stones and in wet runnels on cliff faces, infrequently on mosses, timber or, in one case, on rusting iron of an old boiler at Prince Olav Harbour, in sheltered to moderately exposed situations without regard to aspect; altitudinal range 3–305 m. In exposed habitats this species is almost completely replaced by *Usnea fasciata*.

Distribution. South Georgia: widespread and abundant all around the island (Fig. 31). Circum-polar Antarctic and perhaps sub-Antarctic (Lamb, 1964; Lindsay, 1969*a*), Argentina (Grassi, 1950), New Zealand (Martin, 1966), Tasmania (Wetmore, 1963).

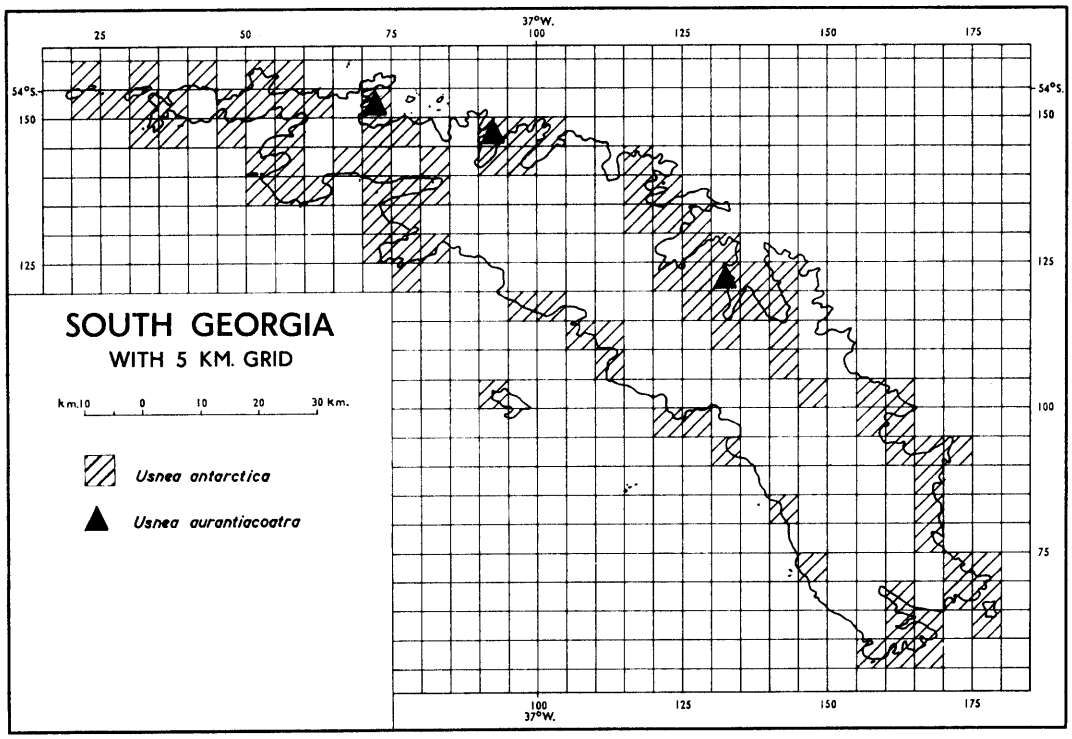


FIGURE 31

The known distribution on South Georgia, by 5 km. squares, of *Usnea antarctica* and *Usnea aurantiacoatra*, based on the specimens and field records given in Appendix A.

Usnea aurantiacoatra (Jacq.) Bory

Syn. *Neuropogon melaxanthus* (Ach.) Nyl.
Usnea melaxantha Ach.
Icon. Lamb (1939, pl. IX, fig. 19 as *Neuropogon melaxanthus*).
Lit. Räsänen (1932, p. 9–10), Lamb (1964, p. 11).

Thallus fruticose, up to 5 cm. tall, much branched, variegated yellow and black, branches densely papillate, papillae becoming confluent and forming a scrobiculate-corrugated surface, medulla K+ yellow and P+ yellow, containing norstictic acid. Apothecia apparently terminal, up to 1·5 cm. in diameter, ventral surface papillate to corrugated, disc black.

This species is very similar to *U. fasciata*, but is distinguishable by the chemical reactions given above. It appears to have a more northerly distribution than *U. fasciata*, being Magellanic (Lamb, 1964) rather than Antarctic. According to Lamb (1964, p. 8), owing to confusion between these two species many records of *U. aurantiacoatra* from South America and all those from the Antarctic botanical zone refer to *U. fasciata*. Darbishire's (1912) records of *Neuropogon melaxanthus* are based on *U. aurantiacoatra*, *U. antarctica* and *U. fasciata*.

Habitat. On dry rocks in non-enriched situations; altitudinal range 15–90 m.

Distribution. South Georgia: currently known from only three localities on the north-east coast, *U. aurantiacoatra* has probably been overlooked because of its similarity to *Usnea fasciata* (Fig. 31). Patagonia and Fuegia (Lamb, 1964), Falkland Islands (Lamb, 1964), New Zealand (Mark and Bliss, 1970).

Usnea fasciata Torrey

Syn. *Neuropogon aurantiaco-ater* f. *strigulosus* M. Lamb.
For further synonymy see Lamb (1964, p. 8).
Icon. Lamb (1964, pl. IIb, d and e).
Lit. Lamb (1964, p. 8–14).

Thallus fruticose, up to 10 cm. tall, much branched, variegated yellow and black towards the tips, branches verrucose-papillate or smooth, rarely becoming scrobiculate-corrugated as in *U. aurantiacoatra*,

medulla K – and P – or K + brown and P + red containing fumarprotocetraric acid. Apothecia abundant, apparently terminal, up to 2 cm. in diameter, ventral surface papillate to scrobiculate-corrugated, disc black, rarely alutaceous.

This species may be confused with the less frequent *U. aurantiacoatra*, but it can be differentiated by the chemical reactions noted above. It also appears to be more southerly in its distribution than *U. aurantiacoatra*, which has not yet been correctly recorded from the Antarctic botanical zone.

Habitat. On dry, exposed, non-enriched pebbles, boulders and cliffs, without regard to aspect; altitudinal range 8–700 m.

Distribution. South Georgia: widespread and very common all around South Georgia and, after *Pseudocyphellaria freycinetii*, perhaps the most abundant lichen species on the island (Fig. 32). It forms extensive stands up to the summits of snow-free hills in the Cumberland Bay and Royal Bay areas. Patagonia, Fuegia, Falkland Islands, South Orkney and South Shetland Islands, Antarctic Peninsula (Lamb, 1964).

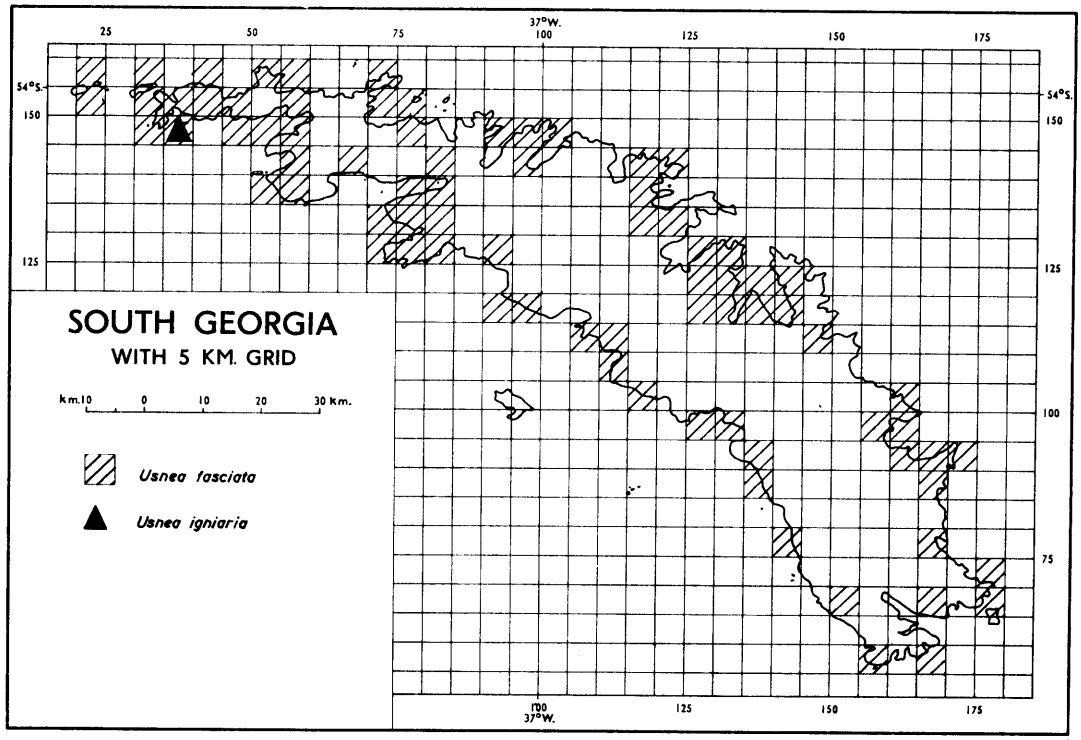


FIGURE 32

The known distribution on South Georgia, by 5 km. squares, of *Usnea fasciata* and *Usnea igniaria*, based on the specimens and field records given in Appendix A.

Usnea igniaria Mot.

Icon. None.
Lit. Lamb (1958, p. 159).

Thallus fruticose, up to 2 cm. tall, pale yellow, branches smooth to warted, the warts formed by incipient branchlets, matt, sorediate, especially towards the tips, bearing small fibrillose branchlets, which may occur singly or in clusters, soralia convex containing granulose soredia concolorous with thallus. Sterile.

U. igniaria differs from the other South Georgian Usneae by its entirely yellow thallus without variegations.

Habitat. On damp bank of hepatic; altitude unknown.

Distribution. South Georgia: at present known from a single collection from near Cape Paryadin, southwest of Undine Harbour (Fig. 32). Southern Argentina, southern Chile, Fuegia (Lamb, 1958), Falkland Islands (specimens in BM).

Xanthoria (Fr.) Th. Fr.

Thallus foliose, yellow, orange or red, occasionally appearing crustose, corticate on both dorsal and ventral surfaces, attached to substratum by rhizinae, K+ purple. Apothecia lecanorine; ascospores 8 per ascus, hyaline, polarilocular, ellipsoid.

This genus is readily recognized by the bright colour of the thallus. It may be confused with certain species of *Caloplaca*, subgenus *Gasparrinia*, but a lower cortex is lacking in many species of that genus.

1. Thallus foliose, lobes ascending, sorediate . . . . . ***X. candelaria***
   Thallus appearing crustose, lobes appressed to substratum, soredia absent . . . ***X. elegans***

Xanthoria candelaria (L.) Th. Fr. f. *antarctica* (Vain.) Hillm.

Syn. *Polycaulionia coralligera* Hue (fide Lamb, 1948*c*, p. 250).
Teloschistes lychneus (Ach.) Tuck.
Xanthoria lychnea (Ach.) Th. Fr.
Xanthoria antarctica (Vain.) C. W. Dodge et Baker (fide Lamb, 1948*c*, p. 250).
Icon. Duncan (1970, pl. XI, fig. 1 as *X. lychnea*), Lamb (1948*c*, pl. IV, fig. 9).
Lit. Vainio (1903, p. 18).

Thallus forming small pulvinate tufts up to 15 mm. in diameter and 8 mm. tall, consisting of numerous irregularly incised lobes up to 3 mm. long and 1·5 mm. broad, sorediate along margins; dorsal surface smooth, orange; ventral surface faintly veined, white, soredia granular, concolorous with dorsal surface, rhizinae sparse on ventral surface, white, up to 0·5 mm. long, unbranched. Sterile.

This species may be recognized by the orange lobes which react K+ purple.

Xanthoria mawsonii C. W. Dodge, apparently widespread in eastern continental Antarctica (Dodge, 1948, p. 236), closely resembles this species and differs only in the punctate-impressed, rugose and scrobiculate dorsal surface, differences which led Filson (1966, p. 59) to surmise that it may be only an environmental modification of *X. candelaria*.

Habitat. On dry, west- and south-facing enriched cliffs; altitudinal range 2–10 m.

Distribution. South Georgia: so far known from only two localities (Fig. 33). Peru (Soukup, 1965), Uruguay (Osorio, 1972), Fuegia (Grassi, 1950), South Sandwich, South Orkney and South Shetland Islands, Antarctic Peninsula (specimens for four areas in AAS), Dronning Maud Land and Theron Mountains (Lindsay, 1972*b*), Tasmania (Wetmore, 1963), Australia (Weber and Wetmore, 1972), widespread in the Northern Hemisphere (Poelt, 1969).

Xanthoria elegans (Link) Th. Fr.

Syn. *Caloplaca elegans* (Link) Th. Fr.
Caloplaca pulvinata (C. W. Dodge et Baker) Cretz.
Caloplaca sparsa (C. W. Dodge et Baker) Cretz.
Gasparrinia austrogeorgica C. W. Dodge.
Gasparrinia harrissonii C. W. Dodge et Baker (fide Murray, 1963).
Placodium elegans (Link.) D.C.
Polycaulionia pulvinata C. W. Dodge et Baker (fide Murray, 1963).
Polycaulionia sparsa C. W. Dodge et Baker.
Icon. Magnusson (1940, pl. II, fig. 3), Taylor (1967, fig. 118).
Lit. Murray (1960*b*, p. 202 as *Caloplaca elegans*), Taylor (1967, p. 143).

Thallus forming rosettes up to 5 cm. in diameter, appearing crustose, but not appressed to substratum, deep orange, red to crimson, lobes up to 0·5 cm. long and 2 mm. broad, flattened to subterete, corticate on both surfaces, tending to fuse and become crustose towards centre of thallus, branching dichotomously or sub-dichotomously several times; ventral surface of lobes white with sparse white rhizinae. Apothecia common, occurring mainly towards centre of thallus, sessile, up to 2 mm. in diameter, disc concolorous with thallus, margin crenulate; ascospores 8 per ascus, hyaline, polarilocular, 10–15 μm. by 5–8 μm.

A highly plastic and common species in the Antarctic and sub-Antarctic, variations of *X. elegans* caused by differences in exposure, such as in colour and morphology, have been described repeatedly in a number of genera. *X. elegans* is, however, much less variable on South Georgia than under the harsher climatic conditions of continental Antarctica. The black hypothallus noted by Taylor (1968) as more or

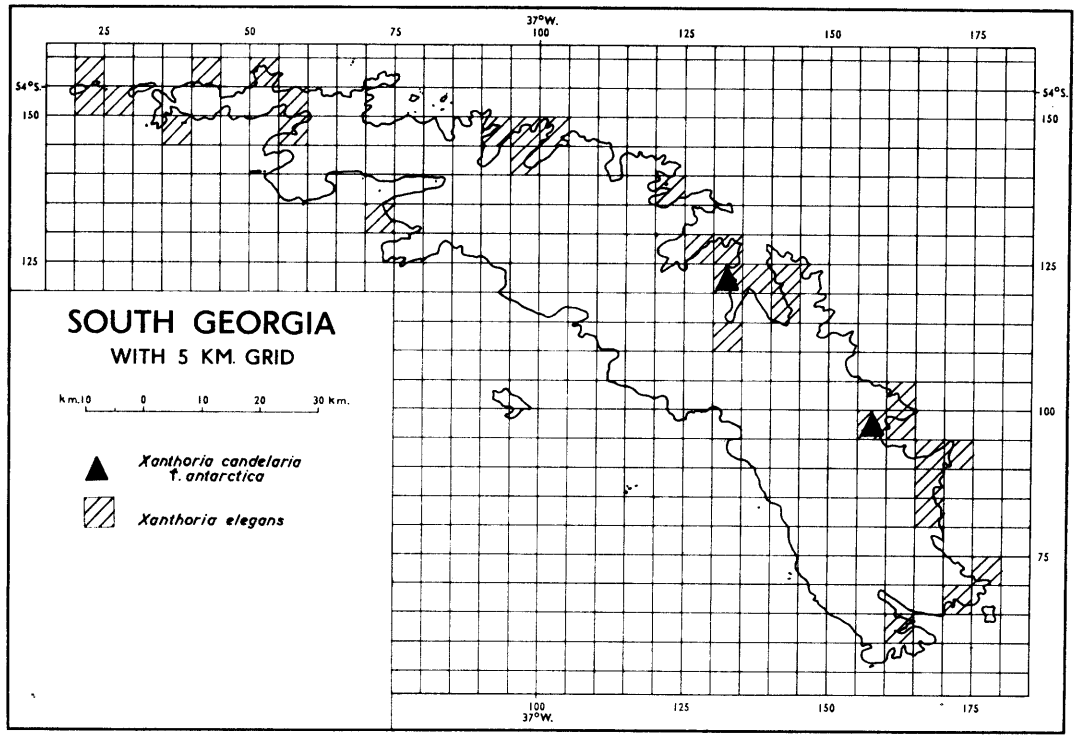


FIGURE 33

The known distribution on South Georgia, by 5 km. squares, of *Xanthoria candelaria* and *Xanthoria elegans*, based on the specimens and field records given in Appendix A.

less evident in and among lobes of North American material appears to be absent from the South Georgian specimens. Further details of the species' anatomy have been given by Magnusson (1940, p. 138–39).

X. elegans superficially resembles species of *Caloplaca* subgen. *Gasparrinia*, e.g. *C. dimorpha*, which appear to form a transition between the two genera, but it is distinguished by the thallus not being appressed to the substratum, and thus easily removed with a knife, and by the rhizinae on the ventral surface, which are absent in South Georgian species of *Caloplaca* subgen. *Gasparrinia*. Future work may show that the distinctions between *Xanthoria* and subgenus *Gasparrinia*, e.g. presence of lower cortex in the former, which also occurs in some species of the latter, are not tenable and the two taxa may have to be merged.

Gasparrinia austrogeorgica C. W. Dodge, described by Dodge (1970, p. 499–501) from material collected by Skottsberg during the Swedish Antarctic Expedition, 1901–03, is *X. elegans*, as shown by the author's examination of the type specimen in Stockholm (S, Skottsberg 163, on coastal rock, Maiviken, Cumberland [West] Bay) which is a quite typical form of the species.

Habitat. On boulders on the shore just above the spray zone and on bird-perching stones, occasionally on morainic debris near bird rookeries, usually in dry situations that are moderately exposed but without regard to aspect; altitudinal range 2–150 m.

Distribution. South Georgia: abundant and widely distributed on the north-east coast, less common on the south-west coast (Fig. 33). Cosmopolitan: South Orkney and South Shetland Islands, Antarctic Peninsula (specimens for three areas in AAS), circum-polar continental Antarctic (Filson, 1966; Kashiwadani, 1970; Lindsay, 1972*b*).

D. GLOSSARY

arachnoid: covered with fine, cobweb-like hairs, e.g. inner surface of lobes of *Hypogymnia lugubris*.

areolate: small area of thallus separated from other areas by cracks or lines, appearing as a small island or part of a mosaic, e.g. podetia of *Cladonia furcata* and *C. gracilis*.

bullate: blistered or puckered.

crenulate: with small rounded notches, e.g. apothecial margin of *Psoroma hypnorum.*

crisped: curled and (when dry) brittle, e.g. thallus of *Cetraria islandica.*

crustose: type of thallus which forms a thin layer over, and inseparable from, the substratum; the genera *Rhizocarpon, Buellia* and *Lecanora* have this growth form.

cyphella: small, rimmed cup-like depression of definite structure in the thallus, e.g. ventral surface of *Sticta gaudichaudii.*

divaricate: applied to branches that diverge from each other at an obtuse angle, e.g. species of *Alectoria.*

evanescent: applied to structures present in juvenile thalli, but disappearing with age and usually absent in old thalli, e.g. primary thallus of many species of *Cladonia.*

farinose: appearing mealy or powdery, e.g. soredia of *Cladonia carneola.*

foliose: type of growth form where the thallus is leafy, usually dorsiventral in structure and readily separable from the substratum, e.g. species of *Parmelia* and *Peltigera.*

foveolate: pitted and wrinkled.

fruticose: type of growth form where the thallus is shrubby, usually radially symmetrical, but occasionally dorsiventral in structure, easily separated from the substratum, e.g. species of *Usnea. Cystocoleus niger* is considered as a fruticose lichen, although it may appear crustose to the naked eye, since it has a filamentous, radially symmetrical growth form.

isidia: small, corticate, globular to coralloid outgrowths usually on the dorsal surface of the thallus, which may serve to increase the photosynthetic area of the thallus or, when broken off by external agents, as a method of vegetative propagation, e.g. *Parmelia saxatilis; isidiate*—thallus bearing isidia; *isidioid*—bearing structures resembling isidia; *isidiose*—with isidia in various stages of development.

labriform: appearing lip-shaped, e.g. soralia of *Physcia* cf. *wainioi.*

laciniate: cut into deep, irregular lobes, e.g. species of *Physcia* and *Xanthoria elegans.*

laminal: occurring over the surface of the thallus.

lecanorine: type of apothecium where the margin is a different colour to the disc and contains algal cells, e.g. species of *Pseudocyphellaria, Psoroma* and *Usnea fasciata.*

lecideine: type of apothecium where the margin is the same colour as the disc and does not contain algal cells, e.g. species of *Cladonia* and *Stereocaulon.*

mazaedium: loose powdery mass of ascospores left after disintegration of the asci, e.g. *Sphaerophorus globosus.*

muriform: applied to ascospores with both transverse and longitudinal septa, resembling bricks in a wall, e.g. spores of *Rhizocarpon geographicum.*

orbicular: flat with a circular outline.

papillose: possessing small, warty protuberances.

phycobiont: the algal component of the lichen, e.g. *Nostoc* in *Leptogium* and *Prasiola* in *Mastodia.*

phyllocladia: small squamules occurring on the pseudopodetia of species of *Stereocaulon.*

podetium: erect or ascending, secondary thallus of species of *Cladonia* which bears apothecia; of ascogenous origin.

pruinose: appearing frosted, covered with very thin layer of white to grey powder, e.g. thallus of *Dermatocarpon intestiniforme.*

pseudocyphella: small, irregular rimless area of thallus which is not corticate, exposing the medulla, usually appearing as small, irregular white blotches over the surface of the thallus, e.g. *Physcia caesia.*

pseudopodetia: "woody" stems of species of *Stereocaulon,* formerly thought to be of ascogenous origin but now known to be vegetative.

pycnidium: minute globose body immersed in the thallus or borne on short stalks in which pycnoconidia (thought to have some reproductive capacity) are produced.

rhizinae: small clusters of hyphae resembling small hair-like roots, e.g. ventral surface of *Dermatocarpon intestiniforme* and species of *Peltigera*; *rhizinose*—bearing rhizinae.

scyphus: cup-like structure on podetia of various species of *Cladonia*; *scyphous*—bearing scyphi.

soralium: delimited area of thallus where soredia are produced, e.g. *Physcia caesia.*

soredium: non-corticate aggregation of a small number of algal cells and fungal hyphae, able to develop vegetatively into a new thallus, e.g. *Cladonia balfourii* f. *chlorophaeoides*; *sorediate*—bearing soredia; *sorediose*—with soredia in various stages of development.
spinulose: bearing small spines, e.g. margin of thallus of *Cetraria islandica.*
squamulose: either a type of lichen thallus which is minutely foliose or scaly, e.g. *Pannaria hookeri*, or bearing squamules or scales, e.g. podetia of *Cladonia squamosa.*
striate: marked with fine, ± parallel lines, e.g. thallus of *Massalongia carnosa.*
subulate: awl-shaped, e.g. podetia of *Cladonia furcata* and *C. gracilis* var. *elongata.*
terete: cylindrical and tapering, circular in cross-section, e.g. branches of *Sphaerophorus globosus.*
tomentum: thin layer of fine hairs resembling matted wool, e.g. dorsal surface of *Peltigera canina*; *tomentose*—bearing a tomentum.
umbilicate: attached to the substratum by a single central point on the ventral surface, e.g. *Dermatocarpon intestiniforme* and species of *Umbilicaria.*
variegated: irregularly and patchily coloured, e.g. thallus of *Hypogymnia lugubris.*

V. THE LICHEN-RICH PLANT COMMUNITIES

ALTHOUGH vascular plants dominate much of the vegetation of South Georgia, a number of lichen-dominated communities are prominent in various habitats, particularly in dry exposed situations. In this section an outline classification is provided of these lichen-rich communities with brief descriptions of their floristic composition and, where appropriate, comparisons with similar communities in the maritime Antarctic.

Ecological observations were made by the author at most localities visited, but time did not permit the collecting of quantitative phytosociological data for the lichen communities. Although it is not yet possible to produce an hierarchical classification, such as that available for the South Orkney Islands (Smith, 1972), the South Shetland Islands (Lindsay, 1971*d*; Allison and Smith, 1973) and the Argentine Islands (Smith and Corner, 1973), it is thought that the following brief descriptive account of the South Georgian communities will be of value in giving some indication of the role of the macrolichens in the island's vegetation.

Many of the lichen communities on South Georgia have numerous species in common with those of the maritime Antarctic, some, for example, being dominated by the same species, whereas others are dominated by different species of the same genus. But in the more diverse flora of South Georgia a number of species which are rare in, or absent from, the maritime Antarctic achieve dominance in certain habitats. Furthermore, there is a considerably wider range of habitats on the island than in the maritime Antarctic and several of the lichen-rich communities appear to be variants of associations usually dominated by phanerogams.

The lichen-rich communities recognized provisionally are listed in Table III. Further work will undoubtedly augment this list and, once adequate quantitative data have been obtained, it should be possible to confirm much of the classification from an analysis of detailed species lists.

TABLE III

PROVISIONAL CLASSIFICATION OF LICHEN-RICH COMMUNITIES ON SOUTH GEORGIA

1. *Communities of moderately to fully exposed non-enriched rock habitats*
   a. Communities dominated by fruticose and crustose lichens
      i. *Usnea fasciata*–crustose lichen community
      ii. *Usnea antarctica*–crustose lichen community
      iii. *Usnea fasciata–Alectoria* spp.–crustose lichen community
   b. Communities dominated by foliose and crustose lichens
      i. *Umbilicaria antarctica*–crustose lichen community
      ii. *Leptogium puberulum* community
   c. Communities dominated by crustose lichens
      i. *Rhizocarpon geographicum* community
      ii. *Placopsis parellina–P. contortuplicata* community
      iii. *Placopsis cribellans* community

2. *Communities of enriched rock habitats*
   a. Communities dominated by foliose and crustose lichens
      i. *Parmelia gerlachei*–crustose lichen community
      ii. *Parmelia ushuaiensis*–crustose lichen community
      iii. *Physcia caesia*–crustose lichen community
      iv. *Mastodia tesselata*–crustose lichen community
      v. *Mastodia tesselata–Caloplaca millegrana* community
      vi. *Xanthoria elegans*–crustose lichen community
   b. Communities dominated by crustose lichens
      i. *Haematomma erythromma–Caloplaca dimorpha* community
      ii. *Haematomma erythromma–Buellia anisomera* community
      iii. *Rinodina convoluta* community

3. *Communities of spray-zone habitats*
      i. *Verrucaria maura* community
      ii. *Verrucaria tesselatula* community
      iii. *Verrucaria durietzii* community
      iv. *Caloplaca millegrana* community

4. *Communities of fresh-water habitats*
      i. *Verrucaria* cf. *aethiobola* community

5. *Communities of moss-turf habitats*
   a. Communities co-dominated by fruticose lichens
      i. *Chorisodontium aciphyllum–Polytrichum alpestre–Cladonia rangiferina* community
   b. Communities co-dominated by foliose lichens
      i. *Chorisodontium aciphyllum–Polytrichum alpestre–Pseudocyphellaria freycinetii* community

6. *Communities of dry grassland habitats*
   a. Communities co-dominated by fruticose lichens
      i. *Festuca contracta*–Cladonia rangiferina* community
   b. Communities co-dominated by foliose lichens
      i. *Festuca contracta*–Pseudocyphellaria* spp. community

* =*Festuca erecta.*

1. *Communities of moderately to fully exposed non-enriched rock habitats*

These communities are typical of stable, dry rock exposures and scree which are only rarely irrigated by slightly nitrogenous melt water. Vascular plants are absent or confined to small pockets of soil in rock crevices. Their composition and habitats are similar to the nitrophobous, halophobous, anemophilous lichen communities of the South Orkney Islands, with many of the communities closely resembling components of the fruticose lichen and moss-cushion sub-formation of the maritime Antarctic (Smith, 1972).

a. *Communities dominated by fruticose and crustose lichens.* The communities grouped under this heading are composed of a layer of fruticose lichens with an understorey of crustose species. Vascular plants are absent but mosses, especially small acrocarpous cushion-forming species, may be common and locally abundant. Three communities have been recognized so far.

i. *Usnea fasciata–crustose lichen community.* This community is very widespread on South Georgia, occurring on dry boulders and cliff faces which are moderately exposed to wind, at altitudes of 10–700 m. It appears to attain its maximum development at high altitudes, above the limits of vascular plant growth. *Usnea fasciata* may attain up to 80 per cent cover, so that from a distance boulders may appear to be covered with a shaggy green growth. Crustose lichens, of the genera *Lecanora*, *Lecidea*, *Pertusaria* and *Rhizocarpon*, form an irregular mosaic under the *Usnea* while bryophytes, mainly species of *Andreaea*, *Dicranoweisia*, *Grimmia* and *Racomitrium* may be locally frequent. In the Cumberland Bay area, where neither aspect nor exposure seems to influence its degree of development or composition, this community covers wide areas of dry, non-enriched greywacke cliffs on most of the hills with individual stands up to several hundred square metres in size. Extensive stands have also been noted on the west side of Nuñez Peninsula, on the hills of Bird Island and on those to the north of Royal Bay.

ii. *Usnea antarctica–crustose lichen community.* Occurring at lower altitudes, between 5 and 70 m. a.s.l., and in less exposed situations than the preceding, this community is typical of rock faces which may be irrigated locally by slightly nitrogenous melt water. *Usnea antarctica*, although

only occasionally as abundant as *U. fasciata*, rarely achieves the cover of that species and the stands are more limited in extent, i.e. rarely more than a few square metres. Because of its more open nature, there is a greater variation in the development of the crustose lichen understorey. In non-enriched situations, various species of *Lecidea*, *Pertusaria* and *Sporastatia*, with *Rhizocarpon geographicum* and *R. polycarpon*, are almost constant associates while, in slightly enriched situations, scattered thalli of *Haematomma erythromma* and *Lecanora skottsbergii* may also occur. As with the *Usnea fasciata*–crustose lichen community, the composition of this assemblage does not appear to be affected by aspect, although many of the crustose species, particularly those that are slightly nitrophilous, are inconspicuous or absent towards its upper altitudinal limits. Bryophytes are relatively uncommon, being mainly species of *Andreaea* and *Grimmia* with their cushions frequently encrusted by *Ochrolechia frigida*, so that certain facies resemble the *Andreaea*–lichen sociation of the South Orkney Islands (Smith, 1972).

iii. *Usnea fasciata–Alectoria spp.–crustose lichen community*. In very dry exposed situations, such as ridges at high altitudes, both *Alectoria pubescens* and *A. minuscula* become prominent and frequently achieve co-dominance with *Usnea fasciata*, often forming a more or less continuous understorey to the virtual exclusion of crustose lichens and moss cushions. This nitrophobous community reaches its maximum development on extremely exposed cliffs, boulders and ridge crests but aspect does not appear to affect its composition. Although locally extensive, as small stands up to 1 m. square, there is rarely a continuity of cover typical of the *Usnea fasciata*–crustose lichen community. Species of *Lecidea*, *Lecanora* and *Rhizocarpon* occur between thalli of the two species of *Alectoria*, while *Pannaria hookeri*, *Stereocaulon ramulosum* and several species of *Cladonia* are found on soil in rock crevices and on cushions of *Andreaea*. The altitudinal range of this community is from 150 to 600 m. a.s.l., but it appears to be restricted in its distribution, being known so far only from the hills to the west of Moraine Fjord (Cumberland East Bay) and those on the north shore of Royal Bay.

b. *Communities dominated by foliose and crustose lichens*. Fruticose lichens are absent or rare in the communities of this group, with foliose lichens predominating, although crustose species may vary in abundance from common to absent. The two communities included here occur in dry, moderately to fully exposed situations at fairly high altitudes. Vascular plants are absent.

i. *Umbilicaria antarctica–crustose lichen community*. This community is dominated by the foliose *Umbilicaria antarctica*, which forms clusters of small- to medium-sized thalli with interspersed crustose species, notably cryptothalline species of *Lecidea*, *Rhizocarpon geographicum*, *R. polycarpon* and *Lecanora skottsbergii*. So far, this community has been recorded at only one locality, at *c.* 600 m. on dry, stable, south-facing shaded block scree, above Moraine Fjord (Cumberland East Bay), where it occurred interspersed with stands of the *Usnea fasciata–Alectoria* spp. crustose lichen community.

ii. *Leptogium puberulum community*. Small thalli of *L. puberulum* form a rather open community scattered irregularly over small rocks and boulders on dry, stable, usually north-facing scree at altitudes between 100 and 200 m. a.s.l. Associated species are infrequent to rare and belong to the genera *Lecanora*, *Lecidea* and *Rhizocarpon*. Although locally extensive at the two localities where it is known, i.e. in the hills to the south and west of Will Point (Royal Bay), and in the mountains to the north-west of Right Whale Bay, large stands are never formed, the largest covering only a few square metres.

c. *Communities dominated by crustose lichens*. The following groups of communities, unlike those just considered, are dominated entirely by crustose lichens, with foliose and fruticose species, bryophytes and vascular plants being rare or absent. Apparently the instability of the substratum prevents the establishment of species of these other groups, whereas microlichen growth may suffer only temporarily.

i. *Rhizocarpon geographicum community*. Although a number of crustose species may be present, *Rhizocarpon geographicum* is the most prominent, occurring in great quantity as large numbers of small, frequently confluent, thalli, on dry recently stabilized or slightly active scree above 50 m. a.s.l. Species of *Lecidea*, *Pertusaria* and *Sprastatia* are almost constant associates but rarely achieve high cover.

ii. *Placopsis parellina–P. contortuplicata community.* This community appears to be the South Georgian equivalent of the *Placopsis contortuplicata* sociation of the South Orkney Islands (Smith, 1972) and South Shetland Islands (Lindsay, 1971*d*). On South Georgia *P. parellina* occupies the same ecological niche as *P. contortuplicata* and is usually the dominant species. Both are found on pebbles and rock fragments subject to periglacial activity, but they may also occur on dry, stable non-enriched rock and cliff faces in very exposed situations at high altitudes as, for example, on the vertical cliff faces at *c.* 300 m. a.s.l. in the hills to the west of Comer Crag, between Right Whale Bay and Ice Fjord, and on dry rock faces at Shallop Cove (Queen Maud Bay). Despite local abundance, this community appears to be restricted mainly to the northern half of the north-east coast.

iii. *Placopsis cribellans community. P. cribellans* is characteristic of glacial outwash fans or dried-up stream beds, where it forms extensive areas of coalesced pink thalli with up to 40 per cent cover over many square metres. Associated cryptogams are rare on the outwash fans but occasional in the dried-up stream beds. In the latter habitats other lichens are rare, but short turf- and cushion-forming mosses and vascular plants such as *Deschampsia antarctica* may occur sporadically. The *P. cribellans* community appears to be widespread around the island, large stands occurring on the glacial outwash plain behind Binder Beach (Right Whale Bay), Hestesletten (Cumberland East Bay) and on the dried-up stream beds behind Moltke Harbour (Royal Bay).

2. *Communities of enriched rock habitats*

Since most of the dominant species of these communities are slightly to extremely nitrophilous, most assemblages are developed around aggregations of birds and seals. However, none of these communities is tolerant of any degree of trampling and so they reach their optimum development near to the periphery of rookeries and on bird-perching stones where there is a fairly regular supply of organic matter in relatively undisturbed habitats. Their altitudinal range is from sea-level to over 150 m., but most are developed at low altitudes near to the shore. Neither aspect nor exposure seems to affect their distribution but, although there is a preference for dry habitats, there is also tolerance of frequent inundations from melting snow during the summer. Vascular plants are absent whilst bryophytes are rare.

a. *Communities dominated by foliose and crustose lichens.* Ornithocoprophilous communities on South Georgia are often dominated by foliose and crustose species or crustose species alone, unlike those in the maritime Antarctic which are often dominated by fruticose lichens such as *Catillaria corymbosa, Lecania brialmontii* and *Ramalina terebrata.* This is surprising since many of the habitats occupied by such communities are similar or identical in the two areas. Individual stands dominated by foliose and crustose lichens rarely cover large areas of rock and are essentially local variants of a broad assemblage of ornithocoprophilous lichen-dominated communities.

i. *Parmelia gerlachei–crustose lichen community.* This occurs as small scattered stands on cliffs and boulders from 5 to 30 m. a.s.l., in slightly to moderately enriched dry habitats, e.g. cliffs below bird nests or bird-perching stones. Under these conditions *P. gerlachei* forms almost circular colonies, frequently formed by the confluence of a number of small thalli, so that crustose species are often excluded by the almost continuous cover of the foliose lichen. In more open stands a number of crustose species such as *Buellia coniops, B. russa, Haematomma erythromma* and *Lecanora dispersa* are commonly associated. This community appears to be restricted in its distribution and has been observed only on part of the north-east coast, between Cumberland West Bay and Royal Bay.

ii. *Parmelia ushuaiensis–crustose lichen community.* Physiognomically very similar to the preceding, this community also occurs on dry boulders and cliffs. *P. ushuaiensis* appears to be less tolerant of manuring than *P. gerlachei* and so it is occasionally found in non-enriched habitats, but not forming a distinct community. It occurs at low altitudes, between 5 and 15 m. a.s.l. on coastal cliffs and boulders, where it may form, locally, almost pure stands again by the coalescence of a number of small thalli. In more open stands, crustose lichens such as *Lecanora skottsbergii* and *Lecidea darbishirei* are frequent while *Usnea antarctica* may occur as small, scattered individual thalli. So far, this community has only been observed in the vicinity of Cumberland East Bay.

iii. *Physcia caesia–crustose lichen community.* Typical of dry moderately to heavily manured boulders used as bird perches, this community occurs mainly on the more or less horizontal crests of such boulders. The dominant lichen *Physcia caesia* forms a mosaic of small thalli which only infrequently coalesce, while a number of crustose species, especially *Buellia anisomera, B. coniops, B. russa, Haematomma erythromma, Rinodina petermannii* and *Sporastatia austrogeorgica*, are usually present. Although most frequently encountered at low altitudes, this assemblage has been observed on skua perches at *c.* 150 m. a.s.l. and in the vicinity of the whaling station at Grytviken on old whale bones used as bird perches. It appears to be frequent along the north-east coast of South Georgia.

iv. *Mastodia tesselata–crustose lichen community.* On damp bird-perching stones the preceding community is replaced by the present one in which the dominant foliose lichen is *Mastodia tesselata.* Owing to its more erect growth form, *M. tesselata* tends to form broken chains of thalli rarely giving the pure stands formed by the appressed species of *Parmelia.* Consequently, there is more diversity in the composition of communities in which it occurs. There appear to be two facies resulting from variation in the associated crustose species which seems to be related to distance from the sea. On bird perches more than *c.* 10 m. from the shore, crustose lichens are relatively inconspicuous and species such as *Buellia coniops, B. russa, Lecanora dispersa, Sporastatia austrogeorgica* and, very occasionally, *Haematomma erythromma* and *Xanthoria elegans* form a discontinuous understorey beneath the *Mastodia.* On bird perches nearer the shore many of these species are replaced by *Caloplaca dimorpha* and *C. millegrana*, but this assemblage appears to be infrequent and was noted only in the area of Cumberland East Bay. Otherwise this community appears to be widespread along the whole north-east coast of South Georgia.

v. *Mastodia tesselata–Caloplaca millegrana community.* What may be only a facies variant of the preceding community occurs on boulders and cliffs on sheltered shores, at the upper limit of the hygrohaline zone. It appears to be subject to much dunging and trampling, e.g. by penguins, but neither lichen species seems to suffer as a consequence. *C. millegrana* forms an almost continuous understorey beneath *Mastodia tesselata,* which may occur as scattered or confluent groups of thalli. Associated crustose lichens, namely *Buellia russa, Lecanora atra* and *Verrucaria racovitzae,* are rare although the moss *Orthotrichum crassifolium* may be locally common.

vi. *Xanthoria elegans–crustose lichen community.* This community, which appears to be the South Georgian equivalent of the *Xanthoria elegans* sociation described from the South Orkney Islands by Smith (1972), occupies similar habitats, i.e. dry enriched boulders and rock faces at low altitudes adjacent to bird and seal colonies. However, unlike the situation in the South Orkney Islands, it appears to be very local and only rarely prominent, its niche being occupied more commonly by the *Haematomma erythromma–Caloplaca dimorpha* community. Associated species are few in number being *Haematomma erythromma* and species of *Buellia* and *Rinodina.* The *X. elegans*–crustose lichen community has been observed at a number of localities along the north-east coast of South Georgia.

b. *Communities dominated by crustose lichens.* Communities where fruticose and foliose lichens are absent are uncommon on South Georgia and are found mainly in exposed situations. Several communities dominated by crustose lichens occur in sheltered enriched situations and, apart from the *Rinodina convoluta* community, may be local variants of communities dominated by macrolichens. The following three communities have been recognized.

i. *Haematomma erythromma–Caloplaca dimorpha community.* This community is typical of bird-perching stones at some distance from the shore, replacing the *Mastodia tesselata–Caloplaca millegrana* community of bird perches that receive some salt spray. It appears to be the counterpart of the *Xanthoria elegans–Haematomma erythromma–Mastodia tesselata* sociation reported from similar habitats in the South Shetland Islands (Lindsay, 1971*d*). Although *H. erythromma* has a fairly wide altitudinal range on South Georgia, *C. dimorpha* is very restricted occurring only between 3 and 10 m. a.s.l. Towards the upper limit of its altitudinal range, the *Caloplaca* decreases rapidly in abundance with a corresponding increase in abundance of associated species, especially *Buellia coniops, B. russa* and *Verrucaria racovitzae.* However, this community has a

wide distribution along the north-east coast of South Georgia and is more frequently encountered in the larger, more sheltered inlets such as Cumberland East Bay.

ii. *Haematomma erythromma–Buellia anisomera community.* This community also occurs on dry bird-perching stones slightly inland in similar situations to, but at slightly higher altitudes than, the *Haematomma erythromma–Caloplaca dimorpha* community. Under these conditions, *H. erythromma* tends to form a continuous stand by the coalescence of many small thalli on which *Buellia anisomera* occur epiphytically. The latter species is found mainly as small clusters of orbicular thalli *c.* 2 cm. in diameter which only occasionally coalesce to form a nearly continuous cover over *H. erythromma.* Like the *H. erythromma–Caloplaca millegrana* assemblage, this community is widespread along the north-east coast, especially in the more sheltered bays.

iii. *Rinodina convoluta community. R. convoluta* appears to be moderately photophobous, the only lichen known so far from South Georgia with such a tendency, which results in this community developing where nitrogenous melt water trickles down shaded south-facing cliffs or boulders just behind storm beaches, i.e. at altitudes of 1·5–4 m. a.s.l. It has only been collected in this particular habitat where it forms large orbicular thalli, up to 15 cm. in diameter, which rarely coalesce but can give up to 50 per cent cover. Associated species are infrequent being restricted to *Acarospora convoluta* and *A. macrocyclos.* This community is local in its development and was noted in abundance at only two localities, Hope Point in Cumberland East Bay and Köppen Point in Royal Bay, although small stands also occur along much of the north-east coast.

3. *Communities of spray-zone habitats*

Plants growing in the spray zone are subject to severe environmental extremes, such as frequent immersion in sea-water, rapid drying by wind and abrasion by brash ice during winter. Because of these conditions, macrolichens, bryophytes and vascular plants are absent and the communities that develop comprise only crustose lichens. A number of such communities develop on both sheltered and exposed stable shores which resemble those reported from the South Orkney Islands (Smith, 1972) and the South Shetland Islands (Lindsay, 1971*d*), their vertical zonation following the same general pattern throughout the maritime Antarctic and South Georgia, although the dominant species in any particular community may vary from one locality to another. All communities appear to have a wide distribution around South Georgia.

i. *Verrucaria maura community.* This occurs on exposed rocky shores where *V. maura* gives more or less continuous cover in a zone from 0 to 2 m. a.s.l., but the upper limit varies depending on exposure to wind and wave action, and may be as high as 6 m. a.s.l. in very exposed situations, such as Rumbolds Point, between Drygalski Fjord and Rogged Bay. Associated species are rare or absent, being scattered thalli of *Verrucaria tesselatula* and *V. ceuthocarpa.* The community appears to be less frequent on shores subject to abrasion by brash ice, i.e. close to glaciers which terminate in the sea, but few observations have been made in such situations.

ii. *Verrucaria tesselatula community.* This occurs on a zone of variable width immediately above the *Verrucaria maura* belt, and appears to correspond to the *Verrucaria tesselatula–V. ceuthocarpa* facies of the *Verrucaria* sociation reported from the South Orkney and South Shetland Islands. On very exposed shores, the width of this zone may be up to 3 m., but in sheltered to moderately exposed localities, it may be only 0·7–0·9 m. wide. At the upper limit of this zone (*c.* 2·5–4 m. a.s.l. on sheltered to moderately exposed shores), a number of less halophilous species may occur intermittently, such as *Caloplaca dimorpha, C. millegrana* and *Verrucaria durietzii.* On sheltered shores where wave and spray action is minimal, such as those of Cumberland East and West Bays, the *Verrucaria tesselatula* community is rapidly invaded towards its upper limit by *V. durietzii,* whereas on more exposed shores it gives way abruptly to a *Caloplaca millegrana* community.

iii. *Verrucaria durietzii community.* This community develops only on very sheltered shores, such as those of Cumberland East and West Bays, where it forms a well-defined zone, *c.* 1 m. wide above the *Verrucaria tesselatula* zone, at altitudes of 2·5–4·5 m. a.s.l., depending on aspect. It appears to have a slightly greater altitudinal range in sites with a north to west exposure than in those facing south or east. As in the other *Verrucaria* communities, *V. durietzii* frequently forms pure stands by the coalescence of many small thalli so that other species are often excluded. In more open

stands, the only slightly halophilous nature of this community is reflected in the associated species, mainly *Caloplaca dimorpha*, *C. millegrana*, *Lecanora atra*, *Lecidea darbishirei* and *Sporastatia austrogeorgica*.

iv. *Caloplaca millegrana community*. This is found on both sheltered and exposed rocky shores, though more prominent in the latter situation, as a narrow belt above the uppermost *Verrucaria* community. On sheltered shores, the zone occupied by *C. millegrana* is very narrow and may even be non-existent due to the occurrence of a number of other crustose species that are not, or are only slightly, halophilous. On more exposed shores, however, the community is more prominent owing to the absence of such species due to increased deposition of spray. Pure stands covering several square metres often occur, being formed by the confluence of many small thalli. Towards the upper limits, *Mastodia tesselata* and *Orthotrichum crassifolium* may occur as scattered individuals, indicating the transition from hygrohaline to more typically terrestrial communities.

4. *Communities of fresh-water habitats*

Although lichens such as *Rinodina convoluta* with a hygrophilous nature, i.e. species in habitats subject to frequent inundation but which cannot tolerate constant immersion, often occur in situations irregularly submerged by melt water, hydrophilous species, i.e. those which are submerged for more or less their entire existence, are uncommon in the maritime Antarctic–South Georgia region. At present only crustose lichens are known from fresh-water habitats in the region.

Although several communities dominated by a variety of species occur in the maritime Antarctic, e.g. sociations dominated by *Buellia russa* and *Verrucaria elaeoplaca* respectively (Smith and Corner, 1973), only one community has so far been observed on South Georgia. It is not known how these communities react to freezing of the water, either as a surface layer of ice on lakes or the entire body as in shallow pools.

i. *Verrucaria cf. aethiobola community*. This occurs on stable rock surfaces in streams and lakes and infrequently in depressions that are periodically inundated by melt water. The cover of the dominant species varies with the nature of the substratum, ranging from small thalli *c.* 2 cm. in diameter, affording low cover on pebbles in streams on Bird Island, to relatively high cover with aggregations of thalli up to 20 cm. in diameter, on flat boulders in lakes in Cumberland East Bay. Associated species are rare, being restricted to *Buellia russa* and *Verrucaria elaeoplaca*, neither of which are abundant. R. I. L. Smith (personal communication) has noted small stands of this community to a depth of *c.* 50 cm. in several lakes.

5. *Communities of moss-turf habitats*

The general structure and composition of the communities described here are very similar to those comprising the moss-turf sub-formation of the maritime Antarctic (Smith, 1972). However, there is a wider range of associated macrolichens on South Georgia, where encrusting microlichens are less prominent than in similar situations in the maritime Antarctic. The two main turf-forming mosses associated with these communities on South Georgia are *Chorisodontium aciphyllum* and *Polytrichum alpestre* but another, *Polytrichum alpinum*, may occasionally be locally abundant. Because of the stable nature, relatively good drainage and slow growth rate of the turves formed by these mosses, they provide an ideal substratum for the establishment and subsequent luxuriant growth of numerous epiphytic lichens. A range of communities develops in which macrolichens are prominent, and which can be separated into two series, one dominated by fruticose lichens and one by foliose species. These communities are best developed at low altitudes, below 150 m., but they may occur as small stands up to 500 m. a.s.l. Flowering plants are infrequent associates. Some quantitative data on the composition of "lichen-rich bryophyte banks" will be found in Lindsay (1973*b*, table II).

a. *Communities co-dominated by fruticose lichens*. Such communities on South Georgia strongly resemble sociations within the *Polytrichum alpestre–Chorisodontium aciphyllum* association described from the South Orkney Islands by Smith (1972), since many of the component species are identical or closely related. However, a major difference is that *Alectoria chalybeiformis* and *Usnea antarctica*, frequent on moss turves in the South Orkney Islands (Smith, 1972), are absent or very rare in similar habitats on South Georgia. Also *Sphaerophorus globosus* is noticeably less abundant in such habitats on South Georgia than in the maritime Antarctic.

i. *Chorisodontium aciphyllum–Polytrichum alpestre–Cladonia rangiferina community.* Although *C. aciphyllum* and *P. alpestre* may individually form locally extensive pure stands, or occur as mixed turves of both species, the nature and composition of the epiphytic fruticose lichen groupings appears to be very similar. *Cladonia rangiferina* is the most frequent and abundant epiphyte although many other species, especially *Cladonia furcata* and *C. gracilis*, may be locally prominent. Some crustose species such as *Lopadium willianum* and *Ochrolechia frigida* may occur in small quantity but foliose lichens are almost entirely absent. The Cladoniae may occur as small pure stands over the moss surface or exist as mixed swards with *Cladonia rangiferina* being the predominant component. Other fruticose lichens such as *Cetraria islandica*, erect forms of *Hypogymnia lugubris* and *Stereocaulon alpinum* occur in small quantities intermixed with the Cladoniae. *Cornicularia aculeata* and *C. epiphorella* are associates on moss turves at the northern end of the island, both species being absent from much of the north-east coast. In the maritime Antarctic, however, both are widely distributed as far south as the Argentine Islands (Smith and Corner, 1973).

b. *Communities co-dominated by foliose lichens.* Here foliose species of *Pseudocyphellaria* replace the fruticose lichens as the predominant epiphytic components of the pure or mixed *Chorisodontium aciphyllum* and *Polytrichum alpestre* moss banks.

i. *Chorisodontium aciphyllum–Polytrichum alpestre–Pseudocyphellaria freycinetii community.* In this community the fruticose Cladoniae are replaced mainly by *Pseudocyphellaria freycinetii* and to a much lesser extent by *Ps. endochrysea*. Both of these species form large thalli, frequently up to 25 cm. in diameter, but only rarely do they form a closed community. However, associated lichens are scarce, consisting of a few Cladoniae such as *C. bellidiflora*, *C. carneola* and *C. furcata*, and a few crustose species, notably *Lopadium willianum* and *Ochrolechia frigida*. Flowering plants are infrequent and occur as isolated individuals usually of *Acaena decumbens* and *Festuca contracta* (=*F. erecta*). This assemblage tends to develop in more exposed situations than the *Chorisodontium aciphyllum–Polytrichum alpestre–Cladonia rangiferina* community, such as on hill crests and ridges, but it only rarely occurs above 150 m. a.s.l. At lower altitudes and in slightly less exposed situations both of these communities tend to intergrade to some extent.

6. *Communities of dry grassland habitats*

Brief accounts of the communities of such habitats have been given by Skottsberg (1912) and Greene (1964), both of whom made only passing reference to lichens. However, in certain situations grassland communities dominated by *Festuca contracta* (=*F. erecta*) are rich in lichens. Development of such vascular plant–lichen co-dominated communities is local, however, since the vascular plants have a much faster growth rate than the lichens and often overgrow the latter. Two variants of *Festuca contracta* grassland communities were noted in which lichens achieved co-dominance.

a. *Communities co-dominated by fruticose lichens.* In moderately exposed *Festuca* grassland species of *Cladonia* become prominent, especially *C. rangiferina*. Such assemblages appear to be the South Georgian equivalent of the "reindeer lichen" stands of the Northern Hemisphere (Ahti, 1959). However, their development on South Georgia appears to be local and subject to much variation in composition, especially of the associated macrolichens. At present, in the absence of quantitative data, only one community is distinguished.

i. *Festuca contracta–Cladonia rangiferina community.* This community develops at low altitude, on moderately stable well-drained ground that may be subject to frost disturbance, where other vascular plants, apart from *Acaena decumbens*, are scarce. In such situations, *Cladonia rangiferina* occurs in abundance on *Chorisodontium aciphyllum* and *Polytrichum alpestre* amongst the open grassland, forming more or less pure swards up to 60 cm. in diameter and occasionally up to several metres across, e.g. on Hestesletten in Cumberland East Bay. The continuity of cover of this species is interrupted by occasional shoots of *F. contracta* (=*F. erecta*) or *Acaena decumbens* growing through the intertwined podetia, while a number of other fruticose lichens, notably *Cetraria islandica*, *Cladonia gracilis*, *Stereocaulon alpinum* and *St. glabrum* occur intermixed in

such swards or infrequently as small individual pure colonies. The composition of this community is quite variable, for example, in sites affected by frost heave, the cover of the grass is quite low and the lichens afford greater abundance, particularly *Stereocaulon glabrum*. Between *c.* 5 and 50 m. a.s.l., *Cladonia rangiferina* is the most prominent fruticose lichen but at slightly higher altitudes, between *c.* 50 and 150 m. a.s.l., *Cetraria islandica* increases markedly in abundance to form colonies up to 25 cm. in diameter. In grassland that is less well drained, *Stereocaulon alpinum* and *St. glabrum* may increase in abundance to become dominant locally. Foliose and crustose lichens are rare.

This community occurs along most of the north-east coast of South Georgia, but it is best developed in the Stromness Bay–Cumberland Bay area.

b. *Communities co-dominated by foliose lichens.* Communities in which foliose lichens achieve co-dominance with vascular plants appear to be rare on South Georgia and only one has been observed.

i. *Festuca contracta–Pseudocyphellaria spp. community.* This community develops mainly in sheltered "radiation traps" in the lee of the Allardyce Range, where local topography allows a high degree of insolation with protection from wind. In such situations *Pseudocyphellaria freycinetii*, and to a lesser extent *Ps. endochrysea*, tend to form a nearly continuous blanket over the substratum, being broken only by shoots of *Festuca contracta* (= *F. erecta*) growing between individual thalli. In view of the high degree of cover given by the two species of *Pseudocyphellaria*, associates are rare although fruticose species such as *Cladonia gracilis* are occasionally present where the growth of the foliose thalli is more open.

Relatively extensive stands of this community were noted at Dartmouth Point (Cumberland East Bay), near Will Point (Royal Bay) and at Rogged Bay on the south-west coast. Despite its relatively wide distribution on South Georgia, this community is very local in its development.

VI. DISTRIBUTION AND ORIGINS OF MACROLICHENS

COLLECTIONS of macrolichens have been made from a total of 135 of the 5 km. grid squares (Fig. 2). Nearly all of the north-east coast, and most of the south-west coast has been surveyed, but few collections have been obtained from the relatively inaccessible mountainous interior. The north-east coast has received the most attention as regards taxonomic collections and ecological observations, since this area represents the largest ice-free area on South Georgia (Fig. 3). Despite the large number of grid squares surveyed, it is not possible at present, due to unevenness in collecting, to designate any which have received a reasonable primary survey for macrolichens. Although many squares have records of over 20 species, several have only one species listed and very few are known to have more than 30 macrolichens. Although most of South Georgia is considered to be too inadequately surveyed to reveal detailed distribution patterns for each species, it is believed that the main components of the macrolichen flora have now been established and that the provisional distribution categories discussed below have some validity.

1. *Distribution patterns within South Georgia*

At present five distribution categories are recognized for the island's macrolichens, three of which appear to be distinct while the other two comprise either introduced species which have not yet managed to establish themselves in natural habitats in competition with native species or species which are known from too few collections to reveal recognizable patterns. Of the 64 macrolichen species recorded, the majority fall into the ubiquitous element, the numbers in each category being as follows:

	Number of species	*Percentage of total*
Ubiquitous	29	46
Northern element	6	9
Southern element	4	6
Introduced	2	3
Uncertain distribution	23	36

a. *Ubiquitous element.* The species in this, the largest, category are to be found throughout the island, and have been recorded from numerous localities on the north-east and south-west coasts. A number of the species have a relatively broad ecological amplitude, such as *Hypogymnia lugubris*, *Stereocaulon glabrum* and several species of *Cladonia*, and so appear in a variety of habitats. Other species are restricted in their choice of habitat, such as *Leptogium menziesii* which is found only in wet *Tortula robusta* turf and other hydrophilous habitats.

The species in this element are:

Cetraria islandica
Cladonia balfourii
C. bellidiflora
C. carneola
C. coccifera
C. furcata
C. gracilis
C. phyllophora
C. pyxidata
C. rangiferina
C. squamosa
Cystocoleus niger
Hypogymnia lugubris
Leptogium menziesii
Mastodia tesselata
Pannaria hookeri
Peltigera canina
P. rufescens
Pseudocyphellaria endochrysea
Ps. freycinetii
Psoroma cinnamomeum
Psoroma hypnorum
Sphaerophorus globosus
Stereocaulon alpinum
St. glabrum
St. ramulosum
Usnea antarctica
U. fasciata
Xanthoria elegans

b. *Northern element.* The species showing this pattern appear to be restricted to the northern extremity of South Georgia, i.e. to the north-west of a line drawn between Fortuna Bay and Holmestrand, but including Annenkov Island. Their main centre appears to be either Bird Island or the northern tip of the main island, with small populations occurring in scattered localities along both coasts. The reasons for their restriction to this part of South Georgia are unknown. Some, for example *Sticta gaudichaudii*, reach their southernmost known geographical distribution here, but others, for example both species of *Cornicularia*, are widely distributed in the maritime Antarctic, having been recorded as far south as lat. 65° S. (Lindsay, 1969*a*), and so their absence from apparently suitable localities in other areas of the island is puzzling.

The species having this distribution pattern are:

Cladia aggregata
Cornicularia aculeata
C. epiphorella
Peltigera horizontalis
Platismatia glauca
Sticta gaudichaudii

c. *Southern element.* These species are confined mainly to the southern part of the north-east coast, from Stromness Bay in the north to Drygalski Fjord in the south. Since peaks higher than 1,500 m. do not occur to the north or west of a line drawn between Stromness Bay and Holmestrand, their restriction to the lee of the Allardyce Range may result from the climatic amelioration caused by the föhn winds which are a feature of this area.

The species showing this distribution pattern are:

Parmelia gerlachei
Parmelia ushuaiensis
Peltigera spuria
Physcia caesia

d. *Introduced species.* A number of alien lichens have been introduced to South Georgia on timber used in the construction of whaling stations (Lindsay, 1973*a*). Only two are macrolichens and they occurred on the wooden deck of the hulk *Louise* at Grytviken (Cumberland East Bay). As a careful search was made for these species in natural habitats nearby, with no success, it appears that they have not managed to establish themselves in competition with other species.

The two species in this category are:

Parmelia sulcata
Umbilicaria polyphylla

e. *Species of uncertain distribution.* The distribution of most of the species in this category is considered to be inadequately known due to undercollecting and/or lack of survey and so, as yet, they exhibit no clearly recognizable pattern. Rather than describe a number of patterns for individual species, which will almost certainly be altered by future field work, it is thought preferable to place them all in this category.

Seven species are known only from single localities, most of which are certainly more widespread and have been overlooked, but others appear to be very localized. *Cladonia pycnoclada*, for example, is known only from an extensive area of fluvio-glacial outwash plain at Hestesletten (Cumberland East Bay), where it occurs in abundance, and was not seen at other localities with similar environmental and geomorphological characteristics. Similarly, *C. mitis* has been recorded from only one locality in Stromness Bay. It was not seen by the author during his visit to this area, and may have been eliminated by reindeer grazing or trampling, as has *C. rangiferina* at various sites in the Royal Bay area (Lindsay, 1973*b*). Other species, such as *Parmelia saxatilis*, which are known from only a few scattered localities, may belong to the ubiquitous element since the author strongly suspects that they will be found in other localities and thus exhibit a more distinct distribution pattern. *Alectoria chalybeiformis* is an example of a species with widely separated localities towards the extremities of the island and which could be designated as bi-centric in the South Georgian context but further field work is necessary to be certain of classifying it correctly.

The species placed in this category are:

Alectoria chalybeiformis
A. minuscula
A. pubescens
Cladonia mitis
C. pleurota
C. pycnoclada
Dermatocarpon intestiniforme
Himantormia lugubris
Leptogium puberulum
Massalongia carnosa
Menegazzia sanguinascens
Parmelia saxatilis
Parmeliella cronia
Peltigera zahlbruckneri
Physcia cf. *wainioi*
Psoroma ciliatum
Ramalina terebrata
Sphaerophorus melanocarpus
Stereocaulon cf. *rivulorum*
Umbilicaria antarctica
Usnea aurantiacoatra
U. igniaria
Xanthoria candelaria

2. *Dispersal mechanisms of macrolichens*

Despite the production of apothecia by many macrolichens, the formation of viable ascospores on South Georgia appears to be a comparatively rare event. For example, *Pseudocyphellaria freycinetii* was found to produce apothecia at a number of localities but, although a number of these were sectioned, no ascospores or asci were found. This situation was also noted in many other macrolichens which have a wide distribution around the island. Other species, such as *Massalongia carnosa* and *Parmeliella cronia*, with a restricted distribution appear to be more or less consistently successful in the production of apparently mature ascospores.

Thus, for many of the ecologically prominent macrolichens, dispersal is mainly or entirely by vegetative methods, either by soredia or thallus fragmentation. The regular production of the various types of diaspore by the 62 macrolichen species (excluding the two introduced species) is as follows:

	Number of species (estimated)
Viable ascospores	11
Soredia	10
Isidia	5
Thallus fragmentation	37

The number of species estimated to produce regularly viable ascospores is lower than the total number which may produce such spores at one time or another, and is a subjective estimate based on the production of mature ascospores in a range of typical habitats, performance in exceptionally favourable situations being discounted. It will be seen that 37, or 59 per cent, appear to rely mainly on thallus fragmentation for dispersal, although some occasionally produce ascospores. *Alectoria minuscula* and *A. pubescens* may

be taken as examples of species which rely solely on thallus fragmentation for dispersal, neither species being known to form apothecia in the Antarctic or sub-Antarctic (Lamb, 1964), while species of *Usnea* exemplify those that rely mainly on thallus fragmentation but occasionally form ascospores. In *U. aurantiacoatra* and *U. fasciata* apothecia are produced frequently and South Georgian populations consistently have more plants bearing apothecia than sterile individuals. However, very few of the apothecia produced actually develop asci and ascospores, although paraphyses, epithecium, hypothecium and other structures may be formed. Many other ecologically prominent species, such as *Pseudocyphellaria endochrysea*, *Ps. freycinetii* and *Stereocaulon glabrum*, frequently bear apothecia but ascospore formation again appears to be rare or non-existent.

Regarding the production of asexual diaspores, only ten species produce soredia and five species develop isidia which may be considered vegetative propagules. Most of the sorediate species, such as *Cladonia balfourii*, *C. carneola*, *Physcia caesia* and *Usnea antarctica*, are widespread on South Georgia but the five isidiate species, *Cornicularia epiphorella*, *Massalongia carnosa*, *Parmelia saxatilis*, *P. ushuaiensis* and *Platismatia glauca*, are restricted in their distribution. Although one of the three specimens of *Massalongia carnosa* bears apparently mature ascospores, the other four isidiate species are not known to produce apothecia on South Georgia and so must rely on fragmentation, in this case the detachment of isidia from the thallus. Their restricted distribution, to localities at or near the northern extremity of the island or the Cumberland Bay area, may suggest that dispersal by isidia is ineffective, but their distribution appears to be governed by climatic factors rather than limiting dispersal mechanisms.

Experiments conducted in Birmingham by the author on the growth of soredia and fragments of thalli of *Cladonia balfourii*, *C. pycnoclada* and *C. rangiferina* from South Georgia indicate that growth of both types of diaspores is rapid on peaty substrata. In the case of *C. balfourii*, small scyphi and numerous squamules were produced within 9 months from soredia. Fragments of both *C. pycnoclada* and *C. rangiferina*, each less than 0·8 mm. long, produced branches up to 1·2 mm. in length in 5 months. These results confirm that local dispersal by diaspores on South Georgia could be efficient, but problems such as establishment on suitable substrata and competition from mosses and phanerogams could prevent the development of mature plants.

3. *Origins of the macrolichen flora*

Clapperton (1971) has shown that at one time, presumably at the height of the Pleistocene glaciation, South Georgia was totally or almost totally covered by an ice cap which may have spread as far as 15 km. beyond the present coastline. Subsequent glaciations were less severe, the advances of recent times rarely extending farther than 3 km. beyond the present glacier snouts. At the height of the Pleistocene glaciation, it thus appears that South Georgia would have experienced an ice cover with nunataks and climatic conditions roughly comparable to those of coastal areas of continental Antarctica today. It is thought likely that such nunataks could have supported a flora similar to the nunatak flora of present-day Antarctica, that is, an entirely cryptogamic flora composed of a small number of species. With the retreat of the ice, extensive areas of land were exposed, allowing a large target area for wind-borne diaspores and this period may be assumed to be the time when most of the South Georgian flora arrived and became established. Following the retreat of the massive Pleistocene ice carapace and before the onset of the relatively minor Recent glacial advances, the climate of South Georgia was warmer than at present (Clapperton, 1971). Other sub-Antarctic islands appear to have experienced similar climatic phases, e.g. Marion Island (Schalke and van Zinderen Bakker, 1967). It is thought probable by the author that the slight climatic deterioration that induced the Recent advance, dated at *c.* 6,000 yr. B.P. by Clapperton (1971), was not great enough to cause extinctions in the flora, but it may have acted as a minor barrier to further immigration. But, in view of the total lack of a lichen fossil record, it is not possible to speculate upon the previous composition of South Georgian lichen floras.

Probable survivors of the Pleistocene glaciations are considered to be those species which also occur in Antarctica today, e.g. *Alectoria minuscula*, *Himantormia lugubris*, *Umbilicaria antarctica*, *Usnea antarctica* and *U. fasciata*. Of *H. lugubris*, Lamb (1964, p. 22) remarked "in general its ecology, like that of *Usnea* (*Neuropogon*) species, is such as to convey the impression of a species probably capable of having survived maximum historical glaciation of ice-free rock faces and nunataks". Its occurrence on South Georgia, on a nunatak at 700 m., tends to confirm this impression. However, the number of lichen species that may have survived on nunataks during the Pleistocene glaciation is probably very small. Other species

undoubtedly arrived after the retreat of the Pleistocene ice cap to within the present coastline. For example, coastal rocks were uncovered which could be colonized by species of microlichens, such as *Verrucaria maura*, *V. tesselatula*, and other maritime or halophilous species that could not possibly have survived on, or even begun to colonize, ice-bound nunataks. Further retreat of the ice and exposure of extensive areas of coastal lowland, with contemporaneous warming of the climate, probably allowed a relatively rapid influx of immigrant species. Certainly the majority of the South Georgian macrolichen flora is likely to have become established during this warmer period. The effect of recent glacial advances on the South Georgian lichen flora was probably minimal, since the relatively minor advance of the glaciers probably did not result in any extinctions. The number of species that may have arrived during historical times is unknown, and a matter of speculation, though some have been introduced by Man at various times during the past century (Lindsay, 1973*a*).

The views of Dodge (1965*b*) that most areas in the Antarctic and sub-Antarctic support their own peculiar, endemic lichen floras, are apparently not applicable to the macrolichens of South Georgia, where there are no endemic genera or species, although incipient speciation in the formation of chemical strains has occurred in several species. Dodge (1970) favoured a very narrow species concept and as a result has described several new, and in his view, endemic species from South Georgia but investigation of the types of a number of these by the author has shown them to be nothing more than local variants of cosmopolitan species. Indeed, if the world distribution of each species occurring on South Georgia is considered, it is possible to group the 64 macrolichens into the following seven phytogeographical categories:

	Number of species	*Percentage of total*
Bi-polar	23	35
Cosmopolitan	16	25
Fuegian	9	16
Sub-Antarctic circum-polar	7	10
Antarctic	5	8
Uncertain distribution	2	3
Introduced	2	3

Species of the bi-polar and cosmopolitan elements, e.g. *Dermatocarpon intestiniforme* and *Xanthoria elegans* respectively, and all the species of the Antarctic element are undoubtedly survivors of the pre-glacial Tertiary flora. Species included in the other phytogeographical elements do not appear to have the ability to withstand continental Antarctic climates, and are thought to have arrived on South Georgia when the climate became more oceanic following the melting of the Pleistocene ice cap.

a. *Bi-polar element.* The large percentage of species referred to this category emphasizes the clear affinities of the South Georgian flora with that of the Arctic regions, species assigned here being restricted to the cool temperate and polar regions of both hemispheres, in some cases with connecting populations scattered along the Andean mountain chain. Within the Southern Hemisphere many have at the same time a distribution similar to those in the sub-Antarctic circum-polar element, i.e. they are centred on Fuegia and New Zealand, with scattered occurrences on the sub-Antarctic islands. Many have penetrated into the maritime Antarctic, e.g. *Dermatocarpon intestiniforme*. The species referred to this category are:

Alectoria chalybeiformis
A. minuscula
A. pubescens
Cetraria islandica
Cladonia balfourii
C. carneola
C. coccifera
C. phyllophora
C. rangiferina
Cystocoleus niger
Dermatocarpon intestiniforme
Hypogymnia lugubris
Massalongia carnosa
Mastodia tesselata
Pannaria hookeri
Peltigera horizontalis
P. rufescens
P. spuria
Physcia cf. *wainioi*
Platismatia glauca
Psoroma ciliatum
Sphaerophorus melanocarpus
Stereocaulon cf. *rivulorum*

b. *Cosmopolitan element.* The species in this category have been recorded from nearly every continent and appear to be widespread on some of the sub-Antarctic islands, while most have penetrated southward into the maritime Antarctic. The species referred to this category are:

Cladonia bellidiflora
C. furcata
C. gracilis
C. mitis
C. pleurota
C. pyxidata
C. squamosa
Cornicularia aculeata
Parmelia saxatilis
Peltigera canina
Physcia caesia
Psoroma hypnorum
Sphaerophorus globosus
Stereocaulon alpinum
Xanthoria candelaria
X. elegans

c. *Fuegian element.* These species are characterized by a distribution centred on Tierra del Fuego and Andean Patagonia, with northern outliers along the Andean mountain chain and southern outliers in the maritime Antarctic. Species such as *Parmelia gerlachei*, which may possibly have a wide distribution in the region of the Antarctic Peninsula (Lindsay, 1973*c*), are considered as part of this rather than the Antarctic element, in view of their ecology. The author considers that species such as *P. gerlachei*, *Ramalina terebrata* and *Parmelia ushuaiensis*, although locally abundant in certain areas of the maritime Antarctic, were not capable of surviving the Pleistocene glaciations, and are thus relatively recent immigrants. The origins of such taxa are apparently in the Fuegian region, not in Antarctica as is the case with *Himantormia lugubris.*

The species listed in this category are:

Cladonia pycnoclada
Cornicularia epiphorella
Parmelia gerlachei
P. ushuaiensis
Psoroma cinnamomeum
Ramalina terebrata
Stereocaulon glabrum
Sticta gaudichaudii
Usnea igniaria

d. *Sub-Antarctic circum-polar element.* Species in this group have two main distribution centres, Fuegia and New Zealand, with scattered occurrences on the sub-Antarctic islands. This type of distribution pattern may have resulted from the northward migration of species caused by the development of the Pleistocene glaciations of Antarctica, or by rapid colonization after the retreat of the ice. The low percentage of species referred to this category is somewhat misleading since, as noted previously, many bi-polar and cosmopolitan species have a similar distribution in the Southern Hemisphere.

The species referred to this element are:

Cladia aggregata
Leptogium menziesii
Menegazzia sanguinascens
Pseudocyphellaria endochrysea
Ps. freycinetii
Stereocaulon ramulosum
Usnea aurantiacoatra

e. *Antarctic element.* These species have their centre of distribution, and presumed origin, in Antarctica with their northern limit being either South Georgia or Patagonia. Although *Himantormia lugubris* was previously considered to be endemic to the maritime Antarctic region and to have no close relatives (Lamb, 1964), Imshaug (1969) recently discovered another species of *Himantormia* in the Falkland Islands and suggested that these islands may have been the origin of the Antarctic species. As mentioned previously, the species referred to here were apparently capable of surviving the maximum Pleistocene glaciation, but they appear to have difficulty competing with other species in less harsh conditions farther north.

The Antarctic species in the South Georgian lichen flora are:

Himantormia lugubris
Leptogium puberulum
Umbilicaria antarctica
Usnea antarctica
U. fasciata

f. *Species of uncertain distribution.* This category has been set aside for two species, *Parmeliella cronia* and *Peltigera zahlbruckneri*, which appear to have an even less completely known world distribution than most of the South Georgian lichens. *Peltigera zahlbruckneri* is known from Fuegia, South Georgia, central Africa and the Himalayas (Lindsay, 1971*b*), whereas *Parmeliella cronia* has been recorded from North America, tropical and temperate South America and New Zealand (Martin, 1966).

g. *Introduced species.* The two introduced macrolichens, *Parmelia sulcata* and *Umbilicaria polyphylla*, both appear to have a cosmopolitan distribution and may be expected to become fully naturalized in time. Their immigration to South Georgia has been facilitated by Man, but as yet neither has spread into the native lichen vegetation.

VII. ACKNOWLEDGEMENTS

I WISH to thank all those who helped with the collection of material for this report; and the Masters, Officers and Crews of R.R.S. *John Biscoe* and R.R.S. *Bransfield* for their assistance with field work during the 1971–72 summer. Thanks are also due to the Keepers and Curators of the herbaria at the British Museum (Nat. Hist.); Staatsinstitut für allgemeine Botanik und Botanische Garten, Hamburg; Swedish Museum of Natural History, Stockholm, and Museum of the Royal Norwegian Society for Science and Letters, Trondheim, for the loan of valuable material. Dr. D. L. Hawksworth of the Commonwealth Mycological Institute, Mr. P. W. James of the British Museum (Nat. Hist.), Dr. P. M. Jørgensen of the University of Bergen, Dr. I. M. Lamb, formerly of the Farlow Herbarium and Library, Cambridge, Massachusetts, and Dr. G. A. Llano of the National Science Foundation, Washington, D.C., all kindly helped me with the identification of material of various genera, while particular thanks are due to Mr. P. W. James, who placed his knowledge of South American lichens at my disposal.

The untiring efforts of Dr. S. W. Greene, who provided valuable comments on the manuscript, have ensured its appearance in print. Mrs. D. M. Greene prepared details of the specimens and field records examined which are listed in Appendix A, and Dr. R. I. L. Smith gave valuable criticism of the section on lichen-rich communities. Professor J. G. Hawkes, Mason Professor of Botany, University of Birmingham, provided facilities in the Department of Botany. Miss A. J. Cox prepared the photographs for the plates and Miss M. Parker typed the manuscript. To all these people I am extremely grateful.

VIII. REFERENCES

ADIE, R. J. 1964. Geological history. (*In* PRIESTLEY, R. E., ADIE, R. J. *and* G. DE Q. ROBIN, *ed. Antartcic research.* London, Butterworth & Co. (Publishers) Ltd., 118–62.)

AHMADJIAN, V. S. 1967. *The lichen symbiosis.* Waltham, Massachusetts, Blaisdell Publishing Co.

AHTI, T. 1959. Studies on the caribou lichen stands of Newfoundland. *Suomal. eläin- ja kasvit. Seur. van. kasvit. Julk.*, **30,** No. 4, 44 pp.

————. 1961. Taxonomic studies on reindeer lichens (*Cladonia* subgenus *Cladina*). *Suomal. eläin- ja kasvit. Seur. van. kasvit. Julk.*, **32,** No. 1, 160 pp.

ALLISON, J. S. *and* R. I. L. SMITH. 1973. The vegetation of Elephant Island, South Shetland Islands. *British Antarctic Survey Bulletin*, Nos. 33 and 34, 185–212.

ASAHINA, Y. 1967. Lichens collected in Tierra del Fuego by Yoshida, member of the scientific expedition to Patagonia, Hokkaido University, 1966. *Miscnea bryol. lichen., Nichinan*, **4,** No. 6, 89–94.

BITTER, G. 1901. Zur Morphologie und Systematik von *Parmelia* Untergattung *Hypogymnia. Hedwigia*, Bd. 43, 171–274.

CLAPPERTON, C. M. 1971. Geomorphology of the Stromness Bay–Cumberland Bay area of South Georgia. *British Antarctic Survey Scientific Reports*, No. 70, 25 pp.

CROMBIE, J. M. 1877. Revision of the Kerguelen lichens collected by Dr. Hooker. *J. Bot., Lond.*, **15,** 101–07.

CULBERSON, W. L. *and* C. F. CULBERSON. 1968. The lichen genera *Cetrelia* and *Platismatia. Contr. U.S. natn. Herb.*, **36,** No. 7, 449–558.

DAHL, E. *and* H. KROG. 1973. *Macrolichens of Denmark, Finland, Norway and Sweden.* Oslo, Bergen, Tromsø, Scandinavian University Books.

DARBISHIRE, O. V. 1912. The lichens of the Swedish Antarctic Expedition. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 4, Lief. 11, 74 pp.

————. 1923. Lichens. *Nat. Hist. Rep. Br. Antarct. Terra Nova Exped.*, Botany, **1,** No. 3, 29–76.

DES ABBAYES, H. 1962. Lichens foliacés et fruticuleux d'Afrique centrale récoltés par l'Expédition Suisse du Virunga en 1954–55. *Revue bryol. lichen.*, N.S., **31,** Fasc. 3–4, 239–50.

DODGE, C. W. 1948. Lichens and lichen parasites. *Rep. B.A.N.Z. antarct. Res. Exped.*, Ser. B, **7**, 276 pp.
———. 1965*a*. Lichenological notes on the flora of the Antarctic continent and the sub-Antarctic islands: VI. New taxa from the Antarctic continent and adjacent islands. *Trans. Am. microsc. Soc.*, **84**, Pt. 4, 507–29.
———. 1965*b*. Lichens. (*In* MIEGHAM, J. VAN *and* P. VAN OYE, *ed.* Biogeography and ecology in Antarctica. *Monographiae Biol.*, **15**, 194–200.)
———. 1966. Líquenes de las Islas Shetland del Sur y de la Tierra O'Higgins (Península Antártica) recolectados por Gerhard Follmann. *Publ. Inst. antárt. chileno*, No. 6, 12 pp.
———. 1968. Lichenological notes on the flora of the Antarctic continent and the subantarctic islands. VII and VIII. *Nova Hedwigia*, **15**, Ht. 2–4, 285–332.
———. 1970. Lichenological notes on the flora of the Antarctic continent and the subantarctic islands. IX–XI. *Nova Hedwigia*, **19**, Ht. 1–4, 439–502.
———. 1973. *Lichen flora of the Antarctic continent and adjacent islands.* Canaan, New Hampshire, Phoenix Publishing.
———. *and* G. E. BAKER. 1938. The Second Byrd Antarctic Expedition—Botany. II. Lichens and lichen parasites. *Ann. Mo. bot. Gdn*, **25**, No. 2, 515–718.
———. *and* V. VARESCHI. 1956. Resultados líquenologicos de excursiones efectuados en Venezuela: 1. *Acta biol. venez.*, **2**, No. 1, 1–12.
DOIDGE, E. M. 1950. The South African fungi and lichens to the end of 1945. *Bothalia*, **5**, 1–1094.
DUNCAN, U. K. 1970. *Introduction to British lichens.* Arbroath, T. Buncle.
DU RIETZ, G. E. 1924. Flechtensystematische Studien. III. *Bot. Notiser*, 1924, 51–68.
———. 1926. Zur Flechtenflora von Südgeorgien. *Nytt Mag. Naturvid.*, **64**, Ht. 2, 229–33.
FILSON, R. B. 1966. The lichens and mosses of Mac.Robertson Land. *A.N.A.R.E. Rep.*, Ser. B(2), No. 82, 169 pp.
FOLLMANN, G. *and* J. REDON. 1972. Beobachtungen zur Verbreitung chilenischer Flechten. IV. *Cystocoleus niger* (Huds.) Hariot. *Philippia*, **1**, Ht. 3, 129–31.
FREY, E. *and* I. M. LAMB. 1939. A new species of *Umbilicaria* from the Antarctic. *Trans. Brit. Mycol. Soc.*, **22**, Pt. 3–4, 270–73.
GALLØE, O. 1954. *Natural history of the Danish lichens. Original investigations based on new principles. Part IX.* Copenhagen, Ejnar Munksgaard.
GRASSI, M. M. 1950. Contribución al catalogo líquenes argentinos. I. *Lilloa*, **24**, 5–294.
GREENE, S. W. 1964. The vascular flora of South Georgia. *British Antarctic Survey Scientific Reports*, No. 45, 58 pp.
HALE, M. E. 1961. *Lichen handbook. A guide to the lichens of the north-eastern United States.* Washington, D. C., Smithsonian Institution Press.
———. 1967. *The biology of lichens.* London, Edward Arnold.
HENSSEN, A. 1963. The North American species of *Massalongia* and generic relationships. *Can. J. Bot.*, **41**, No. 10, 1331–46.
———. 1970. Die Apothecienentwicklung bei *Umbilicaria* Hoffm. emend. Frey. *Ber. dt. bot. Ges.*, N.F., 1970, Nr. 4, 103–26.
HUE, A. M. 1915. *Lichens.* Paris, Masson et Cie. [Deuxième Expédition Antarctique Française (1908–1910), Sciences naturelles: documents scientifiques, 1–202.]
IMSHAUG, H. A. 1957. Alpine lichens of western United States and adjacent Canada. *Bryologist*, **60**, No. 2, 177–272.
———. 1969. Expedition to Falkland Islands, 1968. *Antarct. Jnl U.S.*, **4**, No. 5, 247–48.
KASHIWADANI, H. 1970. Lichens from the Prince Olav Coast, Antarctica. *JARE Sci. Rep.*, Ser. E, No. 30, 1–21.
KRISTINSSON, H. 1972. Additions to the lichen flora of Iceland I. *Acta Bot. Isl.*, **1**, 43–50.
KROG, H. 1968. The macrolichens of Alaska. *Skr. norsk Polarinst.*, No. 144, 180 pp.
LAMB, I. M. 1939. A review of the genus *Neuropogon* (Nees et Flot.) Nyl., with special reference to the Antarctic species. *J. Linn. Soc.*, Botany, **52**, No. 342, 199–237.
———. 1948*a*. Antarctic pyrenocarp lichens. '*Discovery*' *Rep.*, **25**, 1–30.
———. 1948*b*. Further data on the genus *Neuropogon*. *Lilloa*, **14**, 139–68.
———. 1948*c*. New, rare or interesting lichens from the Southern Hemisphere. I. *Lilloa*, **14**, 203–51.
———. 1955. New lichens from northern Patagonia, with notes on related species. *Farlowia*, **4**, Pt. 4, 423–71.
———. 1958. La vegetación líquenica de los Parques Nacionales Patagónicos. *An. Parq. nac., B. Aires*, **7**, 188 pp.
———. 1964. Antarctic lichens: I. The genera *Usnea, Ramalina, Himantormia, Alectoria, Cornicularia. British Antarctic Survey Scientific Reports*, No. 38, 34 pp.
———. 1968. Antarctic lichens: II. The genera *Buellia* and *Rinodina.* With an ontogenetic section by A. Henssen. *British Antarctic Survey Scientific Reports*, No. 61, 129 pp.
LANJOUW, J. *and* F. A. STAFLEU. 1964. Index herbariorum. Pt. 1. The herbaria of the world. 5th edition. *Regnum veg.*, **31**, 1–251.
LAUNDON, J. R. 1958. Lichens new to the British flora. I. *Lichenologist*, **1**, Pt. 1, 31–38.
LINDAHL, P. O. 1953. The taxonomy and ecology of some *Peltigera* species, *P. canina* (L.) Willd., *P. rufescens* (Weis.) Humb., *P. praetextata* (Flk.) Vain. *Svensk bot. Tidsskr.*, **47**, Ht. 1, 94–106.
LINDSAY, D. C. 1969*a*. Further data on Antarctic Usneaceae. *British Antarctic Survey Bulletin*, No. 20, 33–40.
———. 1969*b*. New records for Antarctic Umbilicariaceae. *British Antarctic Survey Bulletin*, No. 21, 61–69.
———. 1971*a*. Notes on Antarctic lichens: I. New records for *Buellia* and *Rinodina. British Antarctic Survey Bulletin*, No. 24, 11–19.
———. 1971*b*. Notes on Antarctic lichens: II. The genus *Peltigera. British Antarctic Survey Bulletin*, No. 24, 115–18.
———. 1971*c*. Notes on Antarctic lichens: III. *Cystocoleus niger* (Huds.) Hariot. *British Antarctic Survey Bulletin*, No. 24, 119–20.

———. 1971*d*. Vegetation of the South Shetland Islands. *British Antarctic Survey Bulletin*, No. 25, 59–83.
———. 1971*e*. Notes on Antarctic lichens: V. The genus *Ochrolechia* Massal. *British Antarctic Survey Bulletin*, No. 26, 77–79.
———. 1972*a*. Notes on Antarctic lichens: VI. The genus *Sphaerophorus* Pers. *British Antarctic Survey Bulletin*, No. 28, 43–48.
———. 1972*b*. Lichens from Vestfjella, Dronning Maud Land. *Meddr norsk Polarinst.*, No. 101, 21 pp.
———. 1972*c*. Lichens new to South Georgia. *British Antarctic Survey Bulletin*, No. 31, 41–43.
———. 1973*a*. Probable introductions of lichens to South Georgia. *British Antarctic Survey Bulletin*, Nos. 33 and 34, 169–72.
———. 1973*b*. Effects of reindeer on plant communities in the Royal Bay area of South Georgia. *British Antarctic Survey Bulletin*, No. 35, 101–09.
———. 1973*c*. Notes on Antarctic lichens: VII. The genera *Cetraria* Hoffm., *Hypogymnia* (Nyl.) Nyl., *Menegazzia* Massal., *Parmelia* Ach. and *Platismatia* Culb. et Culb. *British Antarctic Survey Bulletin*, No. 36, 105–14.
———. 1973*d*. South Georgian microlichens: I. The genera *Buellia* and *Rinodina*. *British Antarctic Survey Bulletin*, No. 37, 81–89.
———. 1974. New taxa and new records of lichens from South Georgia. *British Antarctic Survey Bulletin*, No. 39.
LLANO, G. A. 1950. *A monograph of the lichen family Umbilicariaceae in the Western Hemisphere*. Washington, D.C., Office of Naval Research. [Navexos P-831, 281 pp.]
MAGNUSSON, A. H. 1940. Lichens from central Asia. (*In Reports from the scientific expedition to the north-western provinces of China under the leadership of Dr. Sven Hedin. XI. Botany*, **1.** Stockholm, Tryckeri Aktiebolgeat Thule. [The Sino-Swedish Expedition, Publication 13.]
MALME, G. O. A. 1925. Die Pannariazeen des regnellschen Herbars. *Ark. Bot.*, **20A,** No. 3, 1–23.
MARK, A. F. *and* L. C. BLISS. 1970. The high-alpine vegetation of central Otago, New Zealand. *N.Z. J. Bot.*, **8,** No. 4, 381–451.
MARTIN, W. 1958. Notes on *Cladonia* subgenus *Clathrina*. *Bryologist*, **61,** No. 1, 78–81.
———. 1965. The lichen genus *Cladia*. *Trans. R. Soc. N.Z.*, Botany, **3,** No. 2, 7–12.
———. 1966. Census catalogue of the lichen flora of New Zealand. *Trans. R. Soc. N.Z.*, Botany, **3,** No. 8, 139–59.
———. *and* J. CHILD. 1972. *Lichens of New Zealand*. Wellington, A. H. and A. W. Reed.
MCVEAN, D. N. 1962. *Cladonia elongata* (Jacq.) Hoffm. in the Cairngorms. *Lichenologist*, **2,** Pt. 1, 94–96.
MOORE, B. J. 1968. The macrolichen flora of Florida. *Bryologist*, **71,** No. 3, 161–266.
MÜLLER [ARGOVIENSIS], J. 1886. Lichenologische Beiträge. XXIII. *Flora, Regensburg*, **69,** Ht. 8, 124–28.
———. 1888*a*. Lichenologische Beiträge. XXVIII. *Flora, Regensburg*, **71,** Ht. 9, 129–42.
———. 1888*b*. Lichenes. (*In* HARIOT, P., *ed. Mission Scientifique du Cap Horn 1882–83*, **5,** Botanique, 141–72.)
———. 1890. Lichens. (*In* NEUMAYER, G. *Die Internationale Polarforschung 1882–83. Die Deutschen Expedition und ihre Ergebnisse*. Berlin, A. Asher and Co., Bd. 2, 322–27.)
MURRAY, J. 1960*a*. Studies of New Zealand lichens. I. The Coniocarpineae. *Trans. R. Soc. N.Z.*, **88,** Pt. 2, 177–95.
———. 1960*b*. Studies of New Zealand lichens. II. The Teloschistaceae. *Trans. R. Soc. N.Z.*, **88,** Pt. 2, 197–210.
———. 1960*c*. Studies of New Zealand lichens. III. The family Peltigeraceae. *Trans. R. Soc. N.Z.*, **88,** Pt. 3, 381–99.
———. 1963. Lichens from Cape Hallett area, Antarctica. *Trans. R. Soc. N.Z.*, Botany, **2,** No. 5, 59–72.
NYLANDER, W. 1876. Lichens rapportés de l'Île Campbell par M. Filhol. *C. r. hebd. Séanc. Acad. Sci., Paris*, **83,** No. 1, 87–90.
OSORIO, H. S. 1972. Contribution to the lichen flora of Uruguay. VII. A preliminary catalogue. *Comun. bot. Mus. Hist. nat. Montevideo*, **4,** No. 56, 1–46.
PEPPER, J. 1954. *The meteorology of the Falkland Islands and Dependencies, 1944–1950*. London, Falkland Islands and Dependencies Meteorological Service.
POELT, J. 1969. *Bestimmungsschlüssel europäischer Flechten*. Lehre, J. Cramer.
RÄSÄNEN, V. 1932. Zur Kenntnis der Flechtenflora Feuerlandes sowie der Prov. Magallanes, Prov. der Chilöe und Prov. de Ñuble in Chile. *Suomal. eläin- ja kasvit. Seur. van. kasvit. Julk.*, **2,** No. 1, 1–68.
RAYNER, R. W. 1970. *A mycological colour chart*. Kew, Commonwealth Mycological Institute and British Mycological Society.
REDON, J. 1969. Neuva asociacion de líquenes muscicolas de la Antártica Occidental, con *Sphaerophorus tener* Laur. como especie caracterizante. *Bol. Inst. antárt. chileno*, No. 4, 5–11.
RICHARDS, P. A. *and* W. L. N. TICKELL. 1968. Comparison between the weather at Bird Island and King Edward Point, South Georgia. *British Antarctic Survey Bulletin*, No. 15, 63–69.
ROSS, J. C. 1847. *A voyage of discovery and research in the southern and Antarctic regions, during the years 1839–43*. 2 vols. London, John Murray. [Facsimile reprint: Newton Abbot, David & Charles Reprints, 1969.]
SANTESSON, R. 1942. The South American Menegazziae. *Ark. Bot.*, **30A,** No. 11, 1–35.
SCHALKE, H. J. W. G. *and* E. M. VAN ZINDEREN BAKKER. 1967. A preliminary report on palynological research on Marion Island (sub-Antarctic). *S. Afr. J. Sci.*, **63,** No. 6, 254–59.
SIERK, H. 1964. The genus *Leptogium* in North America north of Mexico. *Bryologist*, **67,** No. 2, 245–317.
SKIDMORE, M. J. 1973. The geology of South Georgia: III. Prince Olav Harbour and Stromness Bay areas. *British Antarctic Survey Scientific Reports*, No. 73, 50 pp.
SKOTTSBERG, C. J. F. 1912. The vegetation in South Georgia. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 4, Lief. 12, 36 pp.
SMITH, R. I. L. 1971. An outline of the Antarctic programme of the Bipolar Botanical Project. (*In* HEAL, O. W., *ed. Working meeting on analysis of ecosystems, Kevo, Finland, September 1970*. London, International Biological Programme, Tundra Biome Steering Committee and Atlantic Richfield Company, 51–70.)

————. 1972. Vegetation of the South Orkney Islands with particular reference to Signy Island. *British Antarctic Survey Scientific Reports*, No. 68, 124 pp.
————. *and* R. W. M. CORNER. 1973. Vegetation of the Arthur Harbour–Argentine Islands region of the Antarctic Peninsula. *British Antarctic Survey Bulletin*, Nos. 33 and 34, 89–122.
SOUKUP, J. 1965. Lista de líquenes del Perú. *Biota*, **6**, No. 45, 28–45.
TAYLOR, C. J. 1967. The lichens of Ohio. Part I. Foliose lichens. *Biol. Notes Ohio biol. Surv.*, No. 3, 1–151.
————. 1968. The lichens of Ohio. Part II. Fruticose and cladoniform lichens. *Biol. Notes Ohio biol. Surv.*, No. 4, 153–227.
TAYLOR, N. 1914. Plants collected on the South Georgia Expedition. (*In* MURPHY, R. C. A report of the South Georgia Expedition. *Sci. Bull. Mus. Brooklyn Inst. Arts. Sci.*, **2**, No. 4, 41–102.)
THOMSON, J. W. 1963. The lichen genus *Physcia* in North America. *Nova Hedwigia, Beih.*, **7**, 212 pp.
————. 1968. *The lichen genus Cladonia in North America.* London, Oxford University Press.
TRENDALL, A. F. 1953. The geology of South Georgia: I. *Falkland Islands Dependencies Survey Scientific Reports*, No. 7, 26 pp.
————. 1959. The geology of South Georgia: II. *Falkland Islands Dependencies Survey Scientific Reports*, No. 19, 48 pp.
VAINIO, E. A. 1903. Lichens. *Résult. Voyage S.Y. Belgica*, **6**, Botanique, 46 pp.
WEBER, W. A. *and* C. M. WETMORE. 1972. Catalogue of the lichens of Australia exclusive of Tasmania. *Nova Hedwigia, Beih.*, **41**, 135 pp.
WETMORE, C. M. 1963. Catalogue of the lichens of Tasmania. *Revue bryol. lichen.*, N.S., **32**, Fasc. 1, 223–64.
ZAHLBRUCKNER, A. 1917. Botanische Ergebnisse der schwedischen Expedition nach Patagonien und dem Feuerlande 1907–09. VI. Die Flechten. *K. svenska VetenskAkad. Handl.*, **57**, No. 6, 1–62.

APPENDIX A

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

The references to herbaria cited after each specimen follow those recommended by Lanjouw and Stafleu (1964) except that AAS has been used for specimens in the British Antarctic Survey herbarium, at present housed in the Department of Botany, University of Birmingham. The six figures before the specimen numbers or field records refer to the 5 km. squares of the distribution maps, each being identified by its south-west corner with eastings being cited before northings.

Field records have been cited only for those squares from which no permanent specimens exist, their numbers indicating their file order in the data bank associated with the Survey's herbarium. The names of people providing field records have been given on p. 8.

Alectoria chalybeiformis (L.) Gray
035 145 R. Smith 1115 (AAS)
070 135 Field record 3865
175 070 Lindsay 3708 (AAS)

Alectoria minuscula (Nyl. ex Arnold) Degel.
125 115 R. Smith 1126 (AAS)
160 095 Field record 5127. 160 100 Lindsay 4037 (AAS)

Alectoria pubescens (L.) Howe jr.
125 115 R. Smith 1127 (AAS). 130 120 Lindsay 4323 (AAS)
155 095 Lindsay 4155 (AAS). 160 095 Field record 5128. 160 100 Lindsay 4039 (AAS, CHR, MEL)

Cetraria islandica (L.) Ach.
025 150 Field record 1504. 030 150 Lindsay 3031 (AAS). 030 155 Field record 4263. 035 145 Field record 1533. 040 150 Field record 1477. 040 155 Field record 1548. 045 145 Field record 1560. 045 150 Field record 1571
050 135 Field record 4115. 050 140 Field record 4135. 050 145 Field record 7271. 050 150 Field record 5042. 050 155 Lindsay 3834 (AAS). 055 135 Field record 4066. 055 145 Field record 3718. 055 150 Lindsay 3865 (AAS). 055 155 Field record 4936. 060 135 Field record 4004. 060 150 Field record 4226. 065 140 Field record 3740. 070 125 R. Smith 1534 (AAS). 070 130 Field record 3783. 070 135 Field record 3863
075 125 Field record 4169. 075 130 Field record 3968. 080 125 Greene 2721 (AAS, CHR, IAA, MEL). 090 100 Field record 6216. 090 140 Field record 7354. 095 095 Field record 6238. 095 145 Field record 1591
100 140 Field record 1478. 110 100 Field record 6273. 120 095 Field record 6300. 120 100 Field record 6315
125 120 Field record 1626. 125 125 Field record 1615. 130 095 Field record 7443. 130 110 Field record 4360. 130 115 Field record 6634. 130 120 Holdgate 462 (AAS, CHR, FH, IAA, MEL, PC, PRE), Lindsay 3145 (AAS), Lindsay 3249 (AAS, S), Lindsay 4313 (AAS), Longton 462 (AAS), J. Smith M219 (AAS, SGO). 130 125 Greene 1980 (AAS, TNS), Lindsay 3117 (AAS). 135 115 Lindsay 3435 (AAS, LE, US). 135 120 Field record 4304. 140 120 Field record 5195
155 095 Greene 2228 (AAS, S, SGO, TNS), Lindsay 4143 (AAS). 160 090 Lindsay 3539 (AAS, BM). 170 070 Field record 4776. 170 090 Field record 4428
175 070 Field record 4803

Cladia aggregata (Sw.) Nyl.
025 150 Field record 1502. 030 150 Lindsay 3033 (AAS), Lindsay 3035 (AAS, CHR). 030 155 Field record 4254. 035 145 Field record 6196. 035 150 Greene 1111 (AAS, MEL, PRE). 035 155 Field record 1481

050 135 Field record 4120. 050 150 Field record 5043. 050 155 Lindsay 3820 (AAS). 055 135 Field record 4079. 055 150 Lindsay 3863 (AAS). 055 155 Field record 4937. 060 135 Field record 4017. 070 125 Field record 3840. 070 130 Field record 3797. 070 135 Field record 3939. 070 150 Field record 5997
075 125 Field record 4182. 080 125 Greene 2725 (AAS, H, S, SGO). 080 135 Field record 3831. 090 100 BAS Misc. 113 (AAS)
105 140 Field record 1480

Inadequately localized
King Haakon Bay, leg. A.B. Dickinson, 15.x.1964, Longton 814 (AAS), Longton 817 (AAS)

Cladonia balfourii Cromb. f. *chlorophaeoides* (Vain.) Evans
030 155 Lindsay 3054 (AAS)
050 150 Lindsay 3737 (AAS), Lindsay 3814 (AAS). 050 155 Field record 4974. 055 135 Field record 4073. 055 150 Field record 5002. 055 155 Field record 4938. 060 135 Field record 4009. 065 140 Field record 3748. 070 125 Field record 3841. 070 130 Field record 3978. 070 135 Field record 3758. 070 150 Lindsay 3091 (AAS)
075 120 Field record 4094. 075 125 Field record 4188. 075 130 Field record 3731. 075 135 Field record 3902. 080 135 Field record 3833
100 100 Field record 6256. 100 140 Field record 1475. 110 140 Field record 7420. 110 145 Field record 7436. 115 130 Field record 4633. 115 135 Greene 1392 (AAS), Greene 3218 (AAS). 115 140 Lindsay 4352 (AAS), Lindsay 4354 (AAS). 120 135 Field record 4604. 120 140 Field record 5276
125 095 Field record 6329. 125 120 Field record 5241. 125 125 Field record 6643. 130 090 Field record 6358. 130 110 Field record 4361. 130 115 Field record 6635. 130 120 Greene 1509 (AAS), Greene 1873 (AAS), Lindsay 3158 (AAS), Lindsay 3165 (AAS, H), Lindsay 3173 (AAS), Lindsay 3250 (AAS), Lindsay 3251 (AAS), Lindsay 3357 (AAS), Lindsay 3359 (AAS, CHR), Longton 465 (AAS, SGO), J. Smith M203b (AAS), J. Smith M204 (AAS), Trøim 14 (TRH, as *C. pyxidata, C. chlorophaea*), Trøim 28 (TRH, as *C. pyxidata, C. chlorophaea*), Trøim 46 (TRH, as *C. pyxidata, C. chlorophaea*). 130 125 Greene 1975 (AAS), Greene 2042 (AAS), Lindsay 3120 (AAS, CHR), J. Smith M202b (AAS), Trøim 3 (TRH, as *C. pyxidata, C. chlorophaea*). 130 135 J. Smith M207 (AAS). 135 115 Lindsay 3447 (AAS). 135 120 Lindsay 3257 (AAS), Lindsay 3258 (AAS, LE), Lindsay 3263 (AAS), Lindsay 3264 (AAS), Lindsay 3269 (AAS, MEL). 140 070 Field record 6399. 140 105 Field record 4195. 140 110 Field record 4201. 140 115 Lindsay 4198 (AAS). 140 120 Greene 973 (AAS). 145 065 Field record 6419. 145 070 Field record 6438. 145 110 Field record 6590. 145 115 Field record 6595
155 055 Lindsay 4423 (AAS). 155 095 Field record 5144. 155 100 Field record 5049. 160 055 Lindsay 4456 (AAS), Lindsay 4461 (AAS). 160 060 Field record 4910. 160 095 Field record 5110. 160 100 Field record 5084. 165 055 Field record 7487. 165 075 Lindsay 3629 (AAS). 165 080 Lindsay 3648 (AAS). 165 085 Field record 4549. 165 090 Field record 4507. 170 065 Lindsay 3724 (AAS). 170 090 Field record 4777
175 065 Field record 4821. 175 070 Lindsay 3716 (AAS)

Inadequately localized
Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S, as *C. pyxidata, C. chlorophaea*); West Cumberland Bay, 15.xii.1931, Trøim 9 (S, as *C. pyxidata, C. chlorophaea*)

Cladonia bellidiflora (Ach.) Schaer. var. *austrogeorgica* D. C. Lindsay
020 150 Field record 6606
030 145 Field record 6611. 030 150 Lindsay 3025 (AAS). 030 155 Lindsay 3044 (AAS). 035 145 Field record 6613. 035 150 Greene 722 (AAS). 040 150 Field record 1473
050 135 R. Smith 1615 (AAS). 050 140 Field record 4143. 050 150 Lindsay 3738 (AAS). 050 155 Lindsay 3840 (AAS). 055 135 R. Smith 1598 (AAS). 055 140 Field record 4033. 055 145 Field record 3918. 055 150 Lindsay 3869 (AAS). 055 155 Field record 4939. 060 135 Field record 4000. 060 150 Field record 3807. 065 140 R. Smith 1556 (AAS, LE, MEL, PC). 070 130 Field record 3794. 070 135 R. Smith 1542 (AAS), R. Smith 1563 (AAS), R. Smith 1564 (AAS). 070 150 Lindsay 3086 (AAS)
075 120 Field record 4096. 075 125 Field record 4185. 075 130 Field record 3775. 075 135 Field record 3898. 075 145 Field record 5356. 080 130 Field record 4161. 080 140 Field record 3816. 090 100 BAS Misc. 112 (AAS). 090 120 Field record 7326. 090 125 Field record 7346. 090 145 Greene 1736 (AAS). 095 115 Field record 7362
110 110 Field record 7416. 110 140 Field record 7419. 110 145 Field record 7432. 115 100 Field record 6281. 115 130 Field record 4634. 115 135 Field record 4687. 115 140 Lindsay 4366 (AAS). 120 095 Field record 6299. 120 135 Field record 4605. 120 140 Field record 5277
125 095 Greene 2576 (AAS). 125 120 Field record 5242. 125 125 Field record 6644. 130 090 Field record 6359. 130 095 Field record 7439. 130 110 Field record 4362. 130 115 Field record 6636. 130 120 Lindsay 3159 (AAS), Lindsay 3160 (AAS), Lindsay 3171 (AAS), Lindsay 3196 (AAS), Lindsay 3198 (AAS), Lindsay 3341 (AAS), Lindsay 3345 (AAS), Lindsay 4311 (AAS), Trøim 13 (TRH), Trøim 25 (TRH). 130 125 Trøim 1 (TRH), Trøim 34 (TRH). 135 090 Field record 6373. 135 115 Field record 4332. 135 120 Field record 4305. 140 070 Field record 6402. 140 115 Field record 5167. 140 120 Field record 5197. 145 065 Field record 6417. 145 070 Field record 6431. 145 110 Field record 6591. 145 115 Field record 6600
150 065 Field record 6461. 155 055 Lindsay 4421 (AAS, CHR). 155 095 Field record 5145. 155 100 Field record 5050. 160 055 Field record 5324. 160 060 Field record 4911. 160 095 Field record 5111. 160 100 Field record 5085. 165 055 Field record 7490. 165 075 Lindsay 3627 (AAS). 165 080 Field record 4757. 165 090 Lindsay 3552 (AAS), Lindsay 3553 (AAS). 170 065 Lindsay 3726 (AAS, CHR, H). 170 070 Lindsay 3699 (AAS). 170 090 Field record 4432
175 065 Field record 4822. 175 070 Field record 4804

Cladonia carneola (Fr.) Fr.
030 150 Field record 4246
050 135 Field record 4119. 050 140 Field record 4144. 050 145 Field record 7278. 050 150 Field record 5044. 050 155 Field record 4975. 055 135 Field record 4070. 055 140 Field record 4036. 055 150 Field record 5004. 055 155 Field record 4940. 060 135 Field record 4002. 060 150 Field record 3810. 065 140 Field record 4231. 070 125 Field record 3852. 070 135 Field record 3871. 070 150 Field record 4290
075 125 Field record 4189. 075 130 Field record 3776. 080 130 Field record 4160. 080 135 Field record 3832. 080 140 Field record 3815. 080 150 Field record 7301. 090 100 Field record 6215. 090 120 Field record 7327. 090 140 Field record 7351. 095 100 Field record 6252. 095 115 Field record 7360
100 115 Field record 7379. 105 110 Field record 7386. 110 110 Field record 7414. 110 145 Field record 7433. 115 130 Field record 4635. 115 135 Field record 4688. 120 095 Field record 6302. 120 135 Field record 4606. 120 140 Field record 5278
125 095 Field record 6325. 125 120 Field record 5243. 125 125 Field record 6645. 130 090 Field record 6360. 130 095 Field record 7446. 130 110 Field record 4363. 130 115 Field record 6638. 130 120 Lindsay 3172 (AAS), Lindsay 3295 (AAS), R. Smith 1101 (AAS, FH, PC), Trøim 42 (TRH). 130 125 Trøim 2 (TRH). 135 085 Field record 6364. 135 115 Field record 4333. 135 120 Lindsay 3399 (AAS, CHR), Lindsay 3415 (AAS). 140 070 Field record 6398. 140 075 Field record 6406. 140 115 Field record 5168. 140 120 Field record 5198. 145 065 Field record 6420. 145 070 Field record 6434. 145 115 Field record 6596
155 055 Lindsay 4419 (AAS). 155 060 Field record 7466. 155 065 Field record 7475. 155 095 Field record 5146. 155 100 Field record 5051. 160 055 Field record 5325. 160 060 Field record 4912. 160 090 Lindsay 3520 (AAS). 160 095 Field record 5112. 160 100 Field record 5086. 165 055 Field record 7494. 165 060 Field record 5311. 165 075 Field record 4730. 165 080 Lindsay 3637 (AAS). 165 085 Lindsay 3576 (AAS, MEL). 165 090 Field record 4509. 170 065 Field record 4583. 170 070 Field record 4778. 170 090 Field record 4431
175 060 Field record 7510. 175 065 Field record 4823. 175 070 Field record 4805

Inadequately localized
Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S, as *C. deformis*)

Cladonia coccifera (L.) Willd.
035 145 BAS Misc. 73 (AAS, CHR)
050 135 R. Smith 1614 (AAS). 050 140 R. Smith 1617 (AAS). 050 150 Lindsay 3734 (AAS). 055 135 R. Smith 1597 (AAS). 055 145 Field record 3919. 055 150 Lindsay 3871 (AAS)
115 140 Lindsay 4351 (AAS). 130 115 Field record 6637. 130 120 Lindsay 4318 (AAS). 130 125 Field record 6653. 135 090 Field record 6390
150 060 Field record 6445

Cladonia furcata (Huds.) Schrad. var. *furcata*
020 150 Field record 6605
030 145 Field record 6607. 030 150 Field record 4244. 030 155 Lindsay 3049 (AAS, MEL). 035 145 Field record 6612. 035 150 Field record 6614. 040 155 Field record 6620. 045 150 Field record 6631
050 135 Field record 4121. 050 150 Lindsay 3791 (AAS). 050 155 Field record 4976. 055 135 Field record 4067. 055 140 Field record 4051. 055 145 Field record 3713. 055 150 Lindsay 3867 (AAS). 055 155 Field record 4941. 060 135 Field record 4001. 065 140 R. Smith 1557 (AAS). 070 130 Field record 3793. 070 135 Field record 3874. 070 150 Lindsay 3092 (AAS)
075 125 Field record 4186. 075 135 Field record 3901. 080 125 J. Smith M217 (AAS). 080 140 Field record 3814. 080 150 Field record 6463. 090 100 BAS Misc. 116 (AAS). 090 125 Field record 7340. 090 140 Field record 7355. 095 095 Field record 6237. 095 100 Field record 6243. 095 145 Field record 6624
100 145 Field record 6627. 110 100 Field record 6270. 115 085 Field record 6277. 115 100 Field record 6280. 115 130 Lindsay 3598 (AAS). 115 135 Field record 4689. 115 140 Lindsay 4353 (AAS, H). 120 095 Field record 6304. 120 135 Field record 4607. 120 140 Field record 5279
125 095 Field record 6317. 125 120 Field record 5244. 125 125 Field record 6646. 130 095 Field record 7445. 130 110 Field record 4364. 130 115 Field record 6639. 130 120 Lindsay 3199 (AAS), Lindsay 3243 (AAS), Lindsay 3245 (AAS), Lindsay 3320 (AAS), Lindsay 4216 (AAS, PRE), Lindsay 4303 (AAS), Lindsay 4324 (AAS). 130 125 Lindsay 4268 (AAS), J. Smith M202a (AAS). 135 085 Field record 6361. 135 090 Field record 6374. 135 115 Field record 4334. 135 120 Lindsay 3407 (AAS), Lindsay 3429 (AAS, FH). 140 070 Field record 6404. 140 115 Field record 5169. 140 120 Field record 5199. 145 065 Field record 6418. 145 070 Field record 6428. 145 115 Field record 6598
150 065 Field record 6460. 155 055 Lindsay 4424 (AAS). 155 095 Field record 5147. 155 100 Field record 5052. 160 055 Field record 5326. 160 060 Field record 4913. 160 090 Lindsay 3519 (AAS, IAA), Lindsay 3531 (AAS). 160 095 Field record 5113. 160 100 Field record 5087. 165 060 Field record 5312. 165 075 Lindsay 3628 (AAS). 165 080 Lindsay 3643 (AAS, LE). 165 090 Field record 4511. 170 065 Field record 4876. 170 070 Field record 4779. 170 090 Lindsay 3487 (AAS)
175 065 Field record 4824

Inadequately localized
Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S, 3 specimens as *C. subsquamosa* and *C. squamosa*)

Cladonia furcata (Huds.) Schrad. var. *subpungens* Müll. Arg.
030 150 Lindsay 3019 (AAS, CHR)
055 150 Lindsay 3866 (AAS)
145 100 Field record 7459

Cladonia gracilis (L.) Willd. ssp. *elongata* (Jacq.) Ahti

025 150 Field record 1719
055 135 Field record 4071. 070 130 Field record 3792
075 145 Field record 5362
155 095 Greene 2225 (AAS, H, MEL). 165 090 Field record 4510

Cladonia gracilis (L.) Willd. ssp. *gracilis*

030 145 Field record 6608. 030 150 Greene 352 (AAS, CHR, LE, S). 030 155 Lindsay 3050 (AAS, CHR). 035 145 Field record 6202. 035 150 Field record 6615. 040 155 Field record 6621. 045 150 Field record 6629
050 135 Field record 4123. 050 140 Field record 4145. 050 145 Field record 7264. 050 150 Lindsay 3744 (AAS, PRE, US), Lindsay 3749 (AAS), Lindsay 3793 (AAS). 050 155 Lindsay 3841 (AAS). 055 135 Field record 4068. 055 140 Field record 4034. 055 145 Field record 3714. 055 150 Field record 5006. 060 135 R. Smith 1583 (AAS, H). 060 150 R. Smith 1527 (AAS). 065 140 Field record 3730. 070 130 Field record 3798. 070 135 Field record 3872. 070 150 Field record 4288. 070 155 Field record 7291
075 120 Field record 4097. 075 125 Field record 4187. 075 130 R. Smith 1573 (AAS). 075 145 Field record 5362. 080 130 Field record 4158. 080 135 Field record 3989. 090 100 BAS Misc. 115 (AAS). 090 120 Field record 7329. 090 140 Field record 7353. 095 095 Field record 6235. 095 100 Field record 6244. 095 115 Field record 7365. 095 145 Field record 6625
100 115 Field record 7372. 105 110 Field record 7390. 110 110 Field record 7413. 110 140 Field record 7418. 115 085 Field record 6278. 115 130 Field record 4637. 115 135 Greene 1380 (AAS, FH, PC, PRE, MEL), Greene 3147 (AAS, IAA, SGO, TNS, US), Greene 3217 (AAS, H, MEL). 120 135 Field record 4608. 120 140 Field record 5280
125 095 Field record 6322. 125 120 Field record 5245. 125 125 Field record 6648. 130 110 Field record 4365. 130 115 Field record 6640. 130 120 Lindsay 3162 (AAS), Lindsay 3164 (AAS), Lindsay 3241 (AAS), Lindsay 3244 (AAS), Lindsay 3296 (AAS), Lindsay 3298 (AAS), Lindsay 3347 (AAS), Lindsay 3369 (AAS), Lindsay 4213 (AAS, IAA), Lindsay 4219 (AAS, PRE), Lindsay 4302 (AAS, TNS), Longton 459 (AAS, PRE, TNS), Longton 466 (AAS). 130 125 Greene 1977 (AAS, CHR, H, MEL), Lindsay 3119 (AAS), J. Smith M205a (AAS). 135 115 Lindsay 3437 (AAS), Lindsay 3470 (AAS). 135 120 Lindsay 3256 (AAS), Lindsay 3265 (AAS), Lindsay 3267 (AAS), Lindsay 3268 (AAS), Lindsay 3406 (AAS), Lindsay 3430 (AAS, FH, H). 140 070 Field record 6396. 140 115 Field record 5170. 145 115 Field record 6599
155 055 Lindsay 4426 (AAS, S, SGO). 155 095 Field record 5148. 155 100 Lindsay 3982 (AAS). 160 090 Lindsay 3537 (AAS, LE). 160 095 Field record 5114. 160 100 Field record 5088. 165 060 Field record 7500. 165 075 Lindsay 3630 (AAS). 165 080 Field record 4758. 165 085 Lindsay 3578 (AAS, MEL, PC). 165 090 Lindsay 3554 (AAS). 170 065 Field record 4875. 170 070 Lindsay 3674 (AAS). 170 090 Field record 4430
175 065 Field record 4825. 175 070 Lindsay 3712 (AAS)

Inadequately localized

King Haakon Bay, leg. A.B. Dickinson, 15.x.1964, Longton 813 (AAS)

Cladonia phyllophora Hoffm.

025 150 Field record 1721. 030 155 Field record 4266
050 135 Field record 4124. 050 150 Field record 5045. 050 155 Field record 4978. 055 135 Field record 4072. 055 140 Field record 4050. 055 150 Field record 5007. 055 155 Field record 4942. 065 140 Field record 3736. 070 125 Field record 3847. 070 135 Field record 3941. 070 145 Greene 1272 (AAS)
075 130 Field record 3707. 080 130 Field record 4159
115 130 Field record 4638. 115 135 Field record 4691. 120 135 Field record 4609. 120 140 Field record 5281
125 120 Field record 5246. 125 125 Field record 6654. 125 130 Skottsberg s.n. (S, as *C. degenerans*, *C. austrogeorgica*). 130 110 Field record 4366. 130 120 Greene 1870 (AAS), Lindsay 4217 (AAS), Longton 458 (AAS), Trøim 10 (TRH). 130 125 Trøim 35 (TRH). 135 115 Field record 4336. 135 120 Field record 4309. 140 120 Field record 5200
155 095 Field record 5149. 160 095 Field record 5115. 165 075 Field record 4731. 165 080 Field record 4759. 165 090 Field record 4513. 170 065 Field record 4877. 170 090 Field record 4433
175 065 Field record 4826

Cladonia pleurota (Flörke) Schaer.

060 135 Field record 4016. 065 140 Field record 3910. 070 130 Field record 3796
075 130 Field record 3971. 075 145 R. Smith 1700 (AAS)
125 125 Greene 1620 (AAS)
170 065 Lindsay 3725 (AAS)

Cladonia pyxidata (L.) Hoffm.

030 155 Lindsay 3052 (AAS)
050 135 Field record 4122. 050 145 Field record 7267. 055 135 Field record 4069. 055 140 Field record 4032. 055 145 Field record 3715. 055 150 Field record 5008. 055 155 Field record 4943. 060 150 Field record 3811. 065 140 Field record 3738. 070 135 Field record 3873. 070 150 Field record 4291
075 125 Field record 4172. 075 130 R. Smith 1525 (AAS), R. Smith 1575 (AAS). 075 145 Field record 5357. 090 115 Field record 7322. 090 120 Field record 7332. 090 140 Field record 7350
100 115 Field record 7378. 115 100 Field record 6283. 115 140 Field record 5299. 120 140 Field record 5282
125 095 BAS Misc. 117 (AAS). 125 120 Field record 5247. 130 120 Lindsay 3169 (AAS). 130 125 Trøim 4 (TRH). 135 090 Field record 6377. 135 120 Lindsay 3400 (AAS). 140 075 Field record 6407. 140 115 Field record 5171. 145 070 BAS Misc. 118 (AAS)

150 065 Field record 6462. 155 055 Lindsay 4420 (AAS). 155 060 Field record 7468. 155 065 Field record 7478 155 100 Field record 5054. 160 055 Lindsay 4453 (AAS). 160 090 Lindsay 3522 (AAS). 160 095 Field record 5116. 160 100 Lindsay 4035 (AAS). 165 055 Field record 7492. 165 060 Field record 5313. 165 080 Field record 4760. 165 090 Field record 4514. 170 065 Lindsay 3723 (AAS). 170 090 Lindsay 3542 (AAS)
175 065 Field record 4827

Cladonia squamosa (Scop.) Hoffm. var. *allosquamosa* Hennipm.
050 150 Lindsay 3741 (AAS), Lindsay 3742 (AAS), Lindsay 3796 (AAS). 055 145 Field record 3716. 070 130 Field record 3799. 070 135 Field record 3764
075 130 R. Smith 1574 (AAS). 090 145 Field record 7516.
115 135 Greene 1379 (AAS), Greene 1480 (AAS), Greene 3148 (AAS). 115 140 Lindsay 4378 (AAS)
125 125 Field record 6655. 130 120 Lindsay 3151 (AAS), Lindsay 3163 (AAS), Lindsay 3166 (AAS), Lindsay 3167 (AAS), Lindsay 3197 (AAS), Lindsay 3348 (AAS), Lindsay 3388 (AAS), Lindsay 3393 (AAS), Lindsay 4215 (AAS), Lindsay 4218 (AAS), Lindsay 4301 (AAS), Lindsay 4325 (AAS), Lindsay 4326 (AAS), Longton 460 (AAS). 130 125 Lindsay 4158 (AAS), Lindsay 4267 (AAS), Lindsay 4286 (AAS). 135 115 Lindsay 3471 (AAS). 135 120 Lindsay 3405 (AAS)
155 055 Lindsay 4422 (AAS), Lindsay 4425 (AAS), Lindsay 4427 (AAS). 155 095 Greene 2223 (AAS). 160 090 Lindsay 3521 (AAS). 165 075 Lindsay 3632 (AAS). 165 080 Lindsay 3638 (AAS). 165 085 Lindsay 3577 (AAS). 170 070 Lindsay 3673 (AAS)

Cladonia squamosa (Scop.) Hoffm. var. *squamosa*
030 150 Greene 356 (AAS). 030 155 Field record 4265
055 150 Field record 5010. 070 150 Field record 4289. 090 145 Greene 1735 (AAS)
115 130 Field record 4640. 115 135 Field record 4693. 115 140 Field record 5300. 120 135 Field record 4611. 120 140 Field record 5284
125 120 Field record 5249. 130 110 Field record 4368. 130 120 Trøim 17 (TRH, as *C. squamosa* f. *murina*). 130 125 Greene 1974 (AAS). 135 120 Field record 4310. 140 120 Field record 5202
165 085 Field record 4550. 165 090 Field record 4516. 170 065 Field record 4879. 170 070 Field record 4781. 170 090 Field record 4480
175 065 Field record 4829. 175 070 Field record 4807

Cladonia mitis Sandst.
120 135 Greene 3343 (AAS, CHR, IAA)

Cladonia pycnoclada (Pers. ex Gaudich.) Nyl.
130 120 Lindsay 4305 (AAS)

Cladonia rangiferina (L.) Web.
030 145 Field record 6609. 030 150 Greene 353a (AAS), Lindsay 3020 (AAS, CHR). 030 155 Field record 4262. 035 145 Field record 6201. 035 150 Field record 6616. 040 155 Field record 6622. 045 145 Field record 6632. 045 150 Field record 6630
050 135 Field record 4118. 050 140 Field record 4142. 050 145 Field record 7269. 050 150 Lindsay 3792 (AAS). 050 155 Field record 4979. 055 135 Field record 4074. 055 140 Field record 4049. 055 145 Field record 3917. 055 150 Lindsay 3868 (AAS). 055 155 Field record 4944. 060 135 Field record 4015. 065 140 Field record 3739. 070 130 Field record 3791. 070 135 Field record 3870. 070 155 Field record 7293
075 125 Field record 4173. 075 130 Field record 3774. 075 145 Field record 5355. 080 140 Field record 3984. 090 100 Field record 6214. 090 120 Field record 7334. 090 140 Field record 7347. 090 145 Greene 1738 (AAS, S). 095 095 Field record 6236. 095 115 Field record 7357. 095 145 Field record 6626
100 140 Field record 1476. 100 145 Field record 6628. 105 110 Field record 7387. 105 145 Field record 1479. 110 100 Field record 6272. 110 110 Field record 7415. 110 140 Field record 7424. 110 145 Field record 7434. 115 085 Field record 6279. 115 100 Field record 6282. 115 130 Field record 4639. 115 135 Cragg D7a (DHM), Greene 1378 (AAS), Lindsay 1685 (AAS). 115 140 Lindsay 4377 (AAS). 120 095 Field record 6301. 120 100 Field record 6310. 120 130 Longton 192 (AAS). 120 135 Field record 4610. 120 140 Lindsay 4379 (AAS)
125 095 Field record 6318. 125 120 Field record 5248. 125 125 Field record 6649. 130 090 Field record 6357. 130 095 Field record 7440. 130 110 Field record 4367. 130 115 J. Smith M187 (AAS). 130 120 Bonner 417 (BM), Bonner 427 (BM), Corner 867 (AAS), Greene 1510 (AAS), Lindsay 3148 (AAS, H), Lindsay 3161 (AAS), Lindsay 3248 (AAS), Lindsay 3297 (AAS, LE), Lindsay 4214 (AAS), Lindsay 4312 (AAS, PC), Longton 461 (AAS, PRE, SGO), Skottsberg s.n. (S, 2 specimens), J. Smith M197 (AAS), J. Smith M203a (AAS), J. Smith M218 (AAS), J. Smith M220 (AAS). 130 125 Greene 1978 (AAS), Lindsay 3116 (AAS, FH), Lindsay 4269 (AAS, TNS), Trøim 36 (TRH). 135 090 Field record 6387. 135 115 Lindsay 3436 (AAS, MEL). 140 115 Field record 5173. 140 120 Field record 5201. 145 065 Field record 6422. 145 110 Field record 6657. 145 115 Field record 6597
155 095 Greene 2227 (AAS), Lindsay 4145 (AAS). 155 100 Lindsay 3951 (AAS), Lindsay 3961 (AAS). 160 090 Lindsay 3532 (AAS). 160 095 Field record 5117. 160 100 Field record 5089. 165 060 Field record 5314. 165 075 Field record 4732. 165 080 Field record 4761. 165 085 Lindsay 3572 (AAS), Lindsay 3574 (AAS), Lindsay 3575 (AAS, IAA). 165 090 Field record 4515. 170 065 Field record 4878. 170 070 Lindsay 3689 (AAS). 170 090 Field record 4434
175 065 Field record 4828. 175 070 Lindsay 3710 (AAS)

Inadequately localized
Moraine Fjord, Cumberland East Bay, 28.i.1957, Bonner 401 (BM); Alt. *c.* 700 ft., Bore Valley, Cumberland East Bay, 22.i.1957, Bonner 423 (BM)

Cornicularia aculeata (Schreb.) Ach.
030 150 Lindsay 3030 (AAS). 030 155 Lindsay 3056 (AAS)
050 150 Field record 5046. 050 155 Lindsay 3827 (AAS). 055 135 R. Smith 1134 (AAS, CHR, MEL). 055 145 Field record 3922. 055 150 Lindsay 3862 (AAS). 055 155 Field record 4945
075 125 R. Smith 1618 (AAS)

Cornicularia epiphorella (Nyl.) Du Rietz
030 150 Greene 2001a (AAS). 030 155 Lindsay 3047 (AAS). 035 145 R. Smith 1114 (AAS)
055 135 R. Smith 1596 (AAS). 070 130 R. Smith 1344 (AAS). 070 135 R. Smith 1621 (AAS)

Cystocoleus niger (Huds.) Hariot
030 150 Greene 358 (AAS)
050 150 Lindsay 3806 (AAS). 050 155 Field record 4980. 055 135 Field record 4083. 055 145 Field record 3712. 055 150 Field record 5012. 060 135 Field record 4007. 060 150 Field record 3808. 070 130 Field record 3976
075 125 Field record 4183. 075 135 Field record 3900
120 140 Field record 5292
125 120 Field record 5258. 130 120 Lindsay 3322 (AAS), Lindsay 4310 (AAS). 140 115 R. Smith 1325 (AAS)
155 095 Lindsay 4120 (AAS), Lindsay 4130 (AAS), Lindsay 4148 (AAS). 155 100 Field record 5055. 160 095 Field record 5118. 160 100 Field record 5076. 165 085 Field record 4559. 170 090 Field record 4482

Dermatocarpon intestiniforme (Körb.) Hasse
115 140 Lindsay 4361 (AAS)
155 095 Lindsay 3884 (AAS, CHR, H), Lindsay 3901 (AAS)

Himantormia lugubris (Hue) M. Lamb
145 095 BAS Misc. 120 (AAS)

Hypogymnia lugubris (Pers.) Krog
020 150 Field record 1483. 025 150 Field record 1499. 030 145 Field record 1521. 030 150 Greene 354 (AAS), Lindsay 3038 (AAS, BM). 030 155 Lindsay 3046 (AAS). 035 145 Field record 1534. 035 155 Field record 1482. 040 150 Field record 1474. 040 155 Field record 1549. 045 145 Field record 1561. 045 150 Field record 1572
050 135 Field record 4117. 050 140 Field record 4130. 050 145 Field record 7265. 050 150 Lindsay 3740 (AAS, US). 050 155 Field record 4981. 055 135 R. Smith 1349 (AAS). 055 140 Field record 4045. 055 145 Field record 3924. 055 150 Clarke and Greene CG28 (AAS). 055 155 Field record 4924. 060 135 Field record 4003. 065 140 Field record 3728. 070 125 Field record 3846. 070 130 Field record 3704. 070 135 Field record 3755. 070 150 Field record 4294. 070 155 Field record 7290
075 120 Field record 3705. 075 125 R. Smith 1346 (AAS). 080 125 Greene 2606 (AAS), J. Smith M210 (AAS), J. Smith M215 (AAS). 080 135 R. Smith 1532 (AAS). 085 125 Field record 7312. 090 100 Field record 6222. 090 120 Field record 7330. 090 145 Greene 1739 (AAS, CHR). 095 095 Field record 6232. 095 145 Field record 1592
100 115 Field record 7369. 105 110 Field record 7392. 110 100 Field record 6268. 110 105 Field record 7400. 110 110 Field record 7409. 110 140 Field record 7429. 115 100 Field record 6284. 115 130 Lindsay 3594 (AAS). 115 135 Lindsay 1687 (AAS). 115 140 Field record 5294. 120 095 Field record 6305. 120 100 Field record 6313. 120 130 Greene 3034 (AAS, S). 120 135 Field record 4612. 120 140 Field record 5271
125 095 Field record 6323. 125 120 Field record 1627. 125 125 R. Smith 1336 (AAS). 130 095 Field record 7441. 130 110 Field record 4370. 130 115 Field record 1671. 130 120 Greene 1871 (AAS, FH, IAA, MEL, PRE), Lindsay 3149 (AAS, LE), Lindsay 3356 (AAS, SGO), Lindsay 3364 (AAS), Skottsberg s.n. (S, as *Parmelia enteromorpha*). 130 125 Greene 1972 (AAS, PC). 135 085 Field record 6368. 135 090 Field record 6385. 135 120 Field record 4312. 140 070 Field record 6403. 140 110 Field record 4200. 140 115 R. Smith 1326 (AAS), R. Smith 1339 (AAS). 140 120 Field record 1680. 145 070 Field record 6437
155 095 Greene 2213 (AAS). 155 100 Lindsay 3963 (AAS). 160 060 Field record 4896. 160 095 Field record 5100. 160 100 Lindsay 4026 (AAS, TNS). 165 055 Field record 7495. 165 075 Field record 4718. 165 080 Field record 4746. 165 085 Field record 4551. 165 090 Lindsay 3556 (AAS). 170 065 Lindsay 3730 (AAS). 170 070 Lindsay 3690 (AAS). 170 090 Field record 4435
175 065 Field record 4830

Leptogium menziesii Mont.
030 150 Lindsay 3037 (AAS). 035 145 Field record 6199
050 135 Field record 4116. 050 140 Field record 4134. 050 150 Lindsay 3739 (AAS, CHR), Lindsay 3813 (AAS). 050 155 Field record 4986. 055 135 Field record 4081. 055 140 Field record 4042. 055 145 Field record 3928. 055 150 Field record 5031. 055 155 Field record 4953. 060 150 Field record 3802. 065 140 Field record 3747. 070 125 Field record 3850. 070 130 Field record 3974. 070 135 Field record 3762. 070 150 Lindsay 3087 (AAS)
075 120 Field record 4102. 075 125 Field record 4168. 075 130 Field record 3743. 075 135 Field record 3897. 075 145 Field record 5360. 080 130 Field record 4154. 080 135 Field record 3829. 085 125 Field record 7316. 090 120 Field record 7328. 090 145 Greene 1742 (AAS). 095 095 Field record 6234. 095 100 Field record 6251
100 100 Field record 6255. 100 115 Field record 7373. 110 100 Field record 6274. 110 110 Field record 7417. 115 100 Field record 6288. 115 130 Field record 4648. 115 135 Greene 1481 (AAS). 115 140 Field record 5301. 120 095 Field record 6294. 120 100 Field record 6314. 120 130 Longton 193 (AAS). 120 135 Field record 4617. 120 140 Field record 5290

125 120 Field record 5257. 125 125 Field record 6650. 130 090 Field record 6346. 130 095 Field record 7447. 130 110 Field record 4371. 130 115 Field record 6641. 130 120 Greene 1506 (AAS), Lindsay 3154 (AAS, H, LE, MEL), Lindsay 3195 (AAS). 135 115 Field record 4338. 135 120 Lindsay 3254 (AAS), Lindsay 3260 (AAS, PC, PRE), Lindsay 3408 (AAS, S). 130 125 Field record 6656. 140 075 Field record 6409. 140 115 Field record 5175. 140 120 Field record 5210
155 055 Lindsay 4431 (AAS). 155 060 Field record 7470. 155 095 Lindsay 3898 (AAS), Lindsay 3937 (AAS), Lindsay 4147 (AAS), Lindsay 4156 (AAS). 155 100 Lindsay 3977 (AAS). 160 055 Lindsay 4454 (AAS). 160 060 Field record 4918. 160 095 Field record 5133. 160 100 Field record 5097. 165 060 Field record 5315. 165 075 Field record 4737. 165 080 Lindsay 3645 (AAS). 165 085 Field record 4561. 165 090 Field record 4527. 170 070 Field record 4774. 170 090 Lindsay 3541 (AAS)
175 065 Field record 4852. 175 070 Field record 4820

Leptogium puberulum Hue
130 120 Lindsay 4317 (AAS). 145 115 Field record 6604
160 090 Lindsay 3533 (AAS)

Massalongia carnosa (Dicks.) Körb.
070 150 Lindsay 3088 (AAS)
130 120 R. Smith 1109 (AAS)
175 065 Lindsay 3720a (AAS)

Mastodia tesselata (Hook. f. et Harv.) Hook. f. et Harv.
050 155 Field record 4969. 055 150 Field record 5023. 055 155 Field record 4929
075 120 Field record 4089. 075 150 Field record 7297
115 130 Field record 4627. 115 135 Field record 4680. 120 135 Field record 4594. 120 140 Field record 5268
125 095 Greene 2509b (AAS). 130 110 Field record 4372. 130 120 Lindsay 3105 (AAS). 135 115 Field record 4340. 135 120 Lindsay 3423 (AAS, CHR). 140 115 Field record 5163. 140 120 Lindsay 4233 (AAS, MEL)
155 055 Field record 5341. 155 095 Lindsay 3923 (AAS). 160 055 Field record 5331. 160 060 Field record 4901. 160 090 Field record 4452. 160 095 Lindsay 4084 (AAS, LE). 160 100 Lindsay 4006 (AAS). 165 060 Field record 5308. 165 075 Field record 4723. 165 080 Lindsay 3660 (AAS). 165 085 Field record 4541. 165 090 Field record 4501. 170 065 Field record 4574. 170 070 Field record 4770. 170 090 Lindsay 3500 (AAS)
175 060 Field record 7508. 175 065 Field record 4846. 175 070 Field record 4793

Menegazzia sanguinascens (Räs.) R. Sant.
035 150 R. Smith 1725 (AAS, CHR)
050 135 R. Smith 1611 (AAS)
075 120 R. Smith 1348 (AAS), R. Smith 1605 (AAS), R. Smith 1608 (AAS)
140 115 R. Smith 1136 (AAS), R. Smith 1333 (AAS)

Pannaria hookeri (Borr. ex Sm.) Nyl.
050 140 Field record 4138. 055 135 R. Smith 1602 (AAS). 055 150 Lindsay 3874 (AAS). 065 140 Field record 3752. 070 130 Field record 4214. 070 135 Field record 3766. 070 140 Field record 7282
075 125 Field record 4171. 080 130 Field record 4157. 080 140 Field record 3820. 090 100 Field record 6224
110 105 Field record 7404. 115 135 Greene 3214 (AAS)
125 120 Field record 5232. 130 115 Lindsay 4298 (AAS). 130 120 Field record 4300. 140 105 Field record 4232. 140 120 Field record 5212. 145 100 Field record 7464
155 095 Lindsay 4113 (AAS), Lindsay 4150 (AAS). 155 100 Lindsay 3954 (AAS), Lindsay 3983 (AAS). 160 095 Greene 2402 (AAS). 170 090 Lindsay 3548 (AAS)

Parmelia gerlachei Zahlbr.
125 125 R. Smith 1318 (AAS). 130 120 Lindsay 3333 (AAS). 130 125 Lindsay 4258 (AAS), R. Smith 1108 (AAS). 140 120 Greene 947 (AAS)
155 095 Lindsay 3899 (AAS), Lindsay 4042 (AAS). 160 090 Field record 4453. 160 095 Field record 5124. 165 085 Field record 4542. 165 090 Field record 4502

Parmelia saxatilis (L.) Ach.
040 155 R. Smith 1118 (AAS)
075 120 R. Smith 1347 (AAS). 090 115 Field record 7324
160 060 Field record 4902. 165 085 Field record 4543. 165 090 Field record 4503

Parmelia sulcata Tayl.
130 120 R. Smith 1354a (AAS)

Parmelia ushuaiensis Zahlbr.
130 125 Lindsay 3109 (AAS), Lindsay 3211 (AAS). 140 115 Lindsay 4197 (AAS)

Parmeliella cronia Tuck.
130 120 Lindsay 4309 (AAS). 140 115 Field record 6658
155 100 Lindsay 3964 (AAS)

Peltigera canina (L.) Willd.
050 135 R. Smith 1612 (AAS). 050 140 Field record 4137. 055 135 R. Smith 1595 (AAS). 055 140 Field record 4047. 060 150 Field record 3806. 070 150 Lindsay 3085 (AAS, CHR)
075 125 Field record 4165. 075 130 Field record 3733. 075 135 R. Smith 1550 (AAS). 080 140 Field record 3818. 095 100 Field record 6254
100 115 Field record 7371. 120 100 Field record 6312. 130 090 Field record 6349. 130 115 Lindsay 3475 (AAS). 130 120 Lindsay 3354 (AAS), Lindsay 4321 (AAS, MEL, S), R. Smith 1133 (AAS). 130 125 R. Smith 1132 (AAS). 135 115 Field record 4343. 135 120 Field record 4316. 145 070 Field record 6435
155 055 Lindsay 4418 (AAS, SGO). 155 100 Lindsay 3979 (AAS), Lindsay 3986 (AAS). 165 080 Lindsay 3636 (AAS, IAA, LE). 170 070 Lindsay 3676 (AAS, PC, PRE)

Peltigera horizontalis (Huds.) Baumg.
080 125 Greene 2605 (AAS)

Peltigera rufescens (Weiss) Humb.
040 155 Field record 1720
050 135 Field record 4112. 055 140 Field record 4048. 070 130 R. Smith 1577 (AAS)
075 125 Field record 4166. 095 095 Field record 6233
120 095 Field record 6298
125 095 Field record 6324. 125 125 Field record 6651. 130 115 Lindsay 3474 (AAS, PC). 130 120 Lindsay 4320 (AAS, PRE). 135 085 Field record 6366. 135 090 Field record 6391. 135 115 Lindsay 3452 (AAS). 135 120 Lindsay 3270 (AAS). 140 070 Field record 6405
155 095 Lindsay 4144 (AAS). 155 100 Lindsay 3980 (AAS, H). 160 090 Lindsay 3538 (AAS). 165 080 Lindsay 3646 (AAS, CHR, MEL)

Inadequately localized
Moraine Fjord, 29.iv.1902, Skottsberg 59 (S, as *P. antarctica*), Skottsberg 68 (S, as *P. antarctica*)

Peltigera spuria (Ach.) DC.
120 135 Greene 3342 (AAS)
125 120 Field record 5259
155 095 Lindsay 3897 (AAS). 165 085 Lindsay 3571 (AAS)
175 065 Field record 4853

Peltigera zahlbruckneri Gyeln.
070 125 R. Smith 1535 (AAS)
115 135 Greene 3149 (AAS), Greene 3216 (AAS). 130 120 Greene 1508 (AAS). 130 125 Greene 1970 (AAS)
160 100 Greene 2445 (AAS)

Physcia caesia (Hoffm.) Hampe
130 110 Field record 4373. 135 115 Lindsay 3446 (AAS, CHR). 140 120 Field record 5188
155 095 Lindsay 4140 (AAS, MEL). 160 055 Field record 5321. 160 060 Lindsay 3732 (AAS). 160 095 Field record 5105. 160 100 Lindsay 4016 (AAS). 165 090 Lindsay 3566 (AAS, FH)
175 070 Field record 4794

Inadequately localized
Mount Duse, 29.iv.1902, Skottsberg s.n. (S, as *Parmelia austrogeorgica* Dodge, HOLOTYPUS)

Physcia cf. *wainioi* Räs.
090 145 Greene 1747 (AAS)
130 120 Lindsay 4207 (AAS). 130 125 Greene 3488 (AAS), R. Smith 1316 (AAS), Trøim 38 (TRH). 135 120 Lindsay 3273 (AAS)
165 080 Lindsay 3659 (AAS). 165 090 Lindsay 3568 (AAS). 170 070 Lindsay 3682 (AAS)

Platismatia glauca (L.) Culb. et Culb.
030 155 Lindsay 3048 (AAS). 035 145 R. Smith 1113 (AAS)

Pseudocyphellaria endochrysea (Del.) Vain.
030 155 Lindsay 3051 (AAS). 035 145 Field record 6203. 035 150 Field record 6618
050 135 Field record 4114. 050 140 Field record 4129. 050 145 Field record 7270. 055 135 Field record 4063. 055 140 Field record 4044. 055 145 Field record 3916. 060 135 Field record 4005. 060 150 Field record 3805. 065 140 Field record 3913. 070 125 Field record 3844. 070 130 Field record 3786. 070 135 Field record 3761. 070 150 Lindsay 3081 (AAS, CHR)
075 125 Field record 4191. 075 130 Field record 3958. 075 135 Field record 3895. 080 125 Greene 2712 (AAS). 080 135 R. Smith 1530 (AAS, MEL). 085 125 Field record 7314. 090 100 Field record 6217. 090 120 Field record 7336. 090 125 Field record 7342. 090 140 Field record 7348. 095 095 Field record 6227. 095 100 Field record 6248
100 115 Field record 7368. 105 110 Field record 7380. 110 145 Field record 7435. 115 135 Field record 4677. 120 100 Field record 6316
125 095 Field record 6340. 130 090 Field record 6344. 130 095 Field record 7442. 130 110 Field record 4374. 130 115 J. Smith M193 (AAS). 130 120 Greene 1073 (AAS), Greene 1507a (AAS), Lindsay 4308 (AAS). 130 125 Lindsay 4287 (AAS). 135 090 Field record 6389. 135 115 Lindsay 3439 (AAS, H, LE). 135 120 Lindsay 3255 (AAS). 145 065 Field record 6423

155 055 Lindsay 4432 (AAS). 155 065 Field record 7477. 155 095 Greene 2220 (AAS), Lindsay 4131 (AAS). 160 065 Field record 7483. 160 090 Lindsay 3517 (AAS, IAA). 160 095 Field record 5120. 160 100 Field record 5092. 165 085 Lindsay 3583 (AAS, PRE). 165 090 Field record 4519

Inadequately localized
King Haakon Bay, leg. A.B. Dickinson, 15.x.1964, Longton 815 (AAS)

Pseudocyphellaria freycinetii (Del.) Malme emend. Du Rietz
020 150 R. Smith 1116 (AAS). 020 155 Field record 1493. 030 145 Field record 6610. 030 150 Greene 355 (AAS), Lindsay 3041 (AAS). 030 155 Field record 1708. 035 145 Field record 1468. 035 150 Field record 6617. 035 155 Field record 1717. 040 145 Field record 1704. 040 150 Greene 759 (AAS). 040 155 Field record 1542. 045 145 Field record 1555. 045 150 Field record 1458
050 135 Field record 4113. 050 140 Field record 4128. 050 145 Field record 7268. 050 150 Lindsay 3735 (AAS, CHR, MEL). 050 155 Lindsay 3837 (AAS, H). 055 135 Field record 4062. 055 140 Greene 1157 (AAS). 055 145 Field record 3711. 055 150 Lindsay 3864 (AAS, PRE). 055 155 Field record 4947. 060 135 Field record 4014. 060 150 Field record 3804. 065 140 Field record 3912. 070 125 Field record 3843. 070 130 R. Smith 1576 (AAS, LE). 070 135 Field record 3760. 070 140 Field record 7284. 070 145 Greene 1332 (AAS). 070 150 Lindsay 3082 (AAS). 070 155 Field record 7294
075 120 Field record 4101. 075 125 Field record 4190. 075 130 Field record 3737. 075 135 Field record 3894. 075 145 Field record 2913. 075 150 Field record 7299. 080 125 Greene 2682 (AAS), Greene 2722 (AAS), J. Smith M209 (AAS), J. Smith M212 (AAS). 080 135 Field record 3826. 080 140 Field record 3981. 080 150 Field record 7304. 085 125 Field record 7313. 090 115 Field record 7320. 090 120 Field record 7337. 090 125 Field record 7343. 090 140 Field record 7352. 090 145 Greene 1743a (AAS). 095 095 Field record 6230. 095 100 Field record 6245. 095 115 Field record 7358. 095 145 Field record 1587
100 115 Field record 7376. 100 140 Field record 1713. 100 145 Field record 1603. 105 110 Field record 7384. 105 140 Field record 1712. 105 145 Field record 1715. 110 100 Field record 6271. 110 105 Field record 7396. 110 110 Field record 7410. 110 140 Field record 7422. 115 100 Field record 6287. 115 130 Field record 4643. 115 135 Cragg D1b (DHM), Cragg D8 (DHM), Greene 1377 (AAS), Greene 3215 (AAS, IAA). 115 140 Field record 5304. 120 130 Greene 3031 (AAS, US). 120 135 Greene 3435 (AAS). 120 140 Field record 5287
125 095 Greene 2574 (AAS). 125 115 Field record 1632. 125 120 Field record 1623. 125 125 Greene 1615 (AAS). 130 090 Field record 6343. 130 095 Field record 7450. 130 110 Lindsay 3477 (AAS, TNS). 130 115 J. Smith M188 (AAS), J. Smith M192 (AAS). 130 120 Greene 191 (AAS), Greene 791 (AAS), Greene 1507b (AAS), Greene 1868 (AAS, SGO), Lindsay 1684a (AAS), Lindsay 3170 (AAS, S), Lindsay 3240 (AAS, FH), Lindsay 3299 (AAS, CHR), Lindsay 3346 (AAS), Longton 463 (AAS, BM), J. Smith M198 (AAS). 130 125 Greene 1969 (AAS), Lindsay 3118 (AAS), J. Smith M205b (AAS), Trøim 5 (TRH), Trøim 39 (TRH). 135 085 Field record 6367. 135 090 Field record 6388. 135 115 Field record 4344. 135 120 Lindsay 3262 (AAS, MEL). 140 075 Field record 6408. 140 080 Field record 6415. 140 105 Field record 4197. 140 110 Field record 4207. 140 115 Field record 1686. 140 120 Greene 946 (AAS). 145 065 Field record 6427. 145 070 Field record 6436
150 060 Field record 6443. 155 055 Lindsay 4435 (AAS). 155 060 Field record 7469. 155 065 Field record 7474. 155 095 Greene 2209 (AAS), Greene 2219 (AAS, IAA), Greene 2229 (AAS), Lindsay 4045 (AAS, SGO), Lindsay 4132 (AAS). 155 100 Lindsay 3965 (AAS, PC). 160 055 Lindsay 4460 (AAS). 160 060 Greene 2466 (AAS). 160 090 Lindsay 3518 (AAS, FH). 160 095 Field record 5121. 160 100 Field record 5093. 165 055 Field record 7488. 165 060 Field record 5316. 165 075 Lindsay 3631 (AAS). 165 080 Lindsay 3640 (AAS, US). 165 085 Lindsay 3573 (AAS). 165 090 Field record 4520. 170 065 Field record 4884. 170 070 Lindsay 3672 (AAS). 170 090 Field record 4488
175 065 Field record 4833. 175 070 Field record 4810

Psoroma ciliatum (Ach. ex Fr.) Nyl. ex Hue
070 150 Lindsay 3079 (AAS)
075 130 Field record 3782
130 110 Lindsay 3476 (AAS)

Psoroma cinnamomeum Malme
055 135 Field record 4082. 055 140 Field record 4041. 055 145 Field record 3709. 055 150 Lindsay 3872 (AAS). 060 135 Field record 3999. 070 130 Field record 3980
075 125 Field record 4164. 075 145 Field record 2923
130 120 Lindsay 4316 (AAS)
155 095 Lindsay 4119 (AAS). 155 100 Lindsay 3984 (AAS)

Psoroma hypnorum (Vahl) Gray
020 150 Field record 1489. 020 155 Field record 1496
025 150 Field record 1507. 030 145 Field record 1523. 030 150 Greene 357a (AAS), Greene 2001b (AAS), Lindsay 3026 (AAS), Lindsay 3032 (AAS). 030 155 Field record 4258. 035 145 Field record 1538. 040 155 Field record 1551. 045 145 Field record 1563. 045 150 Field record 1574
050 135 Field record 4106. 050 140 Field record 4136. 050 145 Field record 7277. 050 150 Lindsay 3745 (AAS), Lindsay 3794 (AAS, CHR, MEL, H). 050 155 Field record 4987. 055 135 Field record 4078. 055 140 Greene 1156 (AAS). 055 145 Field record 3926. 055 150 Field record 5016. 055 155 Field record 4954. 060 150 Field record 4229. 065 140 Field record 3751. 070 125 Field record 3842. 070 130 Field record 3787. 070 135 Field record 3763. 070 140 Field record 7283. 070 145 Greene 1271a (AAS). 070 150 Lindsay 3080 (AAS, S)

075 120 Field record 4099. 075 130 Field record 3781. 075 135 Field record 3896. 075 145 Field record 1582. 080 125 Greene 2607 (AAS). 080 130 Field record 4153. 080 135 Field record 3828. 080 140 Field record 3819. 090 115 Field record 7323. 090 120 Field record 7331. 090 140 Field record 7349. 090 145 Greene 1744 (AAS). 095 095 Field record 6228. 095 100 Field record 6249. 095 145 Field record 1595
100 145 Field record 1462. 105 110 Field record 7383. 105 140 Field record 1463. 110 100 Field record 6267. 110 105 Field record 7401. 110 110 Field record 7411. 110 140 Field record 7425. 115 130 Field record 4647. 115 135 Greene 3220 (AAS), Greene 3257 (AAS). 115 140 Lindsay 4350 (AAS, SGO). 120 100 Field record 6311. 120 135 Field record 4618. 120 140 Field record 5291
125 120 Field record 5253. 125 125 Greene 1619 (AAS). 130 090 Field record 6348. 130 095 Field record 7449. 130 110 Field record 4375. 130 115 J. Smith M190 (AAS). 130 120 Lindsay 3147 (AAS), Lindsay 3353 (AAS, IAA), Longton 467 (AAS), Trøim 26 (TRH). 130 125 Greene 1971 (AAS). 135 085 Field record 6363. 135 090 Field record 6378. 135 115 Field record 4345. 135 120 Lindsay 3259 (AAS), Lindsay 3404 (AAS, US). 140 115 Field record 5345. 140 120 Greene 1010 (AAS). 145 070 Field record 6433. 145 115 Field record 6603
150 060 Field record 6442. 155 055 Lindsay 4434 (AAS). 155 095 Greene 2214 (AAS), Lindsay 3924 (AAS, PC). 155 100 Lindsay 3953 (AAS). 160 055 Lindsay 4455 (AAS, PRE). 160 060 Field record 4915. 160 090 Lindsay 3516 (AAS), Lindsay 3536 (AAS). 160 095 Greene 2404 (AAS). 160 100 Field record 5094. 165 055 Field record 7498. 165 060 Lindsay 4384 (AAS). 165 075 Field record 4735. 165 080 Lindsay 3639 (AAS, TNS). 165 085 Field record 4560. 165 090 Field record 4528. 170 065 Field record 4885. 170 070 Lindsay 3671 (AAS). 170 090 Field record 4437
175 065 Field record 4854. 175 070 Field record 4811

Inadequately localized
Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S, as *Ps. cinnamomeum, Ps. microlepideum*)

Ramalina terebrata Hook. f. et Tayl.
075 120 R. Smith 1609 (AAS)
155 095 Lindsay 4141 (AAS)

Sphaerophorus globosus (Huds.) Vain.
030 150 Greene 353b (AAS), Greene 1171 (AAS), Lindsay 3034 (AAS), Lindsay 3036 (AAS), J. Smith M222 (AAS), J. Smith M225 (AAS). 030 155 Greene 1158 (BM, S), Lindsay 3057 (AAS). 035 150 Field record 6577. 040 145 Field record 1705. 040 155 Field record 1554
050 135 Field record 4127. 050 140 Field record 4132. 050 145 Field record 7266. 050 150 Lindsay 3748 (AAS, CHR). 050 155 Lindsay 3828 (AAS, MEL). 055 135 Field record 4064. 055 140 Greene 1155a (AAS). 055 145 Field record 3719. 055 150 Clarke and Greene CG29 (AAS), Lindsay 3870 (AAS, H, LE). 055 155 Field record 4948. 060 135 Field record 3998. 060 150 Field record 4227. 065 140 Field record 3729. 070 125 Field record 3845. 070 130 Field record 4210. 070 135 Field record 3756. 070 140 Field record 7287. 070 155 Field record 7288
075 125 Field record 4180. 075 130 Field record 3962. 075 135 Field record 3889. 080 125 J. Smith M211 (AAS). 080 130 Field record 4155. 080 135 Field record 3830. 080 140 Field record 3983. 080 150 Field record 7302. 085 125 Field record 7311. 090 125 Field record 7345. 095 095 Field record 6231. 095 100 Field record 6246. 095 115 Field record 7361
105 110 Field record 7385. 105 145 Field record 1716. 110 100 Field record 6275. 110 105 Field record 7394. 110 110 Field record 7408. 110 140 Field record 7423. 115 100 Field record 6285. 115 130 Field record 4646. 115 135 Field record 4701. 115 140 Field record 5305. 120 095 Field record 6297. 120 130 Greene 3036 (AAS). 120 140 Field record 5288
125 095 Field record 6321. 125 120 Field record 5254. 125 125 Field record 6652. 130 095 Field record 7444. 130 110 Field record 4379. 130 115 Field record 6642. 130 120 Lindsay 3150 (AAS), Lindsay 3355 (AAS, S), Lindsay 3387 (AAS, SGO), Lindsay 4212 (AAS, IAA). 130 125 Greene 1976 (AAS). 135 085 Field record 6362. 135 090 Field record 6386. 135 115 Field record 4350. 135 120 Field record 4320. 140 070 Field record 6397. 140 080 Field record 6416. 140 110 Field record 4208. 140 115 Field record 5179. 140 120 Field record 5207. 145 070 Field record 6432
150 060 Field record 6446. 155 060 Field record 7467. 155 065 Field record 7479. 155 095 Greene 2226 (BM), Lindsay 4044 (AAS, PRE). 155 100 Lindsay 3960 (AAS, BM), Lindsay 3968 (AAS, PC). 160 060 Greene 2467 (BM). 160 065 Field record 7482. 160 090 Lindsay 3523 (AAS). 160 095 Field record 5122. 160 100 Field record 5095. 165 055 Field record 7491. 165 075 Field record 4736. 165 080 Field record 4763. 165 085 Field record 4553. 165 090 Field record 4522. 170 065 Lindsay 3731 (AAS, US). 170 070 Lindsay 3691 (AAS, TNS). 170 090 Field record 4440
175 065 Field record 4835. 175 070 Field record 4812

Sphaerophorus melanocarpus (Sw.) DC.
030 155 Field record 1696
065 140 Field record 3742. 070 135 Field record 3765. 070 150 Lindsay 3083 (AAS)
125 125 Greene 1618 (AAS)
155 095 Lindsay 4146 (AAS)

Stereocaulon alpinum Laur.
030 150 Lindsay 3007 (AAS). 030 155 Lindsay 3053 (AAS). 035 150 Field record 1459
050 150 Lindsay 3760 (AAS). 050 155 Field record 1460. 055 150 Lindsay 3878 (AAS). 070 150 Lindsay 3090 (AAS)
075 130 R. Smith 1572 (AAS). 075 135 R. Smith 1549 (AAS)

115 130 Field record 4644. 115 135 Field record 4699. 115 140 Lindsay 4347 (AAS)
125 120 Field record 5255. 130 110 Lindsay 3473 (AAS). 130 120 Lindsay 3146 (AAS), Lindsay 3152 (AAS), Lindsay 4220 (AAS, CHR), Longton 457 (AAS), Skottsberg s.n. (S, 2 specimens), J. Smith M199 (AAS), Trøim 15 (TRH), Trøim 23 (TRH). 135 115 Lindsay 3450 (AAS). 135 120 Field record 4321. 140 115 R. Smith 1319 (AAS). 140 120 Field record 5208
155 095 Lindsay 4118 (AAS). 155 100 Lindsay 3967 (AAS, S), Lindsay 3976 (AAS), Lindsay 3994 (AAS, MEL). 165 080 Lindsay 3641 (AAS), Lindsay 3644 (AAS). 165 085 Lindsay 3580 (AAS). 170 070 Lindsay 3697 (AAS), Lindsay 3700 (AAS). 170 090 Lindsay 3550 (AAS), Lindsay 3551 (AAS)

Stereocaulon glabrum (Müll. Arg.) Vain.
030 150 Greene 2009 (AAS), Lindsay 3029 (AAS, PRE). 040 150 Greene 761 (AAS)
050 135 Field record 4125. 050 140 Field record 4133. 050 145 Field record 7272. 050 150 Lindsay 3789 (AAS), Lindsay 3798 (AAS). 050 155 Lindsay 3817 (AAS), Lindsay 3821 (AAS), Lindsay 3836 (AAS, BM, PC). 055 135 R. Smith 1599 (AAS). 055 140 Greene 1155b (AAS), R. Smith 1592 (AAS). 055 145 Field record 3717. 055 150 Clarke and Greene CG30 (AAS), Lindsay 3876 (AAS, CHR, H, LE, MEL). 055 155 Field record 4949. 060 135 Field record 4006. 060 150 Field record 3800. 065 140 R. Smith 1521 (AAS), R. Smith 1522 (AAS). 070 125 Field record 3851. 070 130 Field record 3979. 070 135 Field record 3940. 070 140 Field record 7286. 070 145 Greene 1237 (AAS). 070 150 Lindsay 3089 (AAS, IAA). 070 155 Field record 7292
075 125 Field record 3961. 075 130 Field record 3770. 075 135 R. Smith 1548 (AAS). 075 145 Field record 2906. 080 125 Greene 2724 (AAS). 080 130 Field record 4151. 080 135 Field record 3991. 080 140 Field record 3817. 085 140 Field record 7318. 090 120 Field record 7325. 090 125 Field record 7341. 090 145 Greene 1737 (AAS). 095 095 Field record 6229. 095 100 Field record 6247. 095 115 Field record 7364
100 115 Field record 7370. 105 110 Field record 7389. 110 100 Field record 6269. 110 105 Field record 7397. 110 110 Field record 7407. 110 140 Field record 7428. 115 100 Field record 6286. 115 130 Greene 3064 (AAS). 115 135 Greene 1381 (AAS). 115 140 Lindsay 4363 (AAS, IAA). 120 095 Field record 6303. 120 120 Field record 4420. 120 130 Greene 3030 (AAS), Greene 3032 (AAS, S). 120 135 Greene 3436 (AAS). 120 140 Field record 5289
125 095 Field record 6328. 125 115 J. Smith M228 (AAS). 125 120 Field record 5237. 125 125 Field record 6647. 130 090 Field record 6345. 130 095 Field record 7448. 130 110 Field record 4381. 130 115 J. Smith M189 (AAS). 130 120 Greene 1872 (AAS), Lindsay 3238 (AAS, PC, US), Lindsay 3252 (AAS), Lindsay 3319 (AAS), Lindsay 3327 (AAS), Lindsay 3350 (AAS, S), Lindsay 3360 (AAS, SGO), Lindsay 4209 (AAS, TNS), Trøim 24 (TRH). 130 125 Greene 603 (AAS), Greene 1973 (AAS), Lindsay 3122 (AAS), Lindsay 3123 (AAS, BM, FH, US), Lindsay 4159 (AAS), Lindsay 4284 (AAS), J. Smith M227 (AAS), Trøim 16 (TRH), Trøim 41 (TRH). 135 090 Field record 6375. 135 115 Lindsay 3438 (AAS), Lindsay 3466 (AAS, CHR). 135 120 Field record 4322. 140 070 Field record 6400. 140 105 Field record 4194. 140 115 Lindsay 4170 (AAS), R. Smith 1321 (AAS). 140 120 Field record 5209. 145 065 Field record 6421. 145 070 Field record 6429. 145 110 Field record 6586
150 060 Field record 6444. 155 055 Lindsay 4430 (AAS). 155 065 Field record 7476. 155 095 Greene 2212 (AAS), Greene 2221 (AAS), Lindsay 4102 (AAS, MEL), Lindsay 4107 (AAS), Lindsay 4151 (AAS). 155 100 Lindsay 3969 (AAS), Lindsay 3970 (AAS, SGO), Lindsay 3985 (AAS). 160 055 Lindsay 4457 (AAS, US). 160 060 Greene 2820a (AAS). 160 065 Field record 7481. 160 090 Lindsay 3530 (AAS, MEL), Lindsay 3534 (AAS). 160 095 Field record 5123. 160 100 Greene 2446 (AAS, S), Lindsay 4040 (AAS). 165 060 Lindsay 4380 (AAS). 165 065 Field record 7504. 165 075 Lindsay 3623 (AAS, CHR). 165 090 Field record 4521. 170 065 Field record 4886. 170 070 Lindsay 3675 (AAS), Lindsay 3702 (AAS). 170 090 Lindsay 3496 (AAS)
175 065 Field record 4834. 175 070 Field record 4813.

Inadequately localized
Moraine Fjord, 26.v.1902, Skottsberg s.n. (S, as *St. alpinum*)

Stereocaulon ramulosum (Sw.) Räusch. var. *pulvinare* (C. W. Dodge) M. Lamb
050 150 Lindsay 3809 (AAS). 050 155 Lindsay 3816 (AAS), Lindsay 3819 (AAS), Lindsay 3825 (AAS). 055 145 R. Smith 1559 (AAS). 055 150 Field record 4998
070 145 Greene 1364 (AAS). 090 120 Field record 7335
130 115 Field record 5221. 130 125 Greene 2041 (AAS)
160 060 Greene 2820b (AAS). 170 065 Field record 4887

Stereocaulon cf. *rivulorum* H. Magn.
130 120 Greene 1512 (AAS)

Sticta gaudichaudii (Mont.) Nyl.
055 140 R. Smith 1591 (AAS). 070 130 R. Smith 1345 (AAS)

Umbilicaria antarctica Frey et Lamb
125 115 R. Smith 1128 (AAS). 130 120 Lindsay 1684b (AAS)

Umbilicaria polyphylla (L.) Baumg.
130 120 R. Smith 1131 (AAS)

Usnea antarctica Du Rietz
020 150 Field record 1490. 020 155 Field record 1497

025 150 Field record 1508. 030 145 Field record 1524. 030 150 J. Smith M221 (AAS). 030 155 Field record 4257. 035 145 Field record 1539. 035 150 Greene 1110 (AAS, PC). 040 155 Field record 1552. 045 145 Field record 1564. 045 150 Field record 1575

050 135 Field record 4126. 050 140 Field record 4146. 050 150 Lindsay 3743 (AAS, CHR, MEL). 050 155 Field record 4965. 055 135 Field record 4058. 055 140 Field record 4030. 055 145 Field record 3923. 055 150 Clarke and Greene CG26 (AAS, SGO). 055 155 Field record 4934. 060 135 Field record 3997. 060 150 Field record 3812. 065 140 Field record 3727. 070 125 Field record 3849. 070 130 Field record 3784. 070 135 R. Smith 1541 (AAS). 070 140 Field record 7285. 070 145 Greene 1183 (AAS), Greene 1201 (AAS). 070 150 Field record 4283

075 120 Field record 4100. 075 125 Field record 4178. 075 130 Field record 3772. 075 135 Field record 3893. 075 145 Field record 1583. 080 125 Greene 2604 (AAS, IAA), J. Smith M216 (AAS). 080 135 Field record 3827. 080 140 Field record 3822. 090 100 Field record 6211. 090 140 Field record 7356. 090 145 Greene 1749 (AAS). 095 115 Field record 7359. 095 140 Field record 1601. 095 145 Field record 1596

100 115 Field record 7374. 100 145 Field record 1608. 105 110 Field record 7391. 110 105 Field record 7395. 110 110 Field record 7405. 115 130 Field record 4631. 115 135 Greene 1483 (AAS, S, SGO, TNS). 115 140 Field record 5297. 120 095 Field record 6296. 120 120 Field record 4421. 120 130 Greene 3035b (AAS, MEL). 120 135 Field record 4599

125 095 Field record 6326. 125 115 Field record 1636. 125 120 Field record 1629. 125 125 Field record 1620. 125 130 Skottsberg s.n. (S, as *U. granulifera*). 130 090 Field record 6347. 130 110 Field record 4382. 130 115 Field record 1674. 130 120 Greene 197 (AAS), Greene 1869 (AAS, CHR), Lindsay 3153 (AAS, CHR), Lindsay 3217 (AAS, IAA), Lindsay 3349 (AAS, H), Lindsay 3380 (AAS), Lindsay 4327 (AAS, S), R. Smith 963 (AAS). 130 125 Greene 1979 (AAS, FH), Greene 3491 (AAS, US), Lindsay 3114 (AAS, H), Lindsay 3121 (AAS), J. Smith M206 (AAS), R. Smith 1331 (AAS). 135 115 Lindsay 3458 (AAS, BM). 135 120 Field record 4323. 140 080 Field record 6414. 140 105 Field record 4196. 140 110 Field record 4202. 140 115 Field record 1692. 140 120 Greene 939 (AAS, BM, H, PRE). 145 070 Field record 6439. 145 100 Field record 7465

155 055 Lindsay 4416 (AAS, CHR). 155 095 Greene 2222 (AAS, LE). 155 100 Lindsay 3957 (AAS, PC, PRE). 160 055 Lindsay 4462 (AAS). 160 060 Field record 4906. 160 065 Field record 7485. 160 090 Field record 4454. 160 095 Field record 5109. 160 100 Field record 5074. 165 055 Field record 7489. 165 060 Field record 5309. 165 075 Field record 4728. 165 080 Field record 4755. 165 085 Field record 4546. 165 090 Field record 4505. 170 065 Lindsay 3727 (AAS, LE, S). 170 070 Lindsay 3693 (AAS). 170 090 Lindsay 3491 (AAS), Lindsay 3544 (AAS, TNS, US)

175 060 Field record 7515. 175 065 Field record 4849. 175 070 Field record 4797

Usnea aurantiacoatra (Jacq.) Bory

070 150 Field record 4284. 090 145 Trøim 8 (TRH)

130 120 Trøim 27 (TRH)

Inadequately localized

Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S)

Usnea fasciata Torrey

020 150 Field record 1491. 020 155 Field record 1498

030 145 Field record 1525. 030 150 Greene 2000 (AAS). 030 155 Greene 1161 (AAS, LE), Lindsay 3060 (AAS, CHR). 035 145 Field record 1540. 035 150 Field record 6619. 040 150 Greene 755 (AAS, CHR). 040 155 Field record 1553. 045 145 Field record 1565. 045 150 Field record 1576

050 135 Field record 6633. 050 145 Field record 7263. 050 155 Field record 4990. 055 135 Field record 6623. 055 140 Greene 1154 (AAS, IAA). 055 145 Field record 3706. 055 150 Lindsay 3850 (AAS, H). 055 155 Field record 4955. 065 140 Field record 3726. 070 125 Field record 3848. 070 130 Field record 3785. 070 150 Field record 4282. 070 155 Field record 7289

075 125 Field record 4179. 075 130 Field record 3773. 075 135 Field record 3892. 075 145 Field record 1584. 075 150 Field record 7300. 080 125 Greene 2603 (AAS, S, SGO). 080 130 Field record 4156. 080 135 R. Smith 1531 (AAS). 080 140 Field record 3823. 090 115 Field record 7321. 090 125 Field record 7344. 090 145 Greene 1741 (AAS). 095 115 Field record 7363. 095 140 Field record 1602. 095 145 Field record 1597

100 145 Field record 1609. 105 110 Field record 7393. 110 105 Field record 7399. 110 110 Field record 7406. 115 100 Field record 6289. 115 130 Greene 3062 (AAS, BM, H, PC, TNS, US). 115 135 Field record 4709. 115 140 Field record 5298. 120 130 Greene 3035a (AAS). 120 140 Field record 5275

125 095 Field record 6327. 125 115 Field record 1637. 125 120 Greene 1071 (AAS, FH). 125 125 Greene 1617 (AAS, MEL, PC). 130 095 Field record 7451. 130 115 Field record 1675. 130 120 Lindsay 3216 (AAS, S), Lindsay 3366 (AAS, MEL). 130 125 Lindsay 4285 (AAS). 135 085 Field record 6365. 135 090 Field record 6380. 135 115 Lindsay 3462 (AAS). 135 120 Field record 4324. 140 075 Field record 6410. 140 115 Field record 1693. 140 120 Field record 1684. 145 110 Field record 6588

150 065 Field record 6459. 155 055 Lindsay 4417 (AAS, US). 155 095 Greene 2224 (AAS, PRE), Lindsay 4138 (AAS). 160 090 Field record 4460. 160 095 Field record 5132. 160 100 Lindsay 4036 (AAS). 165 055 Field record 7497. 165 065 Field record 7503. 165 075 Field record 4740. 165 085 Field record 4558. 165 090 Field record 4526. 170 090 Field record 4441

175 065 Field record 4855. 175 070 Field record 4819

Inadequately localized

Moraine Fjord, 29.iv.1902, Skottsberg s.n. (S)

Usnea igniaria Mot.
035 145 BAS Misc. 72 (AAS)

Xanthoria candelaria (L.) Th. Fr. f. *antarctica* (Vain.) Hillm.
130 120 R. Smith 1726 (AAS)
155 095 Lindsay 4041 (AAS)

Xanthoria elegans (Link) Th. Fr.
020 150 Field record 1487. 020 155 Field record 1494
025 150 Field record 1505. 035 145 Field record 1535. 040 155 Field record 1454
050 155 Field record 4966. 055 145 Field record 3930. 055 150 Field record 5027. 070 130 Field record 3878
090 145 Greene 1748 (AAS). 095 140 Field record 1599. 095 145 Field record 1593
100 145 Field record 1606. 120 135 Field record 4600
125 125 Field record 1617. 130 110 Field record 4383. 130 120 Field record 1661. 130 125 Greene 3482a (AAS), Trøim 6 (TRH). 135 120 Lindsay 3434 (AAS). 140 115 Field record 1690. 140 120 Greene 944 (AAS), Greene 977 (AAS), Lindsay 4236 (AAS)
155 095 Lindsay 3895 (AAS). 160 060 Greene 2465 (AAS). 160 095 Lindsay 4089 (AAS). 160 100 Lindsay 4019 (AAS). 165 080 Field record 4756. 165 085 Field record 4547. 165 090 Field record 4506. 170 065 Field record 4871. 170 090 Field record 4427
175 070 Field record 4799

APPENDIX B

Fungal Parasites

Fungal parasites of lichens are apparently of infrequent occurrence in the Antarctic and sub-Antarctic (e.g. Vainio, 1903; Dodge, 1948) and so it is of interest to record their presence on macrolichens on South Georgia. Unfortunately, the taxonomy of these parasites is poorly known and only one can be definitely identified to species level. It is hoped, however, that the following brief notes will be of value and allow recognition of the taxa.

Discothecium gemmiferum (Tayl.) Vouaux

Perithecia immersed in host tissue with only the ostiole emergent, black, up to 0·5 mm. in diameter, spherical, with entire, carbonaceous involucrellum; ascospores 8 per ascus, brown, ellipsoid, 1-septate, 12–15 by 4–6 μm. Appearing as minute black dots scattered over the thallus of *Caloplaca dimorpha* and *Xanthoria elegans*, especially in the apothecial discs.

Two varieties of *D. gemmiferum* were reported from South Georgia by Zahlbruckner (1917, p. 48–49) as growing on species of *Caloplaca*. *Didymosphaeria placodiorum* Vain., which was described as a parasite of *Caloplaca* from the Antarctic Peninsula by Vainio (1903, p. 39) may prove to be a synonym of *Discothecium gemmiferum*, as may *Didymosphaeria kuttlingeriae* C. W. Dodge from Iles Crozet and *D. macquariensis* C. W. Dodge from Macquarie Island described by Dodge (1948, p. 263–64) as parasites on various species of *Caloplaca*.

Specimens examined
160 100 Lindsay 4007b (AAS), Lindsay 4009b (AAS), Lindsay 4014b (AAS).

Guignardia sp.

Perithecia black, spherical up to 1 mm. in diameter, immersed in gall tissue which is concolorous with rest of podetium, so that only black ostiole *c.* 0·2 mm. in diameter is apparent, surrounded by ± continuous, thin, carbonaceous involucrellum; asci clavate, bitunicate, ascospores 8 per ascus, 7–9 μm., by 3–4 μm., hyaline, ellipsoid, simple, thin-walled. Forming conspicuous, spherical galls up to 2 mm. in diameter near the tips of the podetia of *Cladonia furcata*.

This species superficially resembles *Didymella cladoniae* C. W. Dodge, described as a parasite of *Cladonia mawsonii* C. W. Dodge on Macquarie Island (Dodge, 1948, p. 262), but it differs in having simple, instead of 1-septate ascospores.

Specimen examined
165 085 Lindsay 3582b (AAS).

Lecidea sp.

Apothecia lecideine, black, convex, immarginate, with no trace of proper margin at any stage of development, up to 6 mm. in diameter. Epithecium aeruginose, up to 10 μm. thick, hymenium hyaline, up to 140 μm. tall, hypothecium pallid, merging gradually or abruptly with host tissues, paraphyses unbranched, *c.* 1 μm. in diameter, becoming capitate at apices to *c.* 3 μm. in diameter; asci very rarely developed, clavate, thin-walled, up to 65 μm. by 20 μm., ascospores 4 per ascus, hyaline, simple, ellipsoid, thin-walled, without oil droplets, 15–18 μm. by 7–10 μm. Forming conspicuous black galls particularly on the main branches of *Usnea antarctica*.

Although Lamb (1964, p. 11) considered these apothecia to be galls, since he never found asci or ascospores in sections, the author considers this is a case of arrested development, a feature common to many of the South Georgian macrolichens and some of the microlichens, e.g. *Ochrolechia* (Lindsay, 1971*e*). Although apothecia may be produced fairly frequently, differentiation of asci and ascospores occurs only rarely, mainly in material from very sheltered habitats.

Phacopsis usneae C. W. Dodge, described as a parasite on *Usnea trachycarpa* (Stirt.) Müll. Arg. from Iles Kerguelen by Dodge (1948, p. 264), may resemble this species superficially, but it is distinguished by the smaller (10–12 μm. by 3·5–4 μm.), fusiform ascospores.

Specimen examined
130 120 Lindsay 3349b (AAS).

Lecidea sp.

Apothecia adnate, black, minute, up to 1 mm. in diameter, lecideine, with persistent, smooth, proper margin, disc plane, black; epithecium aeruginose, up to 15 μm. thick, hymenium hyaline, up to 120 μm. tall, hypothecium pallid; ascospores 8 per ascus, hyaline, ellipsoid, thin-walled, simple, 7–10 μm. by 3–4·5 μm. Appearing as minute black discs on phyllocladia towards the tips of pseudopodetia of *Stereocaulon glabrum*.

Specimen examined

050150 Lindsay 3789b (AAS).

APPENDIX C

Index to Genera and Species

(Synonyms are shown in italics)

PLATE I

a. *Cetraria islandica* (L.) Ach. (from Lindsay 3435).

b. *Cladia aggregata* (Sw.) Nyl. (from Lindsay 3035).

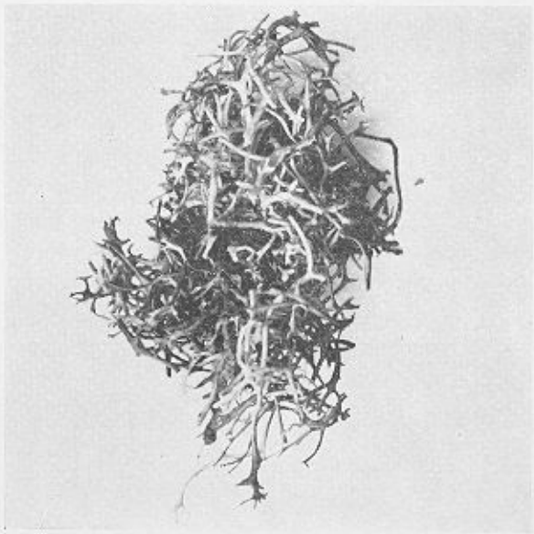
c. *Cladonia balfourii* Cromb. f. *chlorophaeoides* (Vain.) Evans (from Lindsay 3120).

d. *Cladonia bellidiflora* (Ach.) Schaer. var. *austrogeorgica* D. C. Lindsay (from Greene 2576).

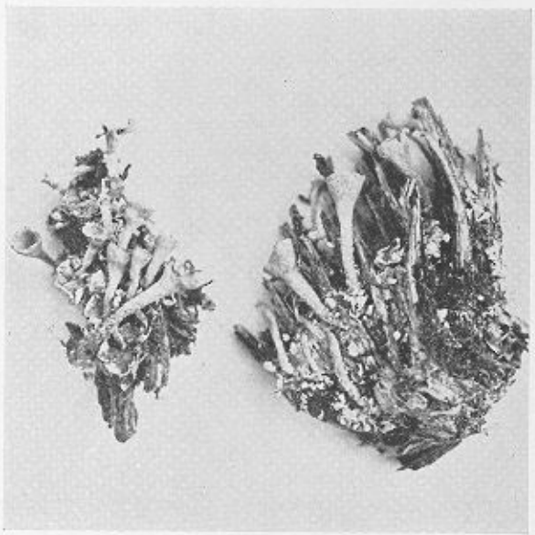
e. *Cladonia gracilis* (L.) Willd. subsp. *elongata* (Jacq.) Ahti (from Greene 2225).

f. *Cladonia gracilis* (L.) Willd. subsp. *gracilis* (from Longton 459).

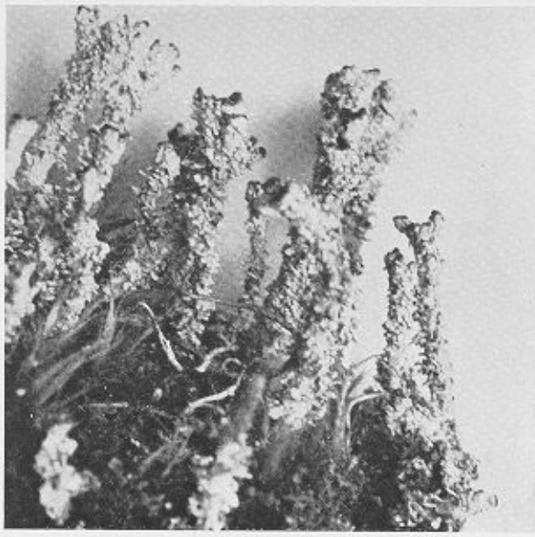
a



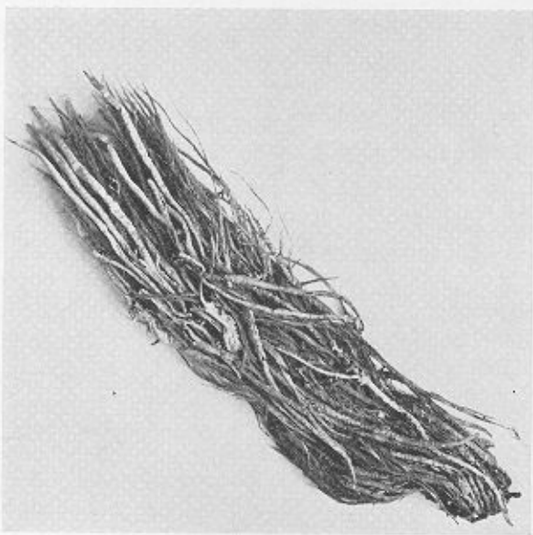
b



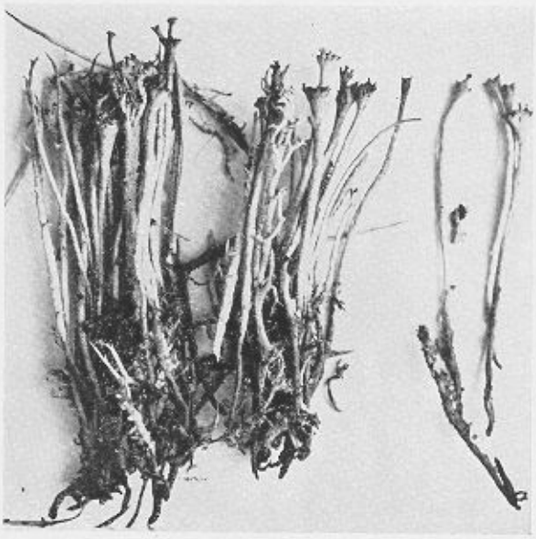
c



d



e



f

PLATE II

a. *Dermatocarpon intestiniforme* (Körb.) Hasse (from Lindsay 3884).

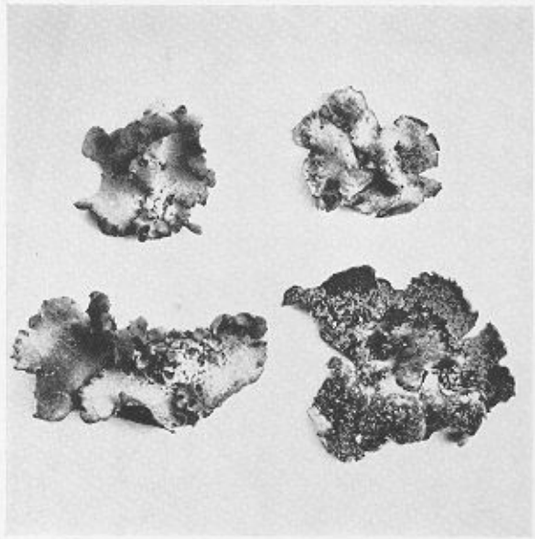
b. *Hypogymnia lugubris* (Pers.) Krog (from Lindsay 3356).

c. *Menegazzia sanguinascens* (Räs.) R. Sant. (from R. Smith 1609).

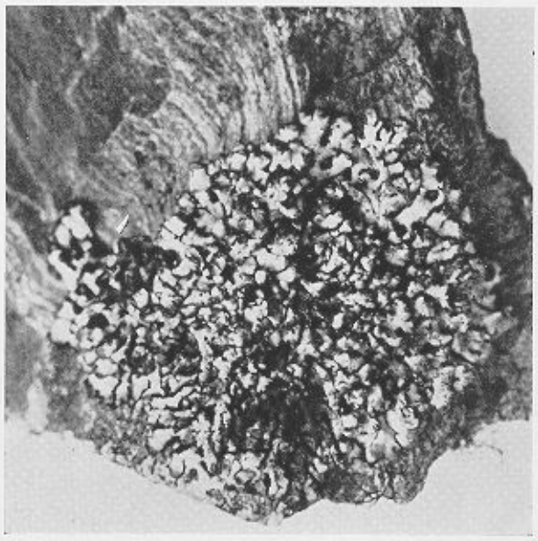
d. *Parmelia gerlachei* Zahlbr. (from Lindsay 3333).

e. *Peltigera canina* (L.) Willd. (from Lindsay 3085).

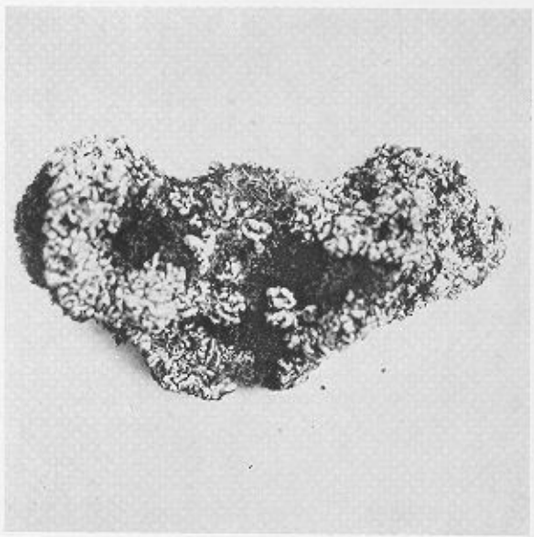
f. *Physcia caesia* (Hoffm.) Hampe (from Lindsay 3446).



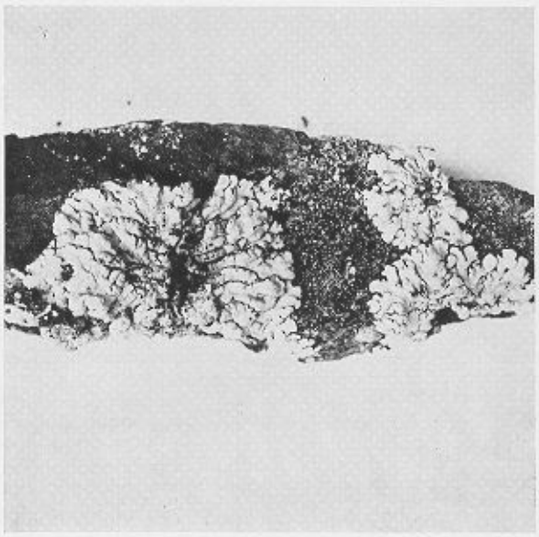
a



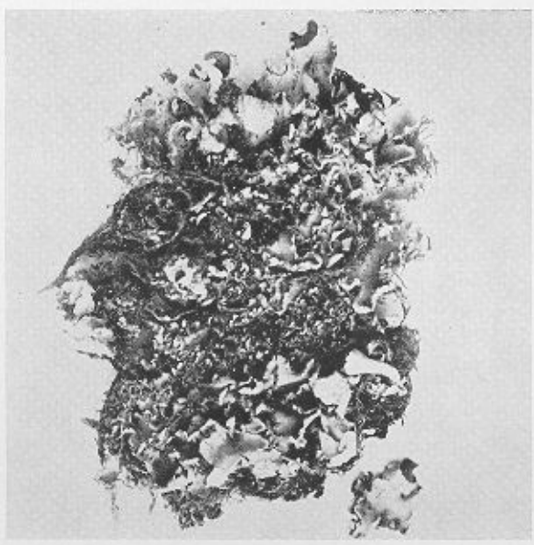
b



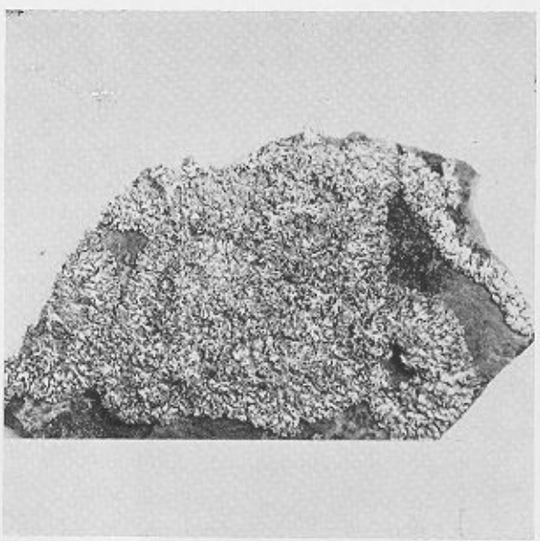
c



d



e



f

PLATE III

a. *Pannaria hookeri* (Borr. ex Sm.) Nyl. (from Lindsay 3954).

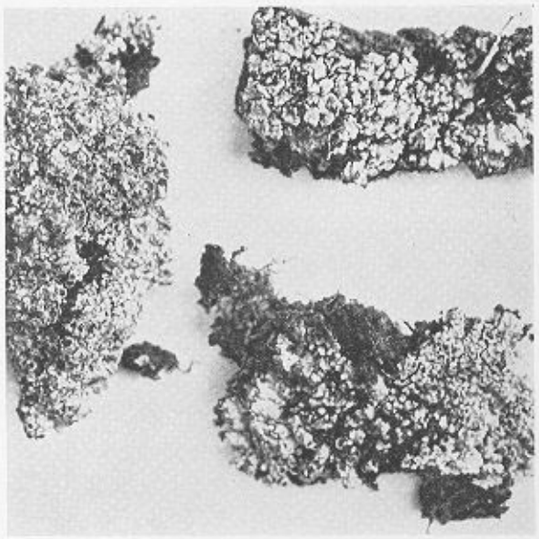
b. *Pseudocyphellaria freycinetii* (Del.) Malme (from Lindsay 3439).

c. *Psoroma ciliatum* (Ach. ex Fr.) Nyl. ex Hue (from Lindsay 3079).

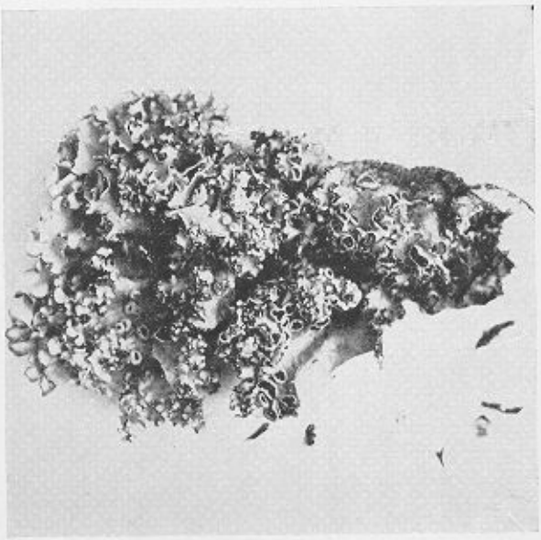
d. *Psoroma hypnorum* (Vahl) Gray (from Lindsay 3080).

e. *Sphaerophorus globosus* (Huds.) Vain. (from Lindsay 3034).

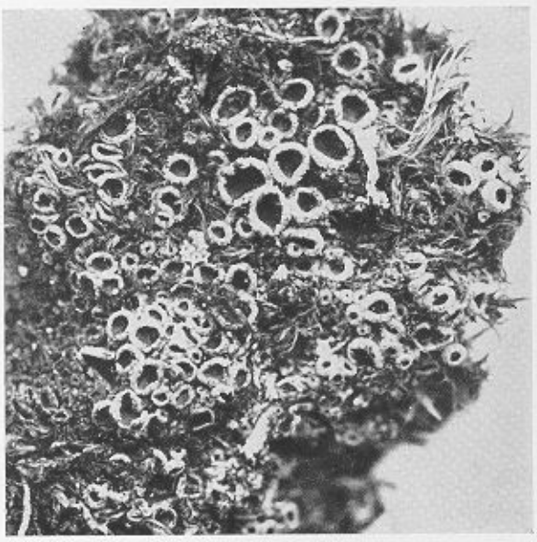
f. *Stereocaulon glabrum* (Müll. Arg.) Vain. (from Lindsay 3626).



a

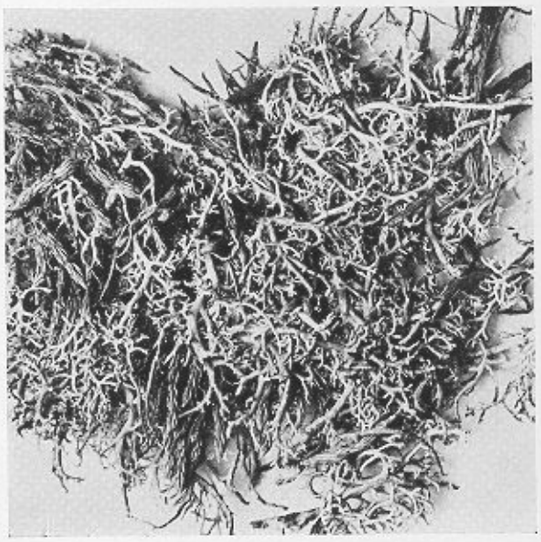


b

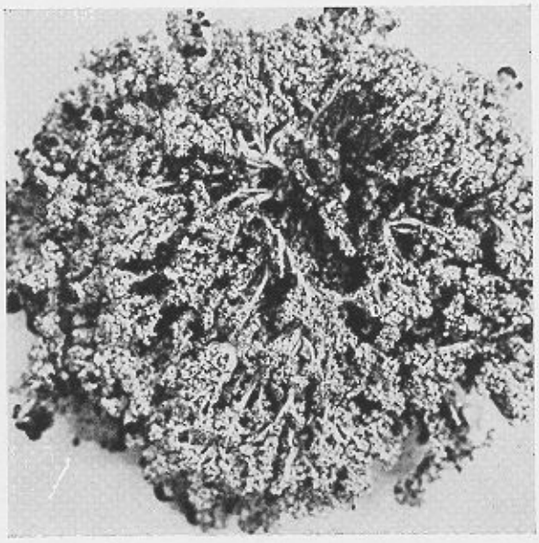


c

d



e



f