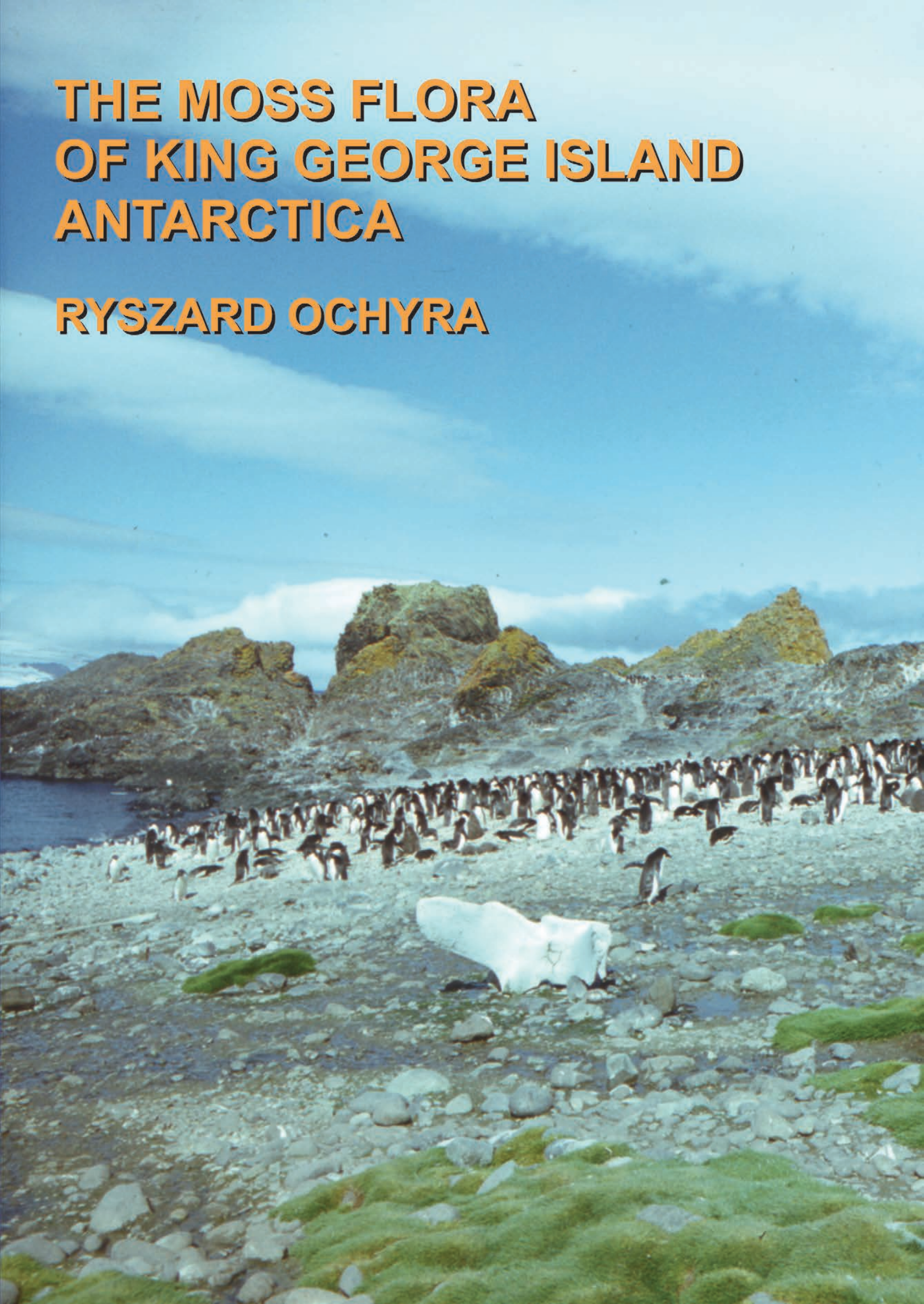
THE MOSS FLORA OF KING GEORGE ISLAND ANTARCTICA

RYSZARD OCHYRA



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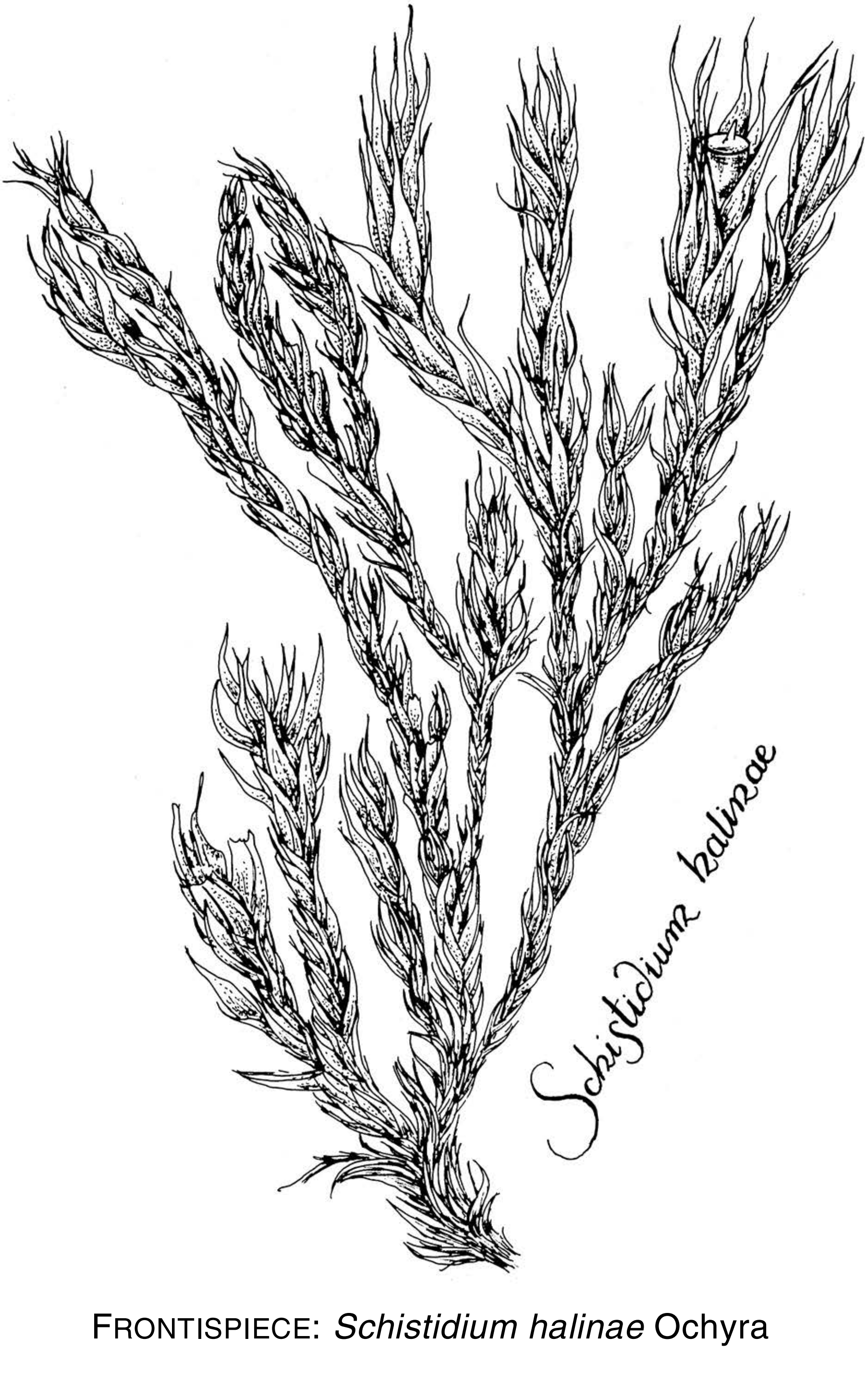

FRONTISPIECE: *Schistidium halinae* Ochyra

THE MOSS FLORA
OF KING GEORGE ISLAND
ANTARCTICA

Ryszard OCHYRA

Polish Academy of Sciences, W. Szafer Institute of Botany
Cracow, 1998

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Dedicated to
Stanley W. Greene
and Ronald I. Lewis-Smith
without whose inspiration
these bryological studies in Antarctica
would not have been undertaken

Table of Contents

List of Illustrations

Taxonomic and nomenclatural changes

New combinations:

New synonyms:

New lectotypes:

Foreword

There is remarkable interest worldwide in biodiversity at present, and yet the training of taxonomists is under serious threat in Europe and North America, and barely exist in the Southern Hemisphere. At the same time, traditional taxonomic methods are being questioned by the application of molecular tools which appear to reveal unexpected phylogenetic relationships. For ecologists, this is both difficult and disturbing. To do ecological work anywhere in the world the field scientist needs the ability to identify the material he is working with. It certainly isn't possible to do DNA analysis in the field yet and so, for the foreseeable future, we will need floras and keys based on morphological and, possibly, simple chemical characteristics that are useable by the field scientist.

The Antarctic flora has only really come under investigation in the 20th century. Indeed, the most important efforts to resolve the taxonomy of the austro-polar cryptogams didn't commence until the mid-1960s. Collections have been made very often by non-biologists who inevitably sampled the most obvious taxa, but usually overlooked the more cryptic taxa, so that their valuable efforts have generally under-represented the flora of a given site. With the extremes of the local climate often causing morphological abnormalities and variants, which are difficult to deal with taxonomically, and with only a small international corpus of qualified cryptogamic taxonomists, the mosses and lichens of the Antarctic have been woefully under-researched.

It is therefore with great enthusiasm that I greet this new detailed bryophyte flora for King George Island, the largest of the South Shetlands archipelago. As one of the richest botanical areas in the Antarctic, and one which has been subjected to more intensive biological research than most others, it is a logical starting point for producing such a regional flora. Even more exciting is that this flora provides an important step towards the production of a bryophyte flora for the whole of the Antarctic, a project which is already well underway. Whilst the initial concept of the latter task was provided by the late Stanley Greene, it is the dedicated enthusiasm and exceptional expertise of Ryszard Ochyra that has taken the task this far. His meticulous work – examining every type specimen and trawling through thousands of other specimens in herbaria worldwide – assures me that the conclusions in terms of species circumscription in this flora are likely to be very soundly based. The addition of his wife Halina's beautifully detailed illustrations will make this a flora both easy to use and a delight to have.

As an ecologist who has worked for over 30 years in the Antarctic, I welcome this volume, and wish to personally thank Ryszard and Halina for their efforts. I commend the vision of the Polish Academy of Sciences in supporting this project which, although it may seem old-fashioned to some, has great practical application and value to many field scientists who will be working in the Antarctic, as well as to bryophyte taxonomists worldwide.

D. W. H. Walton *9 December 1998*

British Antarctic Survey
Cambridge

Preface

Antarctica was the final continent to have been discovered by man and, despite long lasting investigations, knowledge of its natural and biological resources is still incomplete. At the same time it is the great hope of mankind that all the errors committed during the exploration of other continents will be avoided in the Antarctic and consequently its natural environment will be preserved undisturbed. Therefore, in Antarctic Treaty terms, Antarctica is defined as a “continent for science”. Most terrestrial botanical research in this region has so far concentrated on the ecological, physiological and life history aspects of mosses and lichens, which are the main components of the land vegetation. However, biologists must rely on accurate determinations of the plants being studied, for there has always been much confusion regarding the identity of cryptogams, mostly because of slow progress in taxonomic studies. Hence, any handbooks which can facilitate determination of plant specimens are urgently needed for the Antarctic.

The only report with a reasonably comprehensive account of Antarctic mosses is *La flore bryologique des terres magellaniques, de la Géorgie du Sud et de l’Antarctide* by Jules Cardot, published in 1908 and long out of print and date. In fact it was not a classical Flora but only an annotated catalogue of all the mosses discovered in this biome up to 1905. After Cardot’s book no comprehensive treatment of Antarctic mosses appeared until 1970, when British botanists, guided by the late Stanley W. Greene, published the first fascicle of a critical moss Flora of Antarctica. It was the only one of a planned series to appear and included treatment of a few genera and species, but then the project was unfortunately abandoned. Later a few regional floras appeared, for example those covering Enderby Land by Kanda (1987a) and Princess Elizabeth Land by Seppelt (1984, 1986), both in East Antarctica, but no comprehensive modern taxonomic treatment covering any part of West Antarctica has been published.

In 1977, the late Professor Andrzej Środoń, then Deputy Director of the Institute of Botany of the Polish Academy of Sciences, invited me, a newcomer to the Institute, to participate in biological investigations on King George Island, South Shetland Islands, West Antarctica, in the newly established Polish Arctowski Station. It was a great challenge for me because in those days I was a budding bryologist without experience in exotic mosses, having only limited knowledge of East African mosses which I had studied under the guidance of my friend, Professor Tamás Pócs of Eger, Hungary. Thanks to the efforts of Professors Andrzej

Środoń and Krzysztof Birkenmajer, for which I am greatly indebted, my Antarctic voyage became reality when I was appointed a member of the summer group in the IV Polish Antarctic Expedition in 1979–1980. It was the beginning of my long-term involvement in the fascinating world of austral mosses.

In those days I started to compile a bryological bibliography of the region and to accumulate other relevant information on austral mosses. During this initial stage I received special and wide-ranging assistance from the late Dr Stanley W. Greene and Dr Ronald I. Lewis-Smith, the best known botanists ever to have worked in the south polar regions. They supplied me not only with their own publications but also with copies of a formidable amount of other literature relevant to Antarctic botany. I am sure that without their help I could not have overcome all the troubles which face every beginner in the botany of this region. The warm-hearted and willing assistance of Stanley Greene was ended by his sudden and unexpected death in 1989, while long-term cooperation with Ron Lewis-Smith still continues and has resulted in many joint publications on Antarctic mosses. I feel honoured to dedicate this book to Stanley Greene and Ron Lewis-Smith whose inspiration and stimulation developed my great interest in austral mosses.

This book presents the results of taxonomic, distributional and ecological studies on the mosses of King George Island. It is based on material gathered and observations made during my work at Arctowski Station. In addition, I freely used the rich collection of mosses made outside the Admiralty Bay area by Dr Bolesław Jabłoński of Otrębusy near Warsaw, and the specimens collected by Drs Vera Komárková of Leiding, Switzerland, and Florian Schulz, Kiel, and British botanists. I would like to express my gratitude to them for making available their collections from King George Island without which the survey of the island's moss flora would have been less complete. In particular, I am grateful to Florian Schulz for the material of *Notoligotrichum trichodon* which is new to the flora of King George Island.

This book attempts to provide a detailed account of the mosses of King George Island. I have placed special emphasis on the local distribution of all the species encountered on the island because until now no other area of this size, and having such a rich moss flora in Antarctica, has been bryologically surveyed in detail, except for Signy Island in the South Orkney Islands. On the island I collected many species not hitherto recorded in Antarctica, including several new to science, but these will or should have been rediscovered elsewhere by later collectors. Also, I have included here significant extensions of range in the Antarctic for several rare, little known or otherwise noteworthy moss species. Perhaps the most important feature of this account is its clear indication of the abundance and wide geographical range in the Antarctic of several species which, only a few decades ago, were considered to be of great rarity and narrow distribution in southern lands.

The systematic part of the book has been limited to establishing the number of taxa which occur on the island and to providing, by means of brief illustrated descriptions, synoptic definitions of each. The wealth of taxonomic information which I have accumulated during almost twenty years of investigation of austral mosses, with detailed consideration of all the species known from Antarctica, all possible synonymy and full plate illustrations will be presented in the forthcoming *Illustrated Moss Flora of Antarctica* on which I am currently working in cooperation with Dr R. I. Lewis-Smith and my wife, Dr Halina Bednarek-Ochyra. It is expected to be completed in 1999 and it is hoped that it will be an exhaustive taxonomic, bryogeographical and ecological treatment of all the moss species reported from this biome.

The background fieldwork for the present work consisted of a detailed botanical survey of the Admiralty Bay area. I visited and made botanical collections in practically all ice- and snow-free places, and only one or two inaccessible and exceedingly dangerous nunataks were not studied. In addition, I made a botanical reconnaissance of the Fildes Peninsula which is the largest ice-free area on the island, and, at the end of the expedition, I had an opportunity to botanize on Deception Island, famous for its recent volcanic activity.

This exploratory work would not have been possible without the encouragment of the late Professor Andrzej Myrcha, leader of the Expedition, who offered me special facilities at Arctowski Station. Many colleagues were good companions during the fieldwork, namely Edmund Dibowski, Ryszard Halba, Bolesław Jabłoński, Antoni Janasek, Andrzej Kozik, Andrzej Kutner, Tomasz Linkowski, Eugeniusz Moczydłowski, Wojciech Nurkiewicz, Andrzej Paulo, the late Zbigniew Rubinowski, Jacek Siciński, Andrzej Tatur, Antoni Tokarski, Magdalena Tulli, Aleksander Wasilewski and Jacek Zalewski and I am very grateful for their help and comradeship.

My primary duty was the description and mapping of the vegetation cover in the vicinity of the Arctowski Station, but I soon realized that a satisfactory analysis of the vegetation by the Braun-Blanquet method which I had successfully employed in Poland was not possible in the Antarctic, mainly because of poor knowledge of the two principal components of the terrestrial vegetation, namely bryophytes and lichens. Hence, my efforts focused on the accumulation of as much herbarium material as possible which could be used for relevant taxonomic studies. A small fraction of them, comprising 200 numbers, was distributed to 50 world herbaria in *Bryophyta Antarctica Exsiccata* in 1984. Their distribution would not have been possible without the great assistance of Drs Dale H. Vitt and Diana G. Horton of the University of Alberta, Edmonton, Canada, here acknowledged with gratitude. In addition, over the years, hundreds of duplicate specimens have been freely distributed to numerous major botanical institutions which have shown concern for the bryology of southern areas, particularly the British Antarctic Survey (AAS) and the National Institute of Polar Research in Tokyo (NIPR).

From the beginning of my taxonomic work on the mosses of Antarctica I have attempted to take a monographic approach. I located and examined the type of each taxon described from this region and I have also tried to examine all historical collections from Antarctica, and with only a minimal number of exceptions, I have succeeded. It would not have been possible without the cooperation of the Curators and Keepers of many herbaria. In particular, I am grateful to Drs R. I. Lewis-Smith and Helen J. Peat, Cambridge, for providing easy access to the huge bryological collection deposited in the British Antarctic Survey Herbarium (AAS) which has enabled me to resolve many taxonomic problems associated with Antarctic mosses, to Len T. Ellis and Alan Harrington (BM), Denis Lamy and Helene Bischler (PC), Olga M. Afonina (LE), Lars Hedenäs and Thor-Björn Engelmark (S), Timo Koponen, Sinikka Piippo and Johannes Enroth (H) and Herman Stieperaere (BR) for their assistance and hospitality during any personal visits I made to their herbaria, which together house the largest collections of Antarctic mosses, especially from the early expeditions.

Special thanks are also due to Drs William R. Buck (NY), Chen Fu-Dong, Beijing, Hironori Deguchi (HIRO), Sean R. Edwards (MANCH), Rex B. Filson (MEL), Patricia Geissler (G), Hannes Hertel (H), Klaus Kubitzki and Tassilo Feuerer (HBG), David G. Long (E), Bryony H. Macmillan (CHR), Manuel Mahu, Santiago, Celina M. Matteri, Buenos Aires, Roland Moberg (UPS), Uwe Passauer (W), Katherine Rankin and Harold E. Robinson (US), Catherine Rausch (PC), Jacques van Rooy (PRE), Wolfram Schultze-Motel and Harrie Sipman (B), Sven Snogerup (LD), Heinar Streimann (CBG), T. Tønsberg (BG), Dale H. Vitt (ALTA), Emily W. Wood and Benito C. Tan (FH), William A. Weber (COLO), Bernard O. van Zanten (GRO) and Hans-Joachim Zündorf (JE) who arranged loans of thousands of moss specimens from their herbaria, without which a work of this kind would not have been possible at all. Dr Hiroshi Kanda, Tokyo, kindly allowed me to study the type material of *Ceratodon kinggeorgicus* and his cooperation is also gratefully acknowledged.

Many colleagues assisted me in completing my “Antarctic” library. I would like to express my cordial thanks in particular to Denis Lamy for supplying me with many original copies of J. Cardot’s papers including his main work *La flore bryologique des terres magellaniques, de la Géorgie du Sud et de l’Antarctide* which was originally presented with a dedication to T. Husnot and later possessed by R. Potier de la Varde, two eminent French bryologists. Moreover, Alan J. Harrington and Brian O’Shea, London, Patricia Geissler, Geneva, William R. Buck, New York and Timo Koponen, Pekka Isoviita, Sinikka Piippo and Johannes Enroth, Helsinki, have always given me a helping hand and copied many taxonomic papers not readily accessible.

It was difficult to prepare quickly a comprehensive report on the moss flora of King George Island because most of the genera required detailed taxonomic study over a broad geographical range, so I have been able to publish only the most important discoveries. The resolution of many taxonomic problems would not have been possible without discussions with and the cooperation of many specialists, who have shared with me their special knowledge of and insights into various groups of mosses. I am much indebted to B. Graham Bell, Penicuik (various taxa), Hans H. Blom, Trondheim (*Schistidium*), Lars Hedenäs, Stockholm (*Sanionia*), Mikhail S. Ignatov, Moscow (*Brachythecium*), the late Jette Lewinsky, Copenhagen and Kuopio (Orthotrichaceae), Philip J. Lightowlers, Cambridge (*Syntrichia*), Celina M. Matteri, Buenos Aires (various taxa), Jesús Muñoz, Pravia (*Grimmia*), Barbara M. Murray, Fairbanks (*Andreaea*), Martha E. Newton, Manchester (*Anisothecium*), Harumi Ochi, Tottori (*Bryum*), Rodney D. Seppelt, Kingston (*Ditrichum*), Ron I. Lewis-Smith, Cambridge (various taxa), Dale H. Vitt, Edmonton (various taxa), and Richard H. Zander, Buffalo (*Didymodon* and *Bryoerythrophyllum*) for their valuable suggestions and constructive comments which have enabled me to avoid many errors.

I obtained also valuable information from Professors Stanisław Rakusa-Suszczewski, Warsaw and Krzysztof Birkenmajer, Cracow, and Drs S. Maciej Zalewski and Piotr Głowacki, Warsaw, regarding King George Island, and their help is gratefully acknowledged. Dr Johm J. Engel, Chicago, made me available an outline map of the Southern Hemisphere and Celina M. Matteri, Rodney D. Seppelt and Heinar Streimann assisted me in the location of difficult collecting sites for which I thank them very much. I am also greatly indebted to Drs R. I. Lewis-Smith and Florian Schulz for critical reading the manuscript and their valuable criticism suggestions which saved me from many errors. I would also like to express my gratitude to the former for his many linguistic suggestions which considerably improved the text. Dr David W. H. Walton, head of the Terrestrial and Freshwater Life Sciences Division, British Antarctic Survey, Cambridge, kindly agreed to write a foreword to this book and I am pleased to thank him for his encouraging words.

For the financial support of my laboratory research through the years and publication of this book, I acknowledge with gratitude Grant No 6P204 02006 from the State Committee for Scientific Research. To the Institute's directors between 1977 and 1998 I am deeply grateful for their many kindnesses and creating the favourable conditions for my taxonomic research.

Lastly, I would also like to thank heartily several persons who directly contributed much to the production of this book. Mrs Katarzyna Biłyk generated all the distribution maps, Mr Marian Wysocki actively cooperated with me on the layout and acted as typesetter and Mr Jacek Wieser designed the cover and assisted in completing some distribution maps. I am grateful to Drs Jacek Siciński, Łódź, Andrzej Kozik, Katowice, and Ryszard Halba, Warsaw, for several photographs which appear as as illustrations. Very special thanks are due to Mr Arthur Copping, Roydon, Diss, UK, for his kind verification and on occasion outright correction of the English and careful proofreading, which have saved me from many egregious errors, and to Mr Brian O'Shea, London, Dr Helen J. Peat, Cambridge, and Mr Robin Stevenson, King's Lynn, who sent on to him emailed parts of the manuscript. And last but not least, I would like to thank heartily my wife, Halina Bednarek-Ochyra, for her illustrations and constant encouragement and indulgence, without which my work on this flora would not have been so effective.

Ryszard Ochyra *Cracow, 9 November 1998*

Chapter 1

INTRODUCTION

An opinion of the existence of an Antarctic Continent has prevailed ever since the discovery of America rendered us more intimately acquainted with the figure of the earth; nor, when all the circumstances that led to it are considered, can it be called an unreasonable opinion. The vast quantity of floating ice in the higher southern latitudes, justly indicated its origin to be in fresh water rivers and lakes, at no great distance.

Anonymous, *Important discovery*, 1820

The Antarctic continent is centred around the southern pole and is surrounded by the vast Southern Ocean (Fig. 1). It once formed part of Gondwana and its present isolated position is a result of the break-up of this supercontinent and subsequent continental drift during the Mesozoic and early Cainozoic eras. Geologically, Antarctica consists of two parts separated by an ice-filled channel extending below sea level beneath the central ice-plateau. The larger eastern part is a very old, relatively stable continental shield, whereas the western part is a relatively unstable area in which mountains have been formed at various times.

The general belief held for a long time that the Antarctic regions were almost destitute of botanical interest was amply justified until the end of the nineteenth century when a relatively rich plant life was discovered and described as a result of several expeditions undertaken by various nations in the last decade of the XIXth century and in the first decade of the XXth century. The recent renewed interest in the Antarctic, dating from the International Geophysical Year 1957–1958, has shown that the south polar flora, poor as it may be, is nonetheless in some respects richer than was supposed and the huge amount of information now available allows a detailed characterization to be made of the flora in this biome.

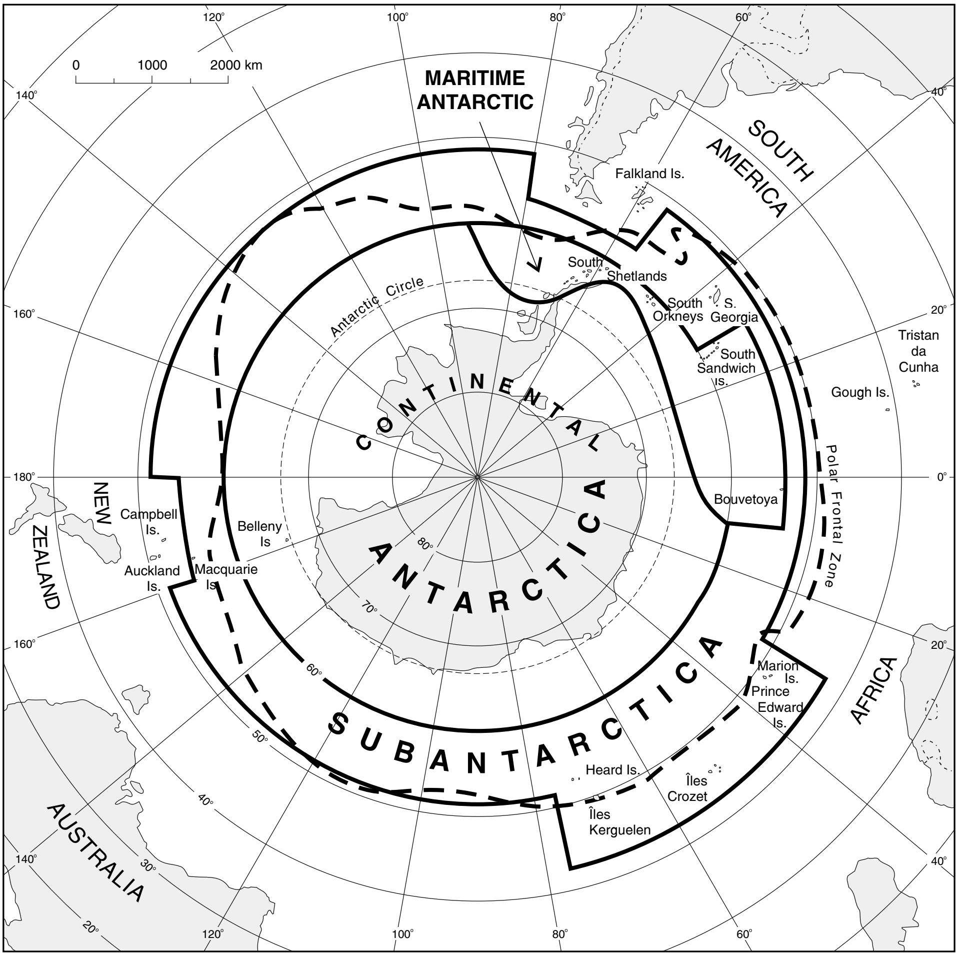

FIGURE 1. Antarctica, the Southern Ocean and subantarctic islands, showing Polar Frontal Zone (PFZ) which is known as Antarctic Convergence in the older literature and subdivisions of the Antarctic into provinces (after Greene, 1964, modified).

The macroscopic terrestrial vegetation and the biology of the Antarctic biome have been discussed in general terms many times. Compared with the first accounts by Rudmose Brown (1906, 1912, 1923, 1928) and Skottsberg (1912), subsequent treatments (e.g. Nordenskjöld, 1928; Siple, 1938; Llano, 1956, 1965; Greene, 1964; Holdgate, 1964, 1967; Wace, 1965; Rudolph, 1966, 1971; Longton, 1967; Lamb, 1970; Ando, 1979; Bliss, 1979; Ochyra, 1983, 1984a; Pickard & Seppelt, 1984; Seppelt *et al.*, 1998) have reflected the progress made in acquiring knowledge of the terrestrial botany of the southern polar region. The most comprehensive accounts of Antarctic terrestrial botany have recently been provided by Lewis-Smith (1984a, 1993a, 1993b, 1996).

Antarctica has been defined in various ways but, for the purpose of the present work, it is considered as all land south of latitude 60^{o}S together with the South Sandwich Islands archipelago and the remote island of Bouvetøya. The main part of this region is occupied by the Antarctic continent. Although this landmass covers about 14.5 million km^2, only about 1% of its surface is ice-free in summer. Accordingly, plant life is restricted to ice-free coastal sites and isolated inland outcrops and nunataks.

The Antarctic biome may be subdivided biogeographically into latitudinal zones which correspond to distinct climatic regions. They have been variously interpreted in earlier accounts (e.g. Skottsberg, 1960; Godley, 1960; Wace, 1960) but at present the system proposed by Greene (1964) and in greater detail by Lewis-Smith (1984a) has gained wide acceptance. This system was also basically adopted by Longton (1988), but with a revised nomenclature. He used the prefixes mild-, cool-, cold- and frigid-, each relating to Arctic and Antarctic regions supporting physiognomically similar vegetation. The following outline is taken from Lewis-Smith (1984a).

(1) The Subantarctic zone, or cool-Antarctic according to Longton (1988), contains eight small isolated island groups from South Georgia in the west to Macquarie Island in the east including, additionally, Marion and Prince Edward Islands, Îles Crozet, Îles Kerguelen, Heard Island and McDonald Islands, scattered in the vast Southern Ocean. They have cool oceanic temperate climates with mean monthly temperatures above freezing point for at least half the year and a precipitation of over 90 cm per annum. The flora is generally depauperate and the tundra-like vegetation is devoid of arborescent vascular plants and is composed mostly of woody herbs, forbs, pteridophytes and cryptogams. In some lowland areas grass heath, herbfields and mires are extensive, with tussock grassland widespread in coastal regions, while fellfields and barren areas occur extensively on non-glaciated terrain in the uplands and some exposed lowlands.

(2) The maritime Antarctic, or cold-Antarctic sensu Longton (1988), comprises the west coast of the Antarctic Peninsula and the neighbouring archipelagoes of the South Shetland, South Orkney and South Sandwich Islands as well as the island of Bouvetøya at about lat. 55^{o}S. It has a cold moist oceanic climate with mean monthly temperatures exceeding 0^{o}C for 1–4 months and precipitation of 35–50 cm per annum. In summer some of this falls as rain. Floristically, the area possesses two species of vascular plant and has relatively rich and diverse bryophyte and lichen floras.

(3) The continental Antarctic or frigid-Antarctic (after Longton 1988) includes the remaining part of the continent including the eastern coast of the Antarctic Peninsula and the southern part of Alexander Island. The climate in this zone is

harsh with an average monthly temperature never exceeding freezing point and annual precipitation ca 10–15 cm of equivalent rainfall. This zone is very poor botanically. It lacks vascular plants, and cryptogams are sparse and represented mostly by lichens. While the east coast of the Antarctic Peninsula is regarded as an extension of the coastal continental zone, there are some isolated areas with a relatively diverse cryptogamic flora, especially around James Ross Island, and also on the eastern coast of Alexander Island. Continental Antarctica may be subdivided into a coastal zone, which is climatically more favourable, and an inland one with a very dry, cold climate and a flora composed almost entirely of lichens.

An alternative biogeographical subdivision of the Antarctic biome was presented by Bliss (1979), who developed a general classification system that embraced comparable Northern and Southern Hemisphere vegetation. He combined alpine, arctic, and antarctic vegetation into one classification system and defined the Antarctic as comprising closed vegetation of grass-forb, herbfield, dwarf shrub, mire and open cushion fellfield found at higher elevations. According to this system Antarctica includes the southern islands of Macquarie Island, Îles Kerguelen, Heard Island, Prince Edward Island, Marion Island, Îles Crozet, South Georgia, the South Shetlands and South Orkneys. Thus, in this system, Antarctica and Subantarctica are merged into a single unit, a not altogether satisfactory situation because the impoverished southern flora has a different balance of life forms from that further north (Lewis-Smith, 1984a).

Chapter 2

KING GEORGE ISLAND

> The first sight you have of the land, is at a distance of about 15 leagues, and its appearance is similar to a white cloud, ranging along the horizon from N.E. to S.W. Still standing on, you gain the land, until some parts touch the clouds, the whole being covered with eternal snow, save here and there a hill in the form of a cone of sugar-loaf, which is of very dark colour, and these spots are generally on the tops of mountains. Three of these are very remarkable; one over Esther Harbour, one over the Bay of Destruction, and one over Potter's Cove.
>
> R. Sherratt, *Observations on South Shetland*, 1821

LOCATION

King George Island is a member of the South Shetland Islands. This archipelago lies approximately 770 km south-east of Cape Horn, from which it is separated by Drake Passage, and almost 160 km north of Trinity Peninsula, the northernmost part of the Antarctic Peninsula from which it is divided by the Bransfield Strait (Fig. 2). The island group stretches for nearly 530 km in a south-west to north-east direction parallel to the Antarctic Peninsula and forms part of the Scotia Ridge, which is a continuous submarine ridge joining South America and Antarctica. Because the island group lies between lat. 61^{o} and 63^{o}S and long. 53^{o} and 63^{o}W, it falls as a whole within the limits of the Antarctic botanical zone as defined by Greene (1964) and specifically within its maritime Antarctic province (Holdgate, 1964; Lewis-Smith (1984a).

The South Shetland Islands consist of about 15 large islands with numerous offshore islets, skerries and rocks. Elephant and Clarence Islands and the three smaller Aspland, O'Brien and Gibbs Islands constitute the northern group, lying about 130 km north-east of the main central cluster which consists of seven large islands comprising King George, Nelson, Robert, Greenwich, Livingston, Decep-

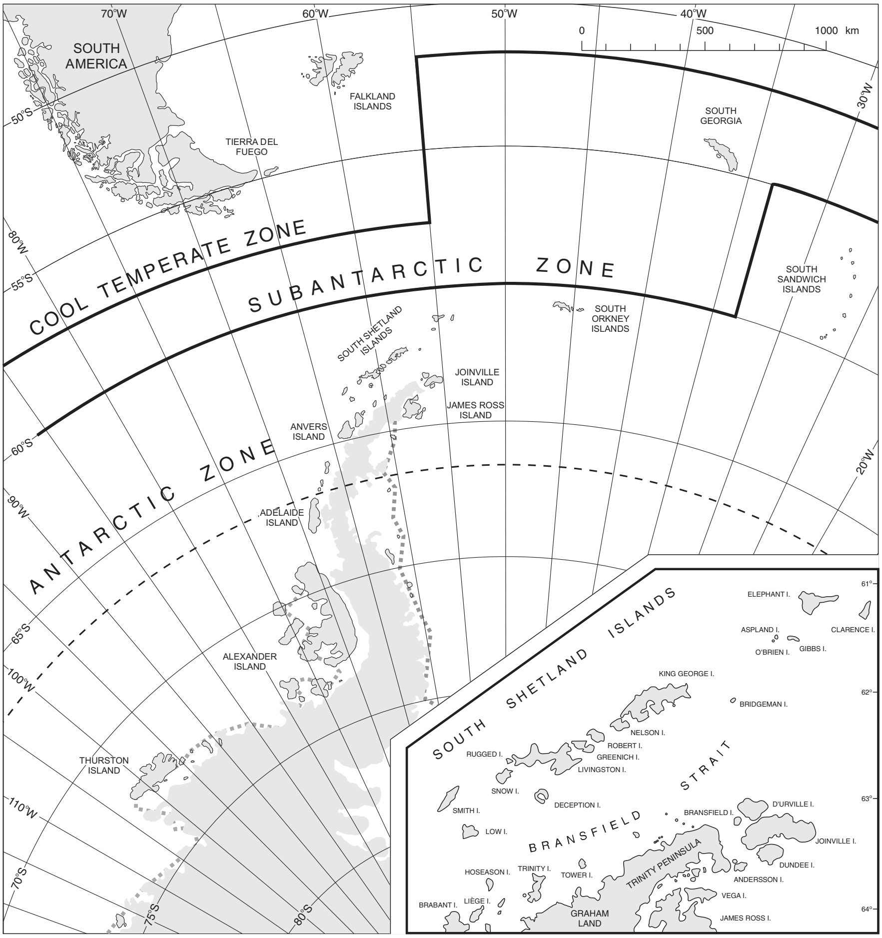

FIGURE 2. The Scotia Ridge and Antarctic Peninsula, showing botanical zones and position of the South Shetland Islands. Inset: The South Shetland Islands, showing location of King George Island.

tion and Snow Islands, together with the somewhat remote Bridgeman Island. Smith and Low Islands form the southern group of the archipelago, lying about 53 km south of Snow Island.

Some of the South Shetland Islands have experienced recent volcanic activity, namely Bridgeman, Penguin and Deception Islands. Three major eruptions occurred on the latter island in 1967, 1969 and 1970, considerably affecting the vegetation cover (Collins, 1969; Young & Kläy, 1971; Lewis-Smith, 1984b, 1984c, 1988a). On the other hand, Penguin Island near King George Island is a small dormant volcano, and the most recent volcanic activity probably occurred in the later 1800s (Birkenmajer, 1980a, 1982a).

King George Island is situated between lat. 61°50′ and 62°15′S and long. 57°30′ and 59°01′W, and is the largest in the South Shetland Islands archipelago. It stretches from south-west to north-east and is somewhat crescent-shaped, about 65 km long by up to 40 km wide, although its width varies considerably due to several embayments, which penetrate deeply into the island (Fig. 3).

TOPOGRAPHY

King George Island is not particularly mountainous, reaching a height of 686 m above sea level at the north-eastern end of the Arctowski Icefield. In this respect it contrasts markedly with some of the other islands of the South Shetlands which are very high and steep. For example, Mount Foster on the small Smith Island reaches 2105 m above sea level and is the highest peak in the archipelago. Likewise, Livingston Island is very mountainous towards its eastern end, its highest peak, Mount Friesland, being over 1760 m above sea level. The highest ice-free nunatak on King George Island, Rolnicki Buttress overlooking Sherratt Bay, reaches 549 m; others are usually much lower and only a few of them exceed 300 m, including Ternyck Needle (433.6 m) (Fig. 4), The Tower (366.9 m) and Florence Nunatak (342.4 m). They are concentrated mainly in the middle section of the island in the proximity of Admiralty Bay.

The coastline is very indented and embayed, especially in the southern part of the island facing Bransfield Strait. The coasts consist mainly of high sea cliffs which are interrupted by many glaciers and icefalls, although some have restricted areas of flat ground in front of them. The southern coast is much the more varied, having four large embayments, Maxwell, Admiralty, King George and Sherratt Bays. They provide a variety of harbours and anchorages, some deep, others with rocks and reefs; many of them have a glacier at their head. The northern and north-eastern shores have far fewer embayments, many more glaciers and comparatively few safe anchorages. Here, there are only two prominent embayments, Corsair Bight and Venus Bay, while Destruction Bay marks the north-eastern end of the island. Permanent snow begins at about 150 m on the exposed north side and 100 m on the protected parts of the south and south-west sides of the island.

Most of the island's beaches are fine shingle, although a few are sandy. Otherwise, where the shores are not glaciers or cliffs, wave-cut platforms are not uncommon and some are easily passable on foot at low tide. Glacier snouts, which reach the ocean or waters of the bays or fjords, can be very spectacular, especially when enormous pieces break off and crash into the water. Pieces of icebergs, growlers and brash infest many bays and fjords, especially after storms, making navigation hazardous.

Admiralty Bay is the largest embayment on King George Island (Fig. 8). It

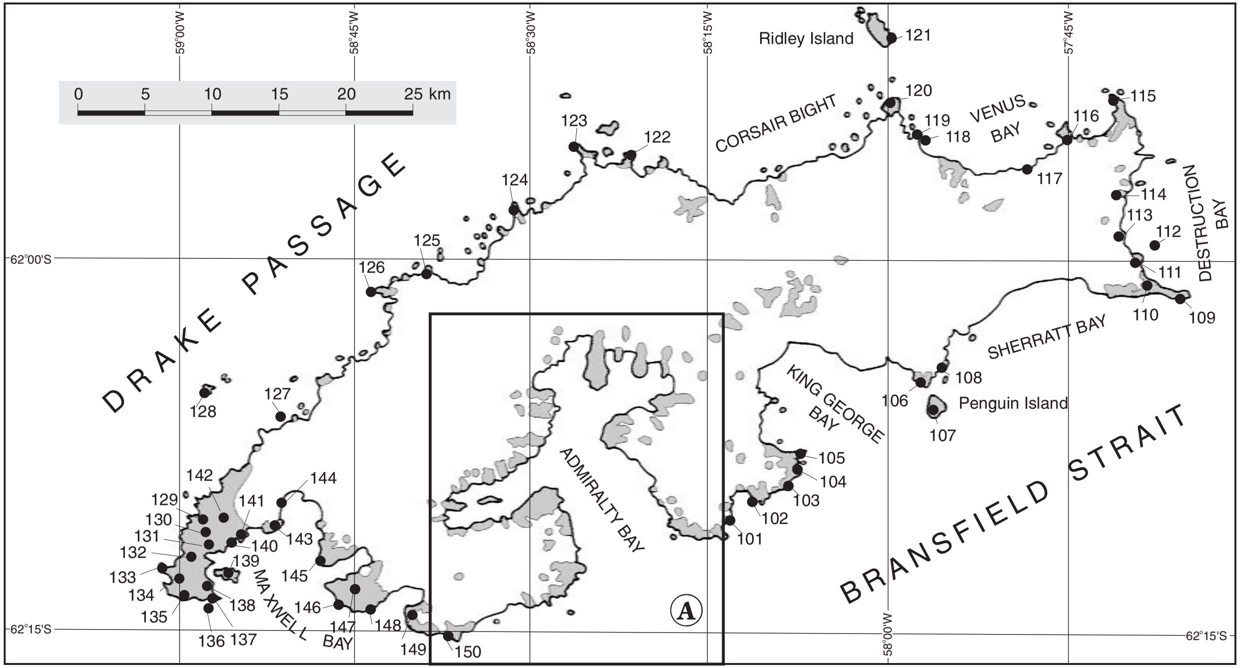

FIGURE 3. Map of King George Island showing ice-free areas (shaded) and localities from which moss specimens were collected outside the Admiralty Bay area (A). Localities are numbered from the east side of the entrance to Admiralty Bay eastwards and then counter-clockwise. **LEGRU BAY**. 101. Malczewski Point. 102. Cinder Spur. **KING GEORGE BAY**. 103. Low Head. 104. Chopin Ridge. 105. Lions Rump. 106. Turret Point. 107. Penguin Island. **SHERRATT BAY**. 108. Three Sisters Point. **DESTRUCTION BAY**. 109. Cape Melville. 110. Melville Peak. 111. Wrona Buttress. 112. Trowbridge Island. 113. Jenny Buttress. 114. Faraway Nunataks. **VENUS BAY**. 115. North Foreland. 116. Bristone Peak. 117. Esther Harbour. 118. Pyrites Island. 119. Gam Point. **CORSAIR BIGHT**. 120. False Round. 121. Ridley Island. 122. Pottinger Point. **DRAKE PASSAGE**. 123. Tartar Point. 124. Davey Point. 125. Cieśkak Point. 126. Stigant Point. 127. Bell Island. 128. Atherton Island. **FILDES PENINSULA**. 129. West Foreland. 130. Gemmel Peaks. 131. Bellinghausen Station. 132. Fossil Hill. 133. Flat Top Peninsula. 134. Horatio Stump. 135. Fildes Strait. 136. Two Summit Island. 137. Half Three Point. 138. Great Wall Station. 139. Ardley Island. 140. Durant Point. 141. Suffield Point. 142. Lake Kitezh. 143. Nebles Point. 144. Green Point. **MARIAN COVE**. 145. North Spit. **BARTON PENINSULA**. 146. Narębski Point. 147. Noel Hill. 148. Winship Point. **POTTER PENINSULA**. 149. Three Brothers Hill. 150. Stranger Point.

consists of three arms which penetrate deeply into the axial part of the island, namely Ezcurra Inlet on the west with the Dufayel Island in its centre (Figs 5–7), MacKellar Inlet on the north (Fig. 9) and Martel Inlet on the east and north-east (Fig. 4). The bay is enclosed on three sides by mountain ranges varying in height from 150 to 680 m with the fourth open to the sea (Fig. 10); thus the bay is well protected from the prevailing north-westerly winds. Admiralty Bay itself covers ca 119 km^2, its coastline is about 100 km in length, while the surrounding land forming the catchment area of the bay occupies ca 246 km^2 (Marsz & Rakusa-Suszczewski, 1987).

The coastal areas of Admiralty Bay possess various topographical features including long, broad or narrow, level or gently sloping beaches (Figs 11–12), high steep cliffs, sea stacks, rocky headlands (Fig. 13) and moraines (Fig. 14), all of which are ice- or snow-free and provide suitable habitats for the development of terrestrial vegetation. Additionally, there are numerous inland rock exposures and nunataks which are also extensively vegetated (Fig. 15). The ice- and snow-free areas usually take the form of isolated enclaves of various size covering in total ca 21 km^2 (8.74%) of the land (Marsz & Rakusa-Suszczewski, 1987).

The coastal ice-free areas are separated from one another by icefields, glaciers and ice falls of varying width and they may be considered as “oases” between the permanent ice and the waters of the Bransfield Strait and Admiralty Bay. They adjoin the sea and on the basis of their mode of origin form three distinct types. The majority owe their existence to the topography and to this type belongs Point Thomas, which is the largest ice-free part of the Admiralty Bay area, occupying 4.2 km^2 (Fig. 17). Here, on a wide, raised marine platform, Arctowski Station is situated (Fig. 11). Other “oases” of this type are Demay Point (Fig. 12) – 1.5 km^2 in area, Pond Hill – 0.4 km^2, Crépin Point – 0.4 km^2, the Keller Peninsula – 4.2 km^2, Ullman Spur (Fig. 4) – 1.3 km^2, Point Hennequin – 1.3 km^2 and Cape Vauréal (Fig. 10) – 0.2 km^2. Some ice-free areas, for instance Blue Dyke, Sphinx Hill (Fig. 13) and Rescuers Hill are determined climatically, while a few, for example Cytadela (Fig. 5), Szafer Ridge (Fig. 4) and Smok, owe their existence to the favourable topography and climate.

In contrast to “oases”, the nunataks are surrounded by glaciers or the icecap. There are two categories of nunatak, altitudinal and topographical. The former are rock exposures high above the surface of the icecap, having a small summit area and precipitous sides, providing very limited opportunities for snow accumulation. Typical representatives of this type of nunatak are Ternyck Needle (Fig. 4), Tern Nunatak, Admiralen Peak (Fig. 9), Czajkowski Needle (Fig. 16), Dufayel Island (Fig. 6) and Brama. In contrast, topographical nunataks are not particularly high, have at least one precipitous face and possess a large and rugged summit area favourable for snow accumulation. In the study area this type of nunatak is represented by Bell Zygmunt (Fig. 11), Siodło, Bastion, Red Hill and Zamek (Fig. 16).


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Most of the ice-free coastal areas are well irrigated by melt-water streams in summer. However, only two watercourses may be designated permanent streams: Ornithologist's Creek at Jersak Hills and Petrified Forest Creek at Skua Cliff. Permanent lakes are absent from the Admiralty Bay area.

The largest area of exposed ground on King George Island is the Fildes Peninsula, which comprises the south-western part of the island, with an irregular coastline. This is the second largest ice-free area of land in the South Shetland Islands being about 8–10 km long and varying in width from 2 to 4 km (the largest summer ice-free area in this archipelago is the Byers Peninsula on Livingston Island). The peninsula has a very undulating topography with numerous low rocky hills and a maximum altitude of 164 m above sea level at Horatio Stump. There are three principal physiographical categories in this area comprising highly elevated denuded hills in the north and central highlands; denuded tableland about 50 m in altitude with gentle slopes, widely distributed in the northern and central parts and on the western coast; and low coastal terraces distributed around the margins of the peninsula. Much of the coastline has beaches with boulders, gravel and sand but in places there are prominent cliffs about 50 m high (John & Sudgen, 1971).

A major feature of the Fildes Peninsula landscape are several small freshwater lakes of varying area and depth, two near the coast, five along the south-west coast and a few farther inland (Simonov, 1973). The two largest lakes, Lake Kitezh and Lake Glubokoye, occupy areas of 0.1 and 0.05 km^2 and have depths of 10 and 16 m, respectively. These are oligotrophic cold lakes (Campos *et al.*, 1978). with main biotic components similar to those known elsewhere in the maritime Antarctic, for example on Signy Island (Heywood, 1967, 1968, 1978, 1984; Heywood *et al.*, 1979, 1980).

There are four prominent islets off King George Island. These are Ridley Island, Dufayel Island, Penguin Island, a small dormant volcano with a little salt lake in the crater (Rakusa-Suszczewski & Lipski, 1980) and Ardley Island. The last is a small island, about 1.7 km^2 in area, with its highest point 70 m above sea level. It is joined to the east coast of the Fildes Peninsula by a sandbank isthmus.

FIGURES 4–7. — **4**. Martel Inlet viewed from the east side of the Keller Peninsula showing Ullman Spur (left), Szafer Ridge (right) and Ternyck Needle in the background. (Photograph by the author, 10 Jan 1980.) — **5**. A general view from Pond Hill of Ezcurra Inlet showing Kalicki Point on the west end of Dufayel Island and the rocky cliffs on the south coast of the inlet. The first cliff on the right is Cytadela where the type locality of *Schistidium steerei* is located, then follows Breccia Crag with one of the very few stations of *Platydictya jungermannioides* and that farthest away is Dutkiewicz Cliff, a site for *Pohlia wahlenbergii*. (Photograph by the author, 20 Jan 1980.) — **6**. Dufayel Island overlooking the waters of Ezcurra Inlet, as viewed from the Italia Valley, with the Emerald Ice Falls in the background. (Photograph by the author, 8 Mar 1980.) — **7**. Emerald Point in Ezcurra Inlet, one of two localities for *Schistidium urnulaceum* in the Antarctic. (Photograph by the author, 20 Jan 1980.)

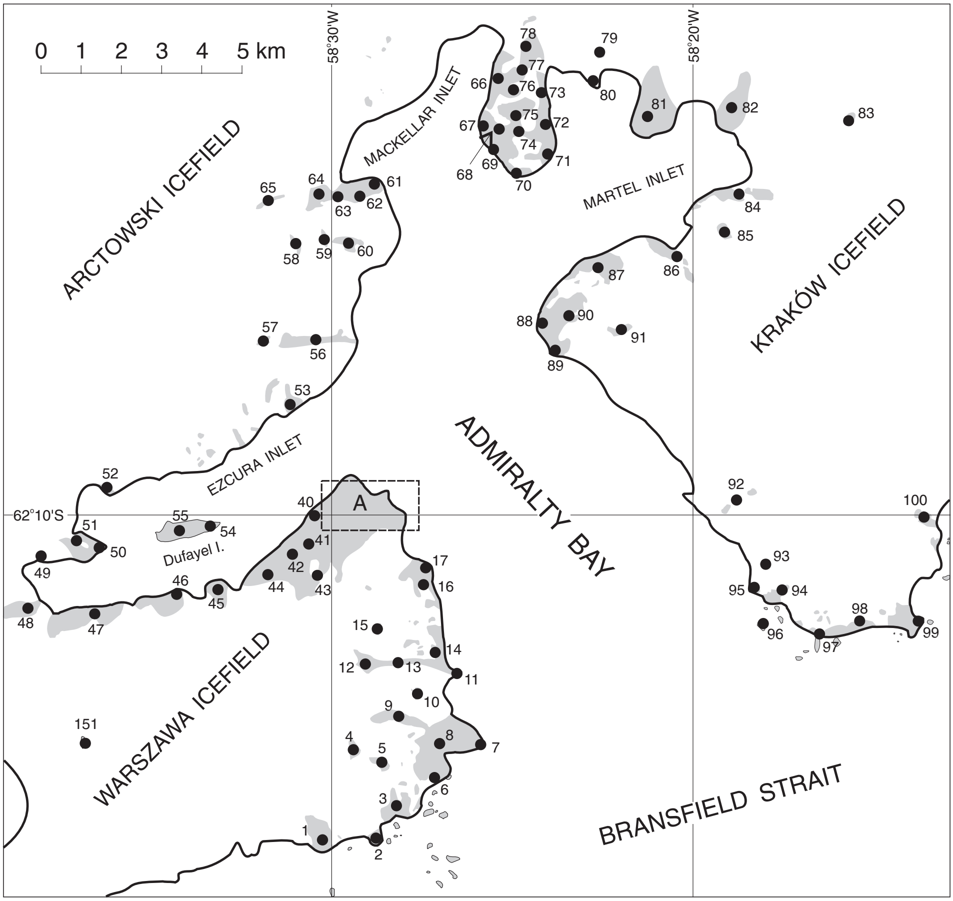

FIGURE 8. Collecting sites for mosses in the Admiralty Bay area on King George Island. Localities are numbered from the west coast of Admiralty Bay clockwise to the east. — **Bransfield Strait**. 1. Red Hill. 2. Patelnia. 3. Blue Dyke. 4. The Tower. 5. Bastion. 6. Uchatka Point. 7. Demay Point. 8. Creeping Slopes. 9. Brama. — **Ecology Glacier**. 10. Siodło. 11. Agat Point. 12. Zamek. 13. Błaszyk Moraine. 14. Sphinx Hill. 15. Czajkowski Needle. 16. Rescuers Hills. 17. Llano Point. — **Point Thomas**. 18–39. For detailed distribution of collecting sites in the area marked by "A" see Figure 17. — **Ezcurra Inlet**. 40. Jardine Peak. 41. Kasprowy Hill. 42. Italia Valley. 43. Unnamed hills on Wróbel Glacier. 44. Dutkiewicz Cliff. 45. Breccia Crag. 46. Krzymiński Point. 47. Cytadela. 48. Belweder. 49. Scalpel Point. 50. Barrel Point. 51. Pond Hill. 52. Emerald Point. 53. Urbanek Crag. — **Dufayel Island**. 54. Gdynia Point. 55. Sopot Peak. — **MacKellar Inlet**. 56. Coastal cliff of Klekowski Crag. 57. Summit of Klekowski Crag. 58. Misty Nunatak. 59. Admiralen Peak. 60. Komandor Peak. 61. Crépin Point. 62. Kapitan Peak. 63. Rymarz Pass. 64. Wegger Peak. 65. Garnuszewski Peak. — **Keller Peninsula**. 66. Ore Point. 67. Speil Point. 68. Round Hill. 69. Harpoon Point. 70. Plaza Point. 71. British Point. 72. Moraine Point. 73. Yellow Point. 74. Mount Flagstaff. 75. Tyrrell Ridge. 76. Piasecki Pass. 77. Rolnicki Pass. 78. Mount Birkenmajer. — **Martel Inlet**. 79. Shark Fin. 80. Stenhouse Bluff. 81. Ullman Spur. 82. Precious Peaks. 83. Ternyck Needle. 84. Szafer Ridge. 85. Tern Nunatak. 86. Warkocz. 87. Smok. 88. Point Hennequin. 89. Basalt Point. 90. Mount Wawel. 91. Bell Zygmunt. — **Viéville Glacier**. 92. Rembiszewski Nunataks. 93. Puchalski Peak. 94. Vauréal Peak. 95. Cape Vauréal. 96. Chabrier Rock. 97. Cape Syrezol. 98. Harnasie Hill. 99. Martins Head. 100. Stańczyk Hill. — **Potter Peninsula**. 151. Florence Nunatak.

GEOLOGY

The first detailed investigation of the geology of King George Island was made by Ferguson (1921), who published the first geological map of the island. He recognized two basic rock complexes comprising an older series of dark mudstones and greywackes with interbedded andesite lavas, tuffs and agglomerates and a younger series of basalts and olivine andesites. Many later expeditions to King George Island made geological observations and collections (Adie, 1957, 1958; Barton, 1961, 1964, 1965). However, it was not until geologists appointed to the Polish Antarctic Expeditions, led by Krzysztof Birkenmajer, started work in 1977 that attempts were made to complete a comprehensive geological reconnaissance of the whole island (cf. Birkenmajer, 1979, 1980b, 1981, 1982b, 1997).

King George Island is largely composed of stratiform volcanic complexes, lavas and pyroclastics, with intercalated plant-bearing clastics (late Jurassic to late Oligocene). In the Admiralty Bay area six rock complexes have been recognized (Birkenmajer, 1980c). The lowest, probably Upper Jurassic, stratiform complex of andesitic and rhyolitic lavas and sediments is exposed in the zone adjoining the Excurra fault and in Martel Inlet (Ullman Spur) and reaches a considerable thickness of more than 1100 m. This complex is associated with Andean intrusions represented by gabbroic and dioritic dykes with associated pyrite mineralization. They are approximately Upper Cretaceous–Lower Tertiary and are exposed as vertical or steeply inclined thick dykes on Wegger Peak, the Keller Peninsula and Stenhouse Bluff.

Next comes a Tertiary stratiform complex consisting mainly of a monotonous sequence of basic andesite lavas and pyroclastics, with coarse agglomerate and terrestrial tuffaceous plant bearing intercalations. It has considerable thickness, altogether more than 2700 m. This complex is traversed by numerous plugs and dykes of the Admiralty Bay Group which represent a late Tertiary (probably from the boundary of the Miocene and Pliocene) intrusive complex. Along the Bransfield Strait this complex is supplanted by late Tertiary (Pliocene or even early Pleistocene) olivine basalts, andesites and sediments about 600 m thick with well-preserved traces of two subsequent glaciations. Rich Cretaceous and Tertiary fossil plants from the Admiralty Bay area have been described by Zastawniak (1981), Zastawniak *et al.* (1985), Birkenmajer and Zastawniak (1986, 1989) and Tokarski *et al.* (1987).

Quaternary deposits are thin and restricted to the margins of glaciers, the coastal zone and the foot of mountains. A detailed Quaternary geological map (scale 1:2500) of the area around the Arctowski Station has been published by Birkenmajer (1997).

On the Fildes Peninsula there are two stratified rock units. The older is a Jurassic volcanic series to the south and on Ardley Island, and the second is a sedimentary series of conglomerates, tuffaceous sandstones and mudstones containing a rich fossil lower Tertiary flora located on the northern part of the peninsula (Bar-

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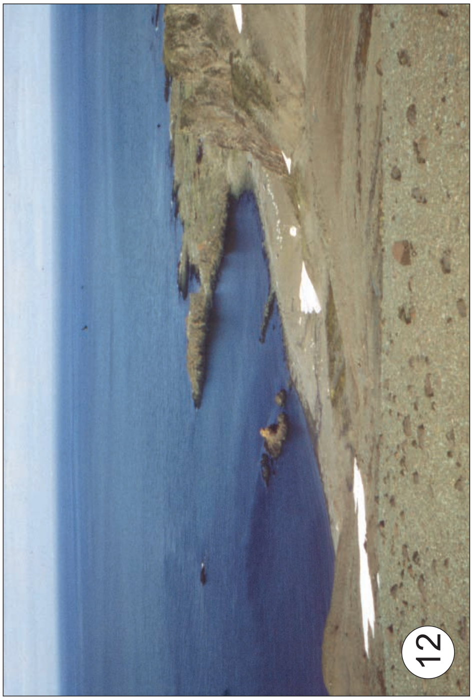

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ton, 1964, 1965). A transverse fault crosses the central southern part of the Fildes Peninsula where the two rock series come into contact.

Apart from the tectonics and vulcanism, the present-day relief of the ice-free area has been strongly affected by glaciations. According to Birkenmajer (1980c, 1980d) the first glaciation of King George Island occurred in the Upper Miocene (Melville Glaciation). It is evidenced by marine-glacial sediments with many organic remnants and erratics of continental origin. During the second, Pliocene, glaciation (Polonez Glaciation) the island was covered by an extensive continental ice-sheet which crossed the Bransfield Strait from the Antarctic Peninsula. It constituted the largest glaciation of this region and is correlated with the Queen Maud Glaciation in the Transantarctic Mountains which occurred 4.2 million years BP.

The next glaciation (Legru Glaciation) was the last pre-Quaternary one and is correlated with the Scott Glaciation in the Transantarctic Mountains which occurred 2.1–2.4 million years BP. Fossil bearing moraines of this glaciation comprise exclusively local material and this suggests that connection with the continental ice-sheet was interrupted, most probably because of the opening of the Bransfield Strait.

The Pleistocene glaciation stage in the Admiralty Bay area is known as the Warsaw Glaciation and is tentatively correlated with the Vistulian (Würm) Glaciation of Europe and the Wisconsin Glaciation of North America (Birkenmajer, 1980d). It is not known precisely when extensive areas of ground became snow-free after the last glaciation but radiocarbon dates of 4950 ±140 years BP (Birkenmajer *et al.*, 1985) and 4090 ±60 years BP (Fabiszewski & Wojtuń, 1997) of peat mounds are a minimum.

Over a large part of the island soil development has been negligible (Everett, 1976). In the higher areas the landscape resembles a polar desert with freshly weathered rock, mineral soil and glacial deposits devoid of vegetation. The lack of well-developed soil is due not so much to the severe climate as to the young age of the surface features and the low resistance of any newly-formed soil to erosion processes and the effects of frost. The coastal soils are formed by the deposit of

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FIGURES 9–12. — **9**. A general view of MacKellar Inlet from Panorama Ridge showing Admiralen Peak (left) overlooking Crépin Point with the Keller Peninsula under snow in the background to the right. (Photograph by the author, 6 Feb 1980.) — **10**. A general view of the entrance to Admiralty Bay as seen from Blue Dyke looking out to Martins Head, Vauréal Peak and Puchalski Peak (indicated with an arrow) on the opposite side of the bay. The latter nunatak is the *locus classicus* of *Schistidium halinae*. (Photograph by the author, 26 Jan 1980.) — **11**. Arctowski Station viewed from Upłaz Hill. The Station is situated on a wide raised marine beach to the south-east of Point Thomas. In the background Bell Zygmunt nunatak overlooks Point Hennequin with the Viéville Glacier to the right. (Photograph by the author, 10 Dec 1979.) — **12**. Creeping Slopes overlooking the picturesque Paradise Cove immediately south of Demay Point with a broad view of Bransfield Strait. (Photograph by the author, 27 Jan 1980.)

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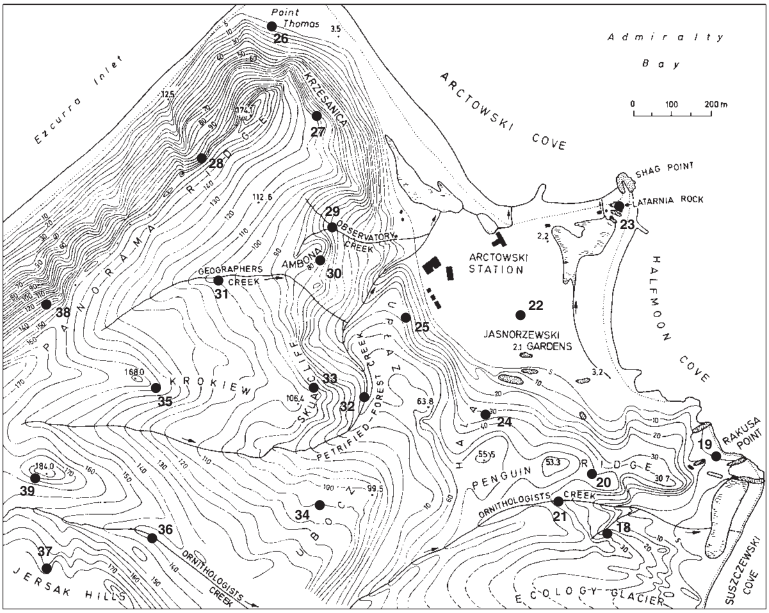

FIGURE 17. Collecting sites for mosses in the Point Thomas area of Admiralty Bay. 18. Moraines by the northern edge of Ecology Glacier. 19. Rakusa Point. 20. Penguin Ridge. 21. Ornithologists Creek. 22. Jasnorzewski Gardens. 23. Shag Point and Latarnia Rocks. 24. Hala. 25. Upłaz. 26. Point Thomas. 27. Krzesanica. 28. NE branch of Panorama Ridge. 29. Observatory Creek. 30. Ambona. 31. Geographers Creek. 32. Petrified Forest Creek. 33. Skua Cliff. 34. Ubocz. 35. Krokiew. 36. Upper part of Ornithologists Creek. 37. Jersak Hills. 38. SW branch of Panorama Ridge. 39. Unnamed hill between Jersak Hills and Krokiew.

windborne aerosols and organic manuring by birds and seals. Penguins play a particularly significant role in supplying the land with nutrients and characteristic ornithogenic soils are formed in areas directly influenced by these birds. They are characterized by the dominance of phosphates in their fine fraction and are usually devoid of plant life, their productivity being shown only in their very high microbial activity (Tatur & Myrcha, 1983, 1988, 1993).

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FIGURES 13–16. — **13**. Steep coastal cliffs on the western shore of Admiralty Bay with Sphinx Hill in the foreground and Demay Point behind, viewed from the raised marine beach at the foot of Rescuers Hill. (Photograph by the author, 5 Jan 1980.) — **14**. The old moraine on the northern edge of Ecology Glacier south of Arctowski Station as seen from Penguin Ridge, showing slopes which are devoid of vegetation. *Usnea antarctica* communities appear in the foreground and at the top of the moraine, with a patch of a community of the moss carpet subformation at its foot. In the background Viéville Glacier and Vauréal Peak can be seen. (Photograph by the author, 17 Jan 1980.) — **15**. The inland rocky Jersak Hills west of the Arctowski Station, densely vegetated by a *Himantormia lugubris–Usnea aurantiaco-atra* community. (Photograph by the author, 27 Dec 1979.) — **16**. Czajkowski Needle (right) and the Zamek (left) nunataks protruding from the Sphinx Glacier. (Photograph by the author, 4 Jan 1980.)

CLIMATE

The weather and climate of King George Island are relatively well-known with meteorological data from the island first becoming available in 1947 following the establishment of a British meteorological station on the Keller Peninsula in Admiralty Bay. This remained in operation until 1961 (Anonymous, 1974). Then, from 1968 and 1969, respectively, meteorological data have been recorded at the Russian Bellingshausen and Chilean Presidente Frei Stations on the Fildes Peninsula, continuing until the present day. Furthermore, since 1977, continuous observations have been made at the Polish Arctowski Station in Admiralty Bay. The data collected have been analysed in a number of publications for individual years and over longer periods, and have been summarized by Rakusa-Suszczewski *et al.* (1993). Additionally, meteorological data are collected in all the scientific stations established on King George Island in the 1980s.

King George Island experiences cold humid conditions with a strong oceanic tendency, typical of the northern part of the maritime Antarctic. Most of the precipitation falls as snow, much of which melts in summer leaving snow-free areas. At the Arctowski Station, from 1978–1987, the mean annual precipitation was 510 mm of equivalent rainfall (Rakusa-Suszczewski *et al.*, 1993), although in particular years the amount varied considerably. For example, in 1977, in the period from April to December, 798 mm of equivalent rainfall were recorded, with precipitation on 241 days (Zubek, 1980). A similar annual precipitation, averaging over 500 mm rainfall equivalent, was recorded between 1985 and 1990 from the Great Wall Station (Hu, 1998). Minimum precipitation occurs in the winter months (May to September), and the highest in the warmer months (December to April).

Air temperature was measured from 1947–1961 at the former British station on the Keller Peninsula. The mean annual temperature for this period was –2.8°C (1.3°C in January and –8.3°C in July) and extreme temperatures ranged from 10.5°C to –32°C (Anonymous, 1974). Corresponding data from the Polish station for the years 1978–1987 were –1.8°C (2.3°C in January and –7.1°C in July) and extreme temperatures ranged from 16.7°C to –32.3°C (Rakusa-Suszczewski *et al.*, 1993). Comparison with more recent data shows that between 1988 and 1997 annual air temperature has risen in Admiralty Bay by 0.2–0.6°C and it would seem that this increase could have prompted the deglaciation on land and the retreat of glaciers on the shores of Admiralty Bay, a process which has been particularly evident since the late 1980s. At the Great Wall Station, from 1985–1990, the mean annual temperature was –2.24°C, with an extreme maximum of 11.7°C in January 1985 (Hu, 1988). In general, the mean monthly and annual air temperatures are a few tenths of a degree higher at the Arctowski Station than at the Bellingshausen Station on the Fildes Peninsula (Rakusa-Suszczewski *et al.*, 1993).

High humidity (mean 84% for 1947–1961 on the Keller Peninsula) is maintained throughout the year. Similar results (81.6%) were obtained from the 1978–1987 measurements at the Arctowski Station. A major feature of this area are the katabatic, predominantly westerly, winds which reach hurricane force. Average wind velocity is 7.0 m s^{-1} (15.7 mph), with an extreme maximum of 60 m s^{-1} (134.2 mph).

General climatic features are important in determining the nature of the terrestrial vegetation. However, more critical in determining plant development are the microclimatic conditions which are usually markedly different from those recorded in synoptic meteorological observations, especially with respect to temperature and water availability (Longton & Holdgate, 1967; Walton, 1982, 1984). At Arctowski Station the thaw extends underground in summer to a depth of 50 cm (Cygan, 1981; Kratke & Wielbińska, 1981), but the frequent freezing and thawing of ground and rocks results in intense frost shattering. Because precipitation exceeds evaporation, the substratum is permanently saturated. In the summer months the air temperature rises above freezing point and consequently water flows from the land to the bay in this period.

Strong winds cause drifting of snow and redistribution of the precipitation into regions where the relief promotes its accumulation, leading to important differences in the microclimatic conditions. Accordingly, areas with rapid snow ablation are quickly denuded in summer and remain dry and warmer for a longer time, whereas those with thick snow cover are cooler and more humid. Ablation processes reduce the amount of loose material on the surface of the land as the strong winds distribute the loamy, sandy or gravelly fractions across glaciers. Wind-blown crystals, granular snow and grains of sand or gravel have a very destructive effect on exposed terrestrial vegetation.

HUMAN PRESENCE

As with all other areas in the Antarctic, King George Island has never been permanently inhabited. Many sealers, especially in the early part of the nineteenth century, spent short periods on the island, some after becoming shipwrecked. However, human presence in those days did not significantly affect the natural environment, with the obvious exception of the excessive slaughter of sea mammals. The situation has changed rapidly since the 1950s and man has acquired the means to accelerate great environmental changes that otherwise might never have occurred.

The first station on King George Island was the British "Base G" on the Keller Peninsula. It was in operation from 1947–1961. In 1957 the Argentinian summer station Teniente Jubany was founded on the Potter Peninsula, while in 1968 and 1969 two permanent stations were established on the Fildes Peninsula, first the Russian Bellingshausen and then the Chilean Presidente Frei, and on 26 February

1977 the permanent Polish Arctowski Station was founded in the Point Thomas area of Admiralty Bay (Fig. 11). In the 1980s and 1990s many new stations were established on the island, namely, the Brazilian Commandante Ferraz (Keller Peninsula, 1984), the Chinese Great Wall (Fildes Peninsula, 1985), the Uruguayan Artigas (Collins Cove in Maxwell Bay, 1986), the Korean King Seijong (Barton Peninsula, 1988), the Peruvian Macchu Picchu (Crépin Point in Admiralty Bay, 1993) and Ecuadorian (Point Hennequin in Admiralty Bay), while the Czech Republic is planning to establish a summer station in the Lions Rump area.

In Antarctic Treaty terms, Antarctica is defined as a "continent for science". The example of King George Island shows clearly that even scientific activity can bring excessive numbers of scientists and support staff to some areas and this poses a danger for the natural environment. The island has suddenly become overcrowded and an additional disadvantage is that all the stations are situated in those areas possessing the greatest biodiversity.

Antarctica has also become a very attractive place for tourists and many cruise ships have paid regular visits to the area since 1966. Arctowski Station is one of the most frequently visited bases in Antarctica and, in the two seasons 1991–1992 and 1996–1997, 12884 tourists recorded visits to this area (Ciaputa & Salwicka, 1997). Despite very tight legal restrictions such a large number of people must have a major impact on the wildlife, especially as some visitors violate the guidelines. In order to protect the biodiversity and inanimate nature of the Antarctic, Sites of Special Scientific Interest (SSSI) have been established (Bonner & Lewis-Smith, 1985). Five of these are on King George Island:

(1) SSSI No. 5 – Fildes Peninsula. It is composed of two parts in the vicinity of the Chilean and Russian stations, covering approximately 1 km^2, with unique fossil ichnolites and representative sequences of Tertiary strata.

(2) SSSI No. 8 – Western shore of Admiralty Bay. This protected area extends to the south of the line connecting Jardine Peak and Rakusa Point and east of the line joining Jardine Peak and Patelnia via The Tower. It supports an exceptional assemblage of Antarctic birds and mammals, a very rich flora of mosses and the largest stand of the two vascular plants in the Antarctic (Myrcha *et al.*, 1991).

(3) SSSI No. 13 – Potter Peninsula/Stranger Point. The site has an exceptionally prolific and diverse avian and mammal fauna and locally rich vegetation.

(4) SSSI No. 33 – Ardley Island. This small island is exceptional for its rich vegetation which is dominated by semi-ombrogeneous peat banks.

(5) SSSI No. 34 – Lions Rump. This area has well-developed and undisturbed terrestrial, limnological and littoral ecosystems with a variety of rock formations and a very diverse biota which includes an especially rich lichen flora (Olech, 1994).

Chapter 3

BRYOLOGICAL EXPLORATION

A species of Polytrichum resembling the alpinum of Lin. one or two lichens and a fucus found in the sea, along the shores – when you add to these occasional plant of a small species of avena, you complete the botanical catalogue of the islands.

J. Eights, *Description of a new crustaceous animal found on the shores of the South Shetland Islands, with remarks on their natural history*, 1833

HISTORICAL HIGHLIGHTS

THE EARLIEST EXPLORERS

King George Island was one of the earliest lands discovered in the Antarctic, but it can also claim the distinction of being the area in which the first observations on the flora in this biome were made. Captain William Smith, when sailing on the ship *Williams* round Cape Horn during a trading voyage from Montevideo to Valparaiso, had been blown southwards off Drake Passage and on 19 February 1819 discovered land at lat. 62°30′S and long. 60°W which he named "New South Shetland" (Anonymous, 1820; Jones, 1975). In a report on this discovery in the *Literary Gazette and Journal of Belles Lettres, Arts, Sciences, etc.* of 5 August 1820 an anonymous author wrote that "the climate [of this land] was temperate, the coast mountainous, apparently uninhabited, *but not destitute of vegetation, as firs and pines were observed in many places*" (my italics). This information is undoubtedly misleading and correctly must refer to areas in more northerly latitudes. A few months later William Smith revisited the South Shetland Islands during his third voyage to this region and on 16 October 1819 landed on King George Island and took possession of it for King George III (Jones, 1975).

Following William Smith's second visit to the South Shetland Islands, several sealing vessels visited these islands in January 1820, and in the summers 1820–1821 and 1821–1822 at least 135 United States and British vessels were engaged in the uncontrolled slaughter of Fur Seals, which had become almost extinct in these islands by the beginning of 1822 (Headland, 1989). From the botanical point of view the most remarkable seems to have been William Smith's fourth visit to the South Shetland Islands with Edward Bransfield as the senior naval officer aboard. This expedition roughly surveyed the South Shetland Islands and discovered the north-western coast of the Antarctic Peninsula which was named "Trinity Land". Around 23 January 1820 the expedition landed on Penguin Island off the southern coast of King George Island where "some mosses were found and taken on board" (Anonymous, 1821, 1946). The whereabouts of these collections is unknown but this was probably the first moss collection from King George Island and the Antarctic. In the same communication information is also given on the vegetation of the island and of skuas using mosses to build their nests: "The swampy land, the lowest of all, was covered with a sort of grass and moss, nourished by the dung of the several oceanic birds; this moss and grass abounds in great quantities, and is all that deserves to be called vegetation". Additionally, there is information about "snow of a reddish tint", this being the first report of cryoplankton in the Antarctic.

During the sealing voyage the vessel *Lady Trowbridge* under the command of Richard Sherratt was wrecked off Cape Melville in the south-eastern corner of the island on 25 December 1820, and he occupied his time until relieved in constructing a historically interesting sketch map of the central portion of the South Shetlands (Fig. 18). Additionally, he made some observations on the the vegetation of the Potter Cove area on King George Island (Sherratt, 1821; Anonymous, 1952) (see also quotation, p. 37).

The first mosses brought back from King George Island (and the whole of the Antarctic) were the collections made by James Eights, an independent investigator who accompanied the United States sealing voyage of 1829–1831 commanded by Benjamin Pendleton and Nathaniel B. Palmer (Hedgpeth, 1971). On King George Island he collected *Polytrichastrum alpinum* (as *Polytrichum alpinum*) (Eights, 1833) and this specimen is now in the National Museum of Natural History in Washington (US) and a duplicate is in the New York Botanical Garden (NY). Additionally, he collected also a specimen of *Sanionia uncinata* (Fig. 19) which is now preserved in the latter herbarium.

In 1828–1831 a British Naval Expedition visited the South Shetland Islands but no information on the plants and vegetation of King George Island is available. Webster (1834) reported the vegetation of Deception Island as including "... only the growth of diminutive moss, and a striped coralloid lichen (=*Usnea* sp.), identically the same as that which is found on the lofty hills of Cape Horn and Tierra del Fuego". Nonetheless this is an important statement because an affinity of the vege-

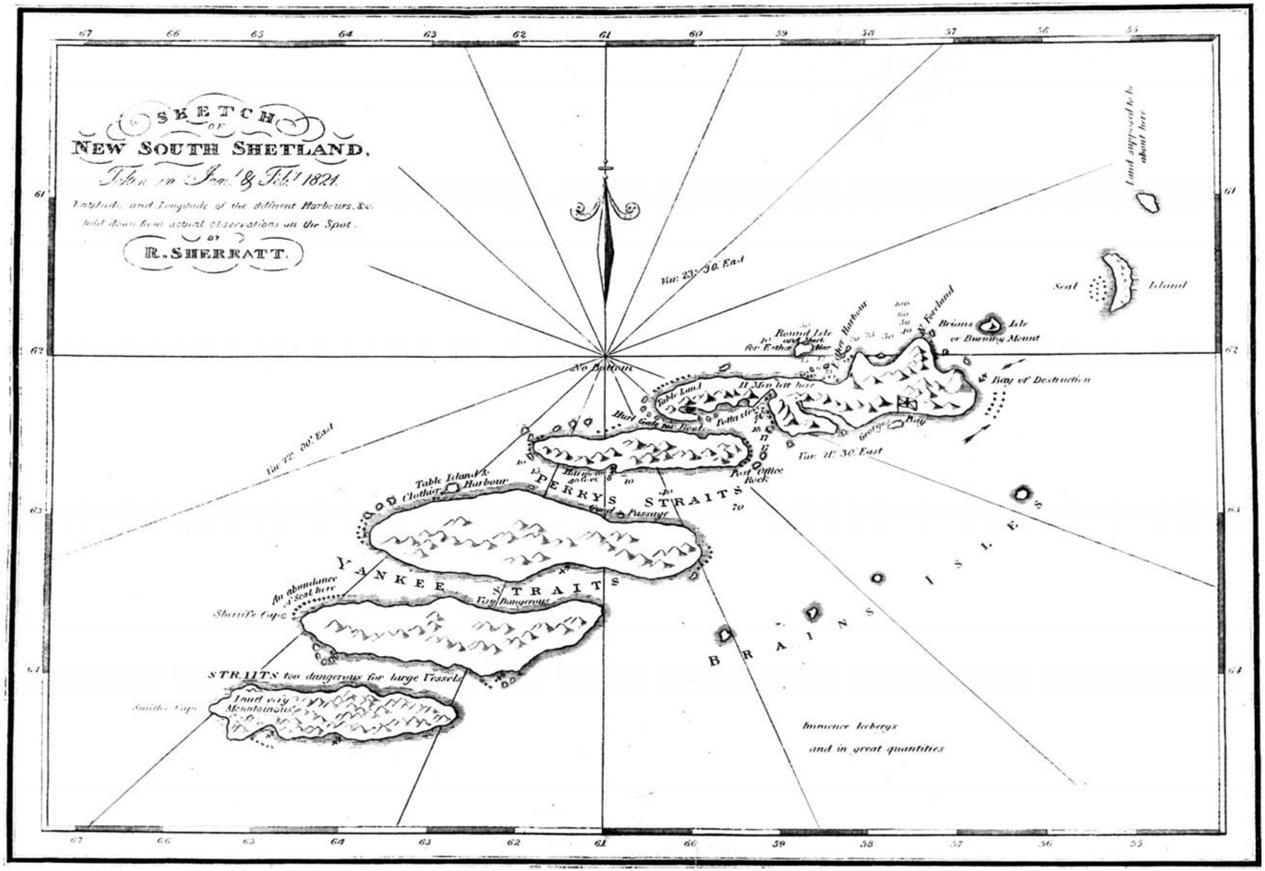

FIGURE 18. Richard Sherratt's chart of the South Shetland Islands, published 21 December 1821.

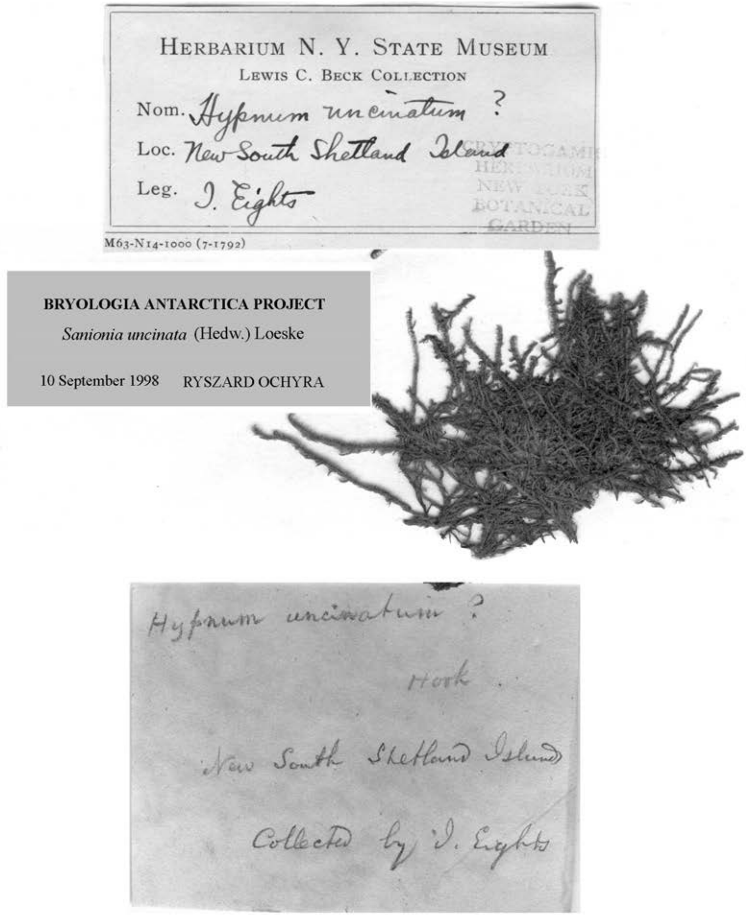

FIGURE 19. *Sanionia uncinata* (Hedw.) Loeske. The oldest specimen of a moss collected in the Antarctic preserved in the New York Botanical Garden Herbarium (NY).

tation of the maritime Antarctic with that of southern South America was recognized for the first time.

THE 1900–1960 PERIOD

For nearly 80 years after the collections made by J. Eights, no further botanical collections or observations were made on King George Island until the second French Antarctic Expedition of 1908–1910 under the command of Jean Charcot. M. Gain, naturalist to the expedition, collected three moss species on the island which were named and published by Cardot (1911a, 1911b, 1913), namely *Distichium capillaceum* var. *brevifolium*, *Bartramia pycnocolea* and *Drepanocladus un-*

cinatus. These mosses were collected between 25–30 December 1909 in Admiralty Bay, unfortunately, without specific localities being given. Until 1970 it was the only published report on mosses from King George Island. Between the two World Wars there was a remarkable general stagnation in botanical exploration of the Antarctic (Ochyra *et al*., 1998). Some miscellaneous collections of mosses were made on King George Island by the British Discovery Expeditions in 1927–1937 and the unpublished specimens were preserved in the Natural History Museum in London (BM). Some of them were eventually published by Greene *et al*. (1970) in the first and only volume to appear of the Antarctic Moss Flora.

An important collection of mosses was made in 1954 and 1955 by O. Kühnemann on Ardley Island and in Potter Cove during the Argentine Expeditions of 1953–1954 and 1954–1955 when a refuge hut was built on Ardley Island. Greene *et al*. (1970) published in their Flora some specimens gathered by this collector, and a set of additional unpublished mosses collected by him is preserved in the herbarium of the British Antarctic Survey in Cambridge (AAS). It was studied during the present work and the specimens are cited in the systematic section of the text (Chapter 6, p. 73).

Recent investigations

The International Geophysical Year of 1957–1958 opened a new period in the bryological exploration of Antarctica. Unlike the early days, when collections of mosses were seldom made by professional botanists, in recent exploratory expeditions collections have often been made by specialists. This has resulted in the rapid expansion of information on Antarctic mosses. A good review of the taxonomic and phytogeographic studies carried out in both West and East Antarctica during this period has been recently outlined by Seppelt *et al*. (1998).

In the late 1960s British botanists, guided by S. W. Greene, initiated the compilation of a critical Antarctic Moss Flora but only one fascicle was published, which included treatment of five genera and twelve species (Greene *et al.*, 1970) before the project was unfortunately abandoned. Eight additional species of moss, namely *Andreaea depressinervis*, *A. gainii*, *A. regularis*, *Pohlia cruda* var. *imbricata*, *P. nutans*, *Polytrichum strictum*, *P. juniperinum* and *P. piliferum* were reported from King George Island, so the moss flora then totalled 12 species.

The first professional botanist who carried out botanical investigations on King George Island was D. C. Lindsay who, during the 1965–1966 austral summer, made a primary floristic survey of several islands in the central part of the South Shetland Islands, from King George Island to Livingston Island. In total, he visited 17 localities on King George Island, mostly on the southern coast including the Admiralty Bay area. Although each of them was examined for only a few hours at most, a surprisingly good and thorough outline of the flora and vegetation was provided (Lindsay, 1971). As a lichenologist the author paid special attention to lichens, but also numerous mosses, mostly common and widespread species, were reported. Most of his specimens were cited by Greene *et al.* (1970) but the only additions to the island's flora were *Chorisodontium aciphyllum* from False Round Point (Lindsay, 1971) and *Racomitrium sudeticum* (Bell, 1973a as *R. austrogeorgicum*). This collection, deposited in BM and AAS, was examined during the present work. Amongst the unpublished material in AAS I found specimens of *Ditrichum lewis-smithii* collected on the Barton Peninsula representing the first discovery of this rare species.

The first professional bryologist to visit and collect on King George Island was R. M. Schuster who, during a period extending from early January to 7 February 1969, pursued intensive field work in the Antarctic Peninsula region from King George Island south to Hook Island in the Biscoe Islands (Schuster, 1969a). Although as a hepaticologist he focused his interest on liverworts which are very scanty and inconspicuous in this biome (Ochyra & Váňa, 1989a) he made a large collection of mosses which was examined by Robinson (1972). This collection is deposited in US and was revised during the present work. Again, seven additional species new to the island's flora were reported including (according to current taxonomic concepts) *Schistidium antarctici*, *Dicranoweisia crispula*, *Syntrichia filaris*, *S. princeps*, *Bryum amblyodon*, *Warnstorfia sarmentosa* and *Hypnum revolutum*. The report of *Dicranoweisia grimmiacea* is based upon a misdetermination. An interesting record of *Conostomum magellanicum* from the Keller Peninsula based on the collection made by R. I. Lewis-Smith and B. J. Taylor in the 1960s was published by Bell (1973b).

Finally, the first professional muscologist to bryologize on King George Island was H. Kanda who explored the Potter Cove area during January and February 1979 (Kanda, 1985) and visited also Arctowski Station, collecting in its vicinity. He published two additions to the island's flora, *Hennediella antarctica* and *H. heimii* (Kanda, 1981 both as *Pottia*) and, moreover, described a species new to science from the island, *Ceratodon kinggeorgicus* (Kanda, 1986). This species proved to be *Meesia uliginosa* (Ochyra & Lewis-Smith, 1999). Unfortunately, his collection as a whole remains unpublished, although a list of the specimens he collected can be found in the catalogue of Antarctic mosses preserved in the herbarium of the National Institute of Polar Research (Kanda, 1987b). Except for the type specimen of *C. kinggeorgicus*, this collection has not been made available to me. In total, some 24 moss species had been published from King George Island by 1981.

During the 1979–1980 austral summer I made a detailed bryological survey of the Admiralty Bay area and additionally I collected intensively in some parts of the Fildes Peninsula, for example on Ardley Island. A review of the collecting sites and specimens is given at the end of this chapter. In order to make Antarctic specimens widely available for taxonomic study I distributed a set of exsiccatae of Antarctic bryophytes consisting of 44 species of moss collected on King George and Deception Islands in the South Shetland Islands (Ochyra, 1984b; Ochyra *et al.*, 1986). Of these, *Didymodon gelidus* was only collected on Deception Island.

Altogether I collected 35 species new to the island which have been published in a long series in various publications including some in the present work. Three of these proved to be new to science, namely *Schistidium steerei* (Ochyra, 1987a), *S. halinae* (Ochyra, 1998a) and *Ditrichum lewis-smithii* (Ochyra, 1996a), while twelve more were new to Antarctica, viz. *Schistidium falcatum* (Ochyra & Bell, 1984), *S. rivulare* (Ochyra, 1984b; Ochyra *et al.*, 1986), *S. amblyophyllum* (Ochyra & Afonina, 1986 as *S. angustifolium*), *S. urnulaceum* (Ochyra, 1990a), *Anisothecium cardotii* (Ochyra & Newton, 1986), *Bryum orbiculatifolium* (Ochyra & Ochi, 1986), *Holodontium strictum* (Ochyra, 1993a), *Meesia uliginosa* (Ochyra & Lewis-Smith, 1999), *Pohlia wahlenbergii* (Ochyra, 1984b; Przywara *et al.*, 1984; Ochyra *et al.*, 1986) as well as *Schistidium cupulare*, *S. occultum* and *Dicranoweisia brevipes* (present work).

Moreover, eight species have also been recorded for the first time from the Antarctic, although in fact they had been known from this region by different names. These are: *Kiaeria pumila* (=*Dicranum oleodictyon*), *Dicranoweisia crispula* (=*D. subinclinata*), *Encalypta rhaptocarpa* (=*E. patagonica*), *Grimmia reflexidens* (=*G. grisea*), *Orthotheciella varia* (=*Pseudoleskea calochroa*, *P. antarctica* and *Amblystegium subvarium*), *Warnstorfia laculosa* (=*Calliergidium austrostramineum*), *Sanionia georgico-uncinata* (=*Hypnum uncinatum* fo. *polare*) and *Platydictya jungermannioides* (=*P. densissima*).

Unfortunately, two reports of species new to King George Island and the continent proved to be misidentifications; specimens of *Bryum dichotomum* (Ochi & Ochyra, 1986) are in fact *B. amblyodon*, although it should be noted that *B. dichotomum* has subsequently been found in Antarctica, while those named as *Brachythecium subpilosum* (Ochyra, 1984b; Ochyra *et al.*, 1986) are actually *B. glaciale* (Lightowlers, 1987).

In 1988–1990 mosses were collected by two Brazilian workers, J. Putzke and A. B. Pereira who published a large treatise entitled *Mosses of King George Island, Antarctica* with keys, descriptions and illustrations of 40 species they had found on the island (Putzke & Pereira, 1990). Unfortunately, this work seems to fall far short of the standards which could have been expected in such a publication. The authors examined only five localities on the island, namely Fildes Peninsula, Point Hennequin, Ullman Spur, Arctowski Station and Keller Peninsula in the Admiralty Bay area but generally they did not specify their collecting sites. The rather small number of specimens examined does not seem to be a strong basis for a treatise of this nature. Taxonomically, the flora is uncritical and presents mostly out-of-date inaccurate concepts, except in cases where independent regional taxonomic revision had previously been undertaken, for example *Tortula* (Lightowlers, 1985) or Polytrichaceae (Greene *et al.*, 1970). Additionally, no reference is made to earlier collections from the island, although specimens distributed in *Bryophyta Antarctica Exsiccata* are available in no fewer than 50 major world herbaria. Unfortunately, no voucher specimens have been available for examination but fortunately no controversial discoveries were reported by these authors. All the aforementioned shortcomings of this flora make it an unreliable treatise which fails to deliver an accurate account of the mosses of King George Island.

In the past ten years several contributions to the moss flora of the Fildes and Barton Peninsulas have been made by Chinese bryologists (Wu & Hu, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998) working from the Great Wall Station. Their efforts have resulted in a handbook of the Fildes Peninsula mosses comprising keys and descriptions, in Chinese, as well as coloured photographs, line drawings and distribution maps for 48 species of moss they discovered in this area. They reported a great many species new to King George Island and the Antarctic which would have been bryogeographically remarkable records had the specimens been correctly named. Alas, examination of the voucher collections of *Andreaea obovata*, *Barbula unguiculata*, *Tortula ruralis*, *Sarconeurum glaciale*, *Racomitrium striatipilum*, *Bryum muehlenbeckii*, *Calliergon stramineum*, *Drepanocladus aduncus*, *D. exannulatus*, *Brachythecium subpilosum* and *B. subplicatum*, as well as species rarely recorded on the island such as *Schistidium hyalino-cuspidatum*, *S. rivulare* and *S. urnulaceum*, were all misidentifications. The only new species correctly recorded from this island was *Bryum pallescens*.

Apart from taxonomic and bryogeographical studies, observations on the chromosomes in some moss and liverwort species have been published (Ochyra *et al.*, 1982; Kuta *et al.*, 1982; Przywara *et al.*, 1984; Zhou *et al.*, 1995) and SEM studies on the morphology of mosses have been conducted (Liu & Li, 1998). Finally, Hu (1998) described in detail some moss communities on the southern Fildes Peninsula and analysed the species diversity of severeal communities.

GAZETTEER OF KING GEORGE ISLAND COLLECTION LOCALITIES

A general problem with the accurate and precise location of collecting sites in Antarctica is the dearth of names for a variety of distinct landmarks. The Antarctic toponymy is quite rich and satisfactory with regard to prominent topographical features, but many small landmarks, especially in areas which have been less frequently explored, remain unnamed. Consequently, many older specimens collected on King George Island bear very imprecise locality data, for example ‘Keller Peninsula’, ‘Point Thomas’ or ‘Martel Inlet’, so locating the exact source of the collection is practically impossible.

An additional complication is the frequent synonymy of place names. In the past, different names have been introduced for the same places by various national expeditions. Accordingly, on older herbarium specimens one can find either English or Spanish names, the latter having been introduced mostly by Argentinian or Chilean explorers. King George Island itself has two additional names, viz. Ostrov (=island) Waterloo dating back to the Russian Naval Expedition of 1819–1821 on the ships *Vostok* and *Mirnyy* under the command of Th. Th. Bellingshausen and M. P. Lazarev, and Isla 25 de Mayo which was introduced by the Argentinians. The Argentinian (Spanish) version of Admiralty Bay is Bahia Lasserre. Fortunately, the problem of this rich synonymy of place names has been satisfactorily resolved by Hattersley-Smith (1991) in a magnificient gazetteer which is an invaluable source of information regarding the history, location and synonymy of all names introduced in the British Antarctic Territory.

The collecting sites listed below are arranged alphabetically and can be located on the maps (Figs 3, 8, 17). The numbers in brackets following the place names pinpoint these localities on the maps. The majority of place names follow Birkenmajer (1980e, 1984), Tokarski (1981) and Cisak (1992); they can also be found on maps of scale 1:50000 (Battke, 1980) and 1:25000 (Furmańczyk & Marsz, 1980). Many older, historical place names can easily be identified in the gazetteer for the British Antarctic Territory (Hattersley-Smith, 1991). The latitude and longitude of each locality are given, so its exact position can easily be located on the distribution maps. In total, mosses have been recorded at 151 collection sites. For each locality the elevation is given, if available, and the collector(s) name(s).

Admiralen Peak (59) — lat. 62°06′S, long. 58°32′W. 320 m, *Ochyra*.
Agat Point (11) — lat. 62°11′30″S, long. 58°26′W. 0–20 m, *Ochyra*.
Ambona (30) — lat. 62°09′30″S, long. 58°29′W. 85 m, *Ochyra*.
Ardley Island (139) — lat. 62°13′S, long. 58°56′W. 0–30 m, *Kühnemann*, *Komárková*, *Ochyra*.
Atherton Island (128) — lat. 62°05′15″S, long. 58°58′W. *Jabłoński*.
Barrel Point (50) — lat. 62°10′15″S, long. 58°35′15″W. 0–15 m, *Ochyra*.
Basalt Point (89) — lat. 62°07′30″S, long. 58°23′W. 0–20 m, *Ochyra*.
Bastion (5) — lat. 62°13′S, long. 58°28′W. 200–250 m, *Ochyra*.
Bell Island (127) — lat. 62°06′S, long. 58°51′W. *Jabłoński*.
Bell Zygmunt (91) — lat. 62°07′S, long. 58°22′W. 300 m, *Ochyra*.
Bellingshausen Station (131) — lat. 62°12′S, long. 58°58′W. 0–20 m, *Ochyra*.
Belweder (48) — lat. 62°11′S, long. 58°38′30″W. 200–250 m, *Ochyra*.
Blue Dyke (3) — lat. 62°13′30″S, long. 58°27′W. 0–145 m, *Ochyra*.
Błaszyk Moraine (13) — lat. 62°11′30″S, long. 58°27′W. 30–40 m, *Ochyra*.
Brama (9) — lat. 62°12′30″S, long. 58°28′W. 150–200 m, *Ochyra*.
Breccia Crag (45) — lat. 62°10′30″S, long. 58°32′30″W. 0–200 m, *Ochyra*.
Bristone Peak (116) — lat. 61°55′S, long. 57°45′W. *Jabłoński*.
British Point (71) — lat. 62°05′S, long. 58°23′30″W. 0–25 m, *Ochyra*.
Cape Melville (109) — lat. 62°01′30″S, long. 57°35′W. *Jabłoński*.

Cape Syrezol (97) — lat. 62°11′30″S, long. 58°16′15″W. 0–25 m, *Ochyra*.
Cape Vauréal (95) — lat. 62°10′45″S, long. 58°18′30″W. 0–20 m, *Ochyra*.
Chabrier Rock (96) — lat. 62°10′15″S, long. 58°18′W. 0–40 m, *Ochyra*.
Chopin Ridge (104) — lat. 62°08′30S, long. 58°08′W. 265 m, *Jabłoński*.
Cieślak Point (125) — lat. 62°01′S, long. 58°39′W. *Jabłoński*.
Cinder Spur (102) — lat. 62°09′30″S, long. 58°11′W. *Jabłoński*.
Creeping Slopes (8) — lat. 62°12′30″S, long. 58°26′W. 0–140 m, *Ochyra*.
Crépin Point (61) — lat. 62°05′20″S, long. 58°28′W. 0–30 m, *Ochyra*.
Cytadela (47) — lat. 62°11′S, long. 58°35′W. 20–280 m, *Ochyra*.
Czajkowski Needle (15) — lat. 62°11′15″S, long. 58°27′30″W. 200–296 m, *Ochyra*.
Davey Point (124) — lat. 61°58′30″S, long. 58°31′W. *Jabłoński*.
Demay Point (7) — lat. 62°13′S, long. 58°25′W. 0–50 m, *Ochyra*, Komárková.
Durant Point (140) — lat. 62°12′S, long. 58°55′W. *Komárková.*
Dutkiewicz Cliff (44) — lat. 62°10′30″S, long. 58°31′W. 0–300 m, *Ochyra*.
Emerald Point (52) — lat. 62°09′30″S, long. 58°36′W. 0–60 m, *Ochyra*.
Esther Harbour (117) — lat. 61°57′S, long. 58°47′W. *Discovery Investigations*.
False Round (120) — lat. 61°54′S, long. 58°00′W. *Jabłoński*.
Faraway Nunataks (114) — lat. 61°57′30″S, long. 57°40′W. *Jabłoński*.
Fildes Strait (135) — lat. 62°13′45″S, long. 59°00′W. *Li*
Flat Top Peninsula (133) — lat. 62°12′45″S, long. 59°02′W. *John & Sudgen*.
Florence Nunatak (151) — lat. 62°13′S, long. 58°36′W. 300–342 m, *Ochyra*.
Fossil Hill (132) — lat. 62°12′20″S, long. 58°58′20″W. 90 m, *Schulz*.
Gam Point (119) — lat. 61°45′30″S, long. 57°30′W. *Jabłoński*.
Garnuszewski Peak (65) — lat. 62°05′30″S, long. 58°31′W. 300 m, *Ochyra*.
Gdynia Point (54) — lat. 62°09′45′S, long. 58°33′W. 0–25 m, *Ochyra*.
Gemmel Peaks (130) — lat. 62°11′45″S, long. 59°00′W. 100–140 m, *Ochyra*.
Geographers Creek (31) — lat. 62°30′S, long. 58°29′W. 80–130, *Ochyra*.
Great Wall Station (138) — lat. 62°13′20″S, long. 58°57′10″W. 40 m, *Li, Schulz*.
Green Point (144) — lat. 62°10′S, long. 58°51′W. *Jabłoński*.
Half Three Point (137) — lat. 62°13′45″S, long. 58°58′10″W. 10 m, *Schulz.*
Hala (24) — lat. 62°09′S, long. 58°29′W. 40–60 m, *Ochyra*.
Harnasie Hill (98) — lat. 62°11′S, long. 58°15′30″W. 250 m, *Ochyra*.
Harpoon Point (69) — lat. 62°05′S, long. 58°25′W. 0–20 m, *Ochyra*.
Horatio Stump (134) — lat. 62°12′45″S, long. 59°01′W. 164 m, *John and Sudgen*.
Italia Valley (42) — lat. 62°10′30″S, long. 58°31′W. 0–110 m, *Ochyra*.
Jardine Peak (40) — lat. 62°10′S, long. 58°30′W. 200–284 m, *Ochyra*.
Jasnorzewski Gardens (22) — lat. 62°09′S, long. 58°28′30″W. 2–4 m, *Ochyra*.
Jenny Buttress (113) — lat. 61°59′S, long. 58°41′30″W. *Jabłoński*.
Jersak Hills (37) — lat. 62°09′30″S, long. 58°29′30″W. 140–200 m, *Ochyra*.
Kapitan Peak (62) — lat. 62°05′30″S, long. 58°29′W. 180–210 m, *Ochyra*.
Kasprowy Hill (41) — lat. 62°10′S, long. 58°30′W. 190–270 m, *Ochyra*.
Klekowski Crag, coastal cliff (56) — lat. 62°07′30″S, long. 58°30′W. 0–230 m, *Ochyra*.
Klekowski Crag, summit (57) — lat. 62°08′S, long. 58°33′W. 240 m, *Ochyra*.
Komandor Peak (60) — lat. 62°06′S, long. 58°29′W. 200–300 m, *Ochyra*.
Krokiew (35) — lat. 62°09′30″S, long. 58°29′W. 100–168 m, *Ochyra*.
Krzesanica (27) — lat. 62°09′15″S, long. 58°29′W. 0–173.5 m, *Ochyra*.

Krzymiński Point (46) — lat. 62°30′S, long. 58°33′30″W. 0–40 m, *Ochyra*.
Lake Kitezh (142) — lat. 62°12′S, long. 58°57′W, 10 m, *Ochyra*.
Lions Rump (105) — lat. 62°08′20S, long. 58°08′W. *Lindsay*, *Jabłoński*.
Llano Point (17) — lat. 62°10′15″S, long. 58°26′30″W. 0–45 m, *Ochyra*.
Low Head (103) — lat. 62°09′S, long. 58°08′W. *Jabłoński*.
Malczewski Point (101) — lat. 62°10′30″S, long. 58°13′W. *Jabłoński*.
Martins Head (99) — lat. 62°11′S, long. 58°14′W. 20 m, *Ochyra*.
Melville Peak (110) — lat. 62°01′30″S, long. 57°40′W. *Jabłoński*.
Misty Nunatak (58) — lat. 62°06′S, long. 58°31′W. 290 m, *Ochyra*.
Moraine Point (72) — lat. 62°04′20″S, long. 58°24′W. 0–30 m, *Ochyra*.
Moraines by the northern edge of Ecology Glacier (18) — lat. 62°10′S, long. 58°25′W. 60 m, *Ochyra*.
Mount Birkenmajer (78) — lat. 62°03–04′S, long. 58°24′30″W. 200–300 m, *Ochyra*.
Mount Flagstaff (74) — lat. 62°05′S, long. 58°25′W. 60–267 m, *Ochyra*.
Mount Wawel (90) — lat. 62°07′S, long. 58°24′W. 40–288 m, *Ochyra*.
Narębski Point (146) — lat. 62°14′30″S, long. 58°47′W. *Jabłoński*.
Nebles Point (143) — lat. 62°11′S, long. 58°51′30″W. *Jabłoński*.
NE branch of Panorama Ridge (28) — lat. 62°09′30″S, long. 58°29′W. *Ochyra*.
Noel Hill (147) — lat. 62°13′30″S, long. 58°46′W. *Lindsay*, *Jabłoński*.
North Foreland (115) — lat. 61°53′30″S, long. 57°41′W. *Lindsay*
North Spit (145) — lat. 62°13′S, long. 58°49′W. *Lindsay*.
Observatory Creek (29) — lat. 62°30′S, long. 58°29′W. 40–90 m, *Ochyra*.
Ore Point (66) — lat. 62°04′20″S, long. 58°25′30″W. 0–50 m, *Ochyra*.
Ornithologists Creek (21) — lat. 62°09′30″S, long. 58°28′W. 10–50 m, *Ochyra*.
Patelnia (2) — lat. 62°14′S, long. 58°28′W. 0–25 m, *Ochyra*.
Penguin Island (107) — lat. 62°06′S, long. 57°56′W. *Jabłoński*.
Penguin Ridge (20) — lat. 62°09′30″S, long. 58°28′W. 40–55 m, *Ochyra*.
Petrified Forest Creek (32) — lat. 62°30′S, long. 58°29′W. 40–100 m, *Ochyra*.
Piasecki Pass (76) — lat. 62°04′30″S, long. 58°24′30″W. 200 m, *Ochyra*.
Plaza Point (70) — lat. 62°05′20″S, long. 58°24′30″W. 0–10 m, *Ochyra*.
Point Hennequin (88) — lat. 62°07′S, long. 58°28′30″W. 0–30 m, *Lindsay*, *Ochyra*.
Point Thomas (26) — lat. 62°09′15″S, long. 58°29′W. 0–25 m, *Ochyra*, *Kanda*.
Pond Hill (51) — lat. 62°10′15″S, long. 58°37′W. 50–190 m, *Ochyra*.
Pottinger Point (122) — lat. 61°56′20″S, long. 58°22′W. *Jabłoński*.
Precious Peaks (82) — lat. 62°04′15″S, long. 58°18′30″W. 100–361 m, *Ochyra*.
Puchalski Peak (93) — lat. 62°10′S, long. 58°17′30″W. 150–190 m, *Ochyra*.
Pyrites Island (118) — lat. 61°45′45″S, long. 57°29′30″W. *Jabłoński*.
Rakusa Point (19) — lat. 62°09′30″S, long. 58°27′30″W. 0–20 m, *Ochyra*.
Red Hill (1) — lat. 62°14′S, long. 58°30′W. 100–110 m, *Ochyra*.
Rembiszewski Nunataks (92) — lat. 62°09′30″S, long. 58°18′W. 90–200 m, *Ochyra*.
Rescuers Hills (16) — lat. 62°10′30″S, long. 58°27′W. 0–95 m, *Ochyra*.
Ridley Island (121) — lat. 61°51′30″S, long. 58°01′W. *Jabłoński*.
Rolnicki Pass (77) — lat. 62°03′20″S, long. 58°24′30″W. 210 m, *Ochyra*.
Round Hill (68) — lat. 62°04′40″S, long. 58°27′W. 20 m, *Ochyra*.
Rymarz Pass (63) — lat. 62°05′20″S, long. 58°29′30″W. 160–170 m, *Ochyra*.
Scalpel Point (49) — lat. 62°10′15″S, long. 58°37′20″W. 0–50 m, *Ochyra*.

Shag Point and Latarnia Rocks (23) — lat. 62°09′20″S, long. 58°27′30″W. 0–20 m, *Ochyra*.
Shark Fin (79) — lat. 62°03′S, long. 58°22′W. 230 m, *Ochyra*.
Siodło (10) — lat. 62°12′S, long. 58°27′W. 100–130 m, *Ochyra*.
Skua Cliff (33) — lat. 62°09′30″S, long. 58°29′30″W. 80–106 m, *Ochyra*.
Smok (87) — lat. 62°06′30″S, long. 58°22′W. 0–60 m, *Ochyra*.
Sopot Peak (55) — lat. 62°09′45″S, long. 58°33′45″W. 200–205 m, *Ochyra*.
Speil Point (67) — lat. 62°04′45″S, long. 58°25′30″W. 0–60 m, *Ochyra*.
Sphinx Hill (14) — lat. 62°11′15″S, long. 58°26′W. 0–142 m, *Ochyra*.
Stańczyk Hill (100) — lat. 62°09′40″S, long. 58°13′30″W. 250 m, *Jabłoński*.
Stenhouse Bluff (80) — lat. 62°03′S, long. 58°22′W, 0–60 m, *Ochyra*.
Stigant Point (126) — lat. 62°02′S, long. 58°43′W. *Jabłoński*.
Stranger Point (150) — lat. 62°16′S, long. 58°39′W. *Jabłoński*.
Suffield Point (141) — lat. 62°12′S, long. 58°55′W, 0–60 m, *Ochyra*.
SW branch of Panorama Ridge (38) — lat. 62°00′S, long. 58°30′W. 50–170 m, *Ochyra*.
Szafer Ridge (84) — lat. 62°05′30″S, long. 58°18′W. 200–260 m, *Ochyra*.
Tartar Point (123) — lat. 61°56′S, long. 58°26′30″W. *Jabłoński*.
Tern Nunatak (85) — lat. 62°06′15″S, long. 58°18′30″W. 250–266 m, *Ochyra*.
Ternyck Needle (83) — lat. 62°04′45″S, long. 58°15′30″W. 400–433.6 m, *Ochyra*.
The Tower (4) — lat. 62°13′S, long. 58°28′W. 300–366.9 m, *Ochyra*.
Three Brothers Hill (149) — lat. 62°14′30″S, long. 58°40′30″W. 196 m, *Lindsay*, *Jabłoński*.
Three Sisters Point (108) — lat. 62°04′S, long. 57°55′W. *Jabłoński*.
Trowbridge Island (112) — lat. 62°00′S, long. 58°38′W. *Jabłoński*.
Turret Point (106) — lat. 62°05′S, long. 58°57′W. *Lindsay*, *Jabłoński*.
Two Summit Island (136) — lat. 62°13′45″S, long. 58°56′30″W. *Li*.
Tyrrell Ridge (75) — lat. 62°04′S, long. 58°24′30″W. 220 m, *Ochyra*.
Ubocz (34) — Ubocz (34) — lat. 62°10′S, long. 58°29′W. 80–185 m, *Ochyra*.
Uchatka Point (6) — lat. 62°13′15″S, long. 58°25′W. 0–40 m, *Ochyra*.
Ullman Spur (81) — lat. 62°04′30″S, long. 58°21′W. 0–289 m, *Ochyra*.
Unnamed hill between Jersak Hills and Krokiew (39) — lat. 62°09′30″S, long. 58°30′W. 150–184 m, *Ochyra*.
Unnamed hills on Wróbel Glacier (43) — lat. 62°09′45″S, long. 58°30′15″W. 120 m, *Ochyra*.
Upłaz (25) — lat. 62°09′30″S, long. 58°29′W. 40–60 m, *Ochyra*.
Upper part of Ornithologists Creek (36) — lat. 62°10′30″S, long. 58°29′W. 60–90 m, *Ochyra*.
Urbanek Crag (53) — lat. 62°08′30″S, long. 58°32′W. 0–130 m, *Ochyra*.
Vauréal Peak (94) — lat. 62°10′45″S, long. 58°17′30″W. 50–110 m, *Ochyra*.
Warkocz (86) — lat. 62°06′30″S, long. 58°19′W. 100–300 m, *Ochyra*.
Wegger Peak (64) — lat. 62°05′30″S, long. 58°31′30″W. 200–320 m, *Ochyra*.
West Foreland (129) — lat. 62°08′30″S, long. 58°55′W. 0–30 m, *Ochyra*.
Winship Point (148) — lat. 62°15′S, long. 58°44′W. *Jabłoński*.
Wrona Buttress (111) — lat. 62°00′S, long. 57°39′W. *Jabłoński*.
Yellow Point (73) — lat. 62°04′S, long. 58°24′W. 0–60 m, *Ochyra*.
Zamek (12) — lat. 62°11′30″S, long. 58°29′W. 280–339 m, *Ochyra*.

PERSONAL COLLECTION LOCALITIES AND NUMBERS

During my fieldwork on King George Island in 1979–1980 I collected altogether over 3000 specimens of moss, liverwort, lichen and vascular plant at 106 collection localities. Of these, hepatics contributed 142 numbers (Ochyra & Váňa, 1989b), while the moss collection cited in the present work comprises 1300 specimens. The large collection of lichens remains mostly undetermined and only a limited number of specimens have been studied by specialists and cited in relevant monographic publications (e.g. Hertel, 1984; Søchting & Øvstedal, 1991; Stenroos, 1993). It is worth noting that two lichen taxa new to science have been described from the material collected in the Admiralty Bay area, namely *Lecidea spheniscidarum* Hertel and *Austrolecia antarctica* Hertel, the latter representing a new monotypic genus.

The following is the list of sites where I personally collected botanical specimens accompanied by collection numbers and dates.

Bransfield Strait

1. Red Hill — 1083–1124/80 (25 Jan 1981).
2. Patelnia — 1125–1139/80 (25 Jan 1980).
3. Blue Dyke — 1140–1180/80 (25 Jan 1980) and 1181–1223/80 (26 Jan 1980).
4. The Tower — 811–816/80 (18 Jan 1980), 1024–1041/80 (21 Jan 1980) and 1378–1379/80 (1 Feb 1980).
5. Bastion — 975–1023/80(21 Jan 1980).
6. Uchatka Point — 1042–1082/80 (24 Jan 1980).
7. Demay Point — 1320–1375/80 (27 Jan 1980) and 1381–1394/80 (2 Feb 1980).
8. Creeping Slopes — 1024–1301/80 (26 Jan 1980), 1302–1907/& & 1376/80 (27 Jan 1980) and 1380/80 (2 Feb 1980).
9. Brama — 783–810/80 (18 Jan 1980).

Ecology Glacier

10. Siodło — 728–782/80 (18 Jan 1980).
11. Agat Point — 349–407/80 and 413/80 (8 Jan 1980).
12. Zamek — 1–40/80 (1 Jan 1980)
13. Błaszyk Moraine — 2630–2631/80 (9 Mar 1980).
14. Sphinx Hill — 190–284/80 (5 Jan 1980), 408–412/80 (8 Jan 1980) and 648/80 (16 Jan 1980).
15. Czajkowski Needle — 649–694/80 (16 Jan 1980).
16. Rescuers Hills — 165–189/80 (4 Jan 1980), 285–189/80 (5 Jan 1980) and 1897/80 (15 Feb 1980).
17. Llano Point — 164/80 (4 Jan 1980), 1377/80 (30 Jan 1980), 1896/80 (15 Feb 1980) and 2632/80 (9 Mar 1980).

Point Thomas

18. Moraines by the northern edge of Ecology Glacier — 695–727/80 (17 Jan 1980).
19. Rakusa Point — 290–301/80 (6 Jan 1980), 302–348/80 (7 Jan 1980) and 2397/80 (29 Feb 1980).
20. Penguin Ridge — 1395–1448/80 (5 Feb 1980), 2396/80 (24 Feb 1980) and 2398–2400 (29 Feb 1980).
21. Ornithologists Creek — 900–912/80 (19 Jan 1980).
22. Jasnorzewski Gardens — 1449–150/80 (5 Feb 1980), 2349/80 (22 Feb 1980) and 2352/80 (24 Feb 1980).
23. Shag Point and Latarnia Rocks — 1547–1573/80 (10 Feb 1980).
24. Hala — 5198–5228/79 (31 Dec 1979), 1894–1895/80 (12 Feb 1980) and 2385–2394/80 (24 Feb 1980).
25. Upłaz — 1501–1546/80 (5 Feb 1980) and 2353–2359/80 & 2395/80 (24 Feb 1980).
26. Point Thomas — 1730–1754/80 (6 Feb 1980).
27. Krzesanica — 4970–4984/79 (24 Dec 1979), 1650–1669/80 (6 Feb 1980) and 2351/80 (23 Feb 1980).
28. NE branch of Panorama Ridge — 1695–1715/80 (6 Feb 1980).
29. Observatory Creek — 1648–1649/80 (6 Feb 1980).
30. Ambona — 1601–1647/80 (6 Feb 1980).
31. Geographers Creek — 603–605/80 (14 Jan 1980).
32. Petrified Forest Creek — 606–612/80 (14 Jan 1980).
33. Skua Cliff — 160–161/80 (3 Jan 1980) and 613–642 (14 Jan 1980).
34. Ubocz — 49–85/79 (26 Dec 1979), 5121–5126/79 (28 Dec 1979), 2350/80 (23 Feb 1980) and 2360–2384/80 (24 Feb 1980).
35. Krokiew — 1670–1694/80 (6 Feb 1980).
36. Upper part of Ornithologists Creek — 124–159/80 (3 Jan 1980) and 643–647/80 (15 Jan 1980).
37. Jersak Hills — 5016–5074/79 (27 Dec 1979), 5087–5120/79 (28 Dec 1979), 5127–5148/79 (29 Dec 1979), 82–86/80 (2 Jan 1980) and 2249 (19 Feb 1980).
38. SW branch of Panorama Ridge — 1716–1729/80 (6 Feb 1980).
39. Unnamed hill between Jersak Hills and Krokiew — 5149–5153/79 (30 Dec 1979).

Ezcurra Inlet

40. Jardine Peak — 5154–5197/79 (30 Dec 1979).
41. Kasprowy Hill — 67–81/80 (2 Jan 1980) and 162–163/80 (3 Jan 1980).
42. Italia Valley — 5075–5078/79 (27 Dec 1979), 41–66/80 (2 Jan 1980), 87–119/80 (3 Jan 1980) and 2629/80 (8 Mar 1980).
43. Unnamed hills on Wróbel Glacier — 120–123/80 (3 Jan 1980).
44. Dutkiewicz Cliff — 5079–5086/79 (27 Dec 1979)
45. Breccia Crag — 913–933/80 (20 Jan 1980).
46. Krzymiński Point — 934–842/80 (20 Jan 1980)
47. Cytadela — 943–974/80 (20 Jan 1980).
48. Belweder — 1586–1600/80 (11 Feb 1980).
49. Scalpel Point — 1789–1816/80 (11 Feb 1980).
50. Barrel Point — 891–899/80 (19 Jan 1980).
51. Pond Hill — 861–890/80 (19 Jan 1980) and 1817–1832/80 (11 Feb 1980).
52. Emerald Point — 817–860/80 (19 Jan 1980).
53. Urbanek Crag — 2313–2348/80 (20 Feb 1980).

Dufayel Island

54. Gdynia Point — 1755–1789/80 (11 Feb 1980).
55. Sopot Peak — 1574–1585/80 (11 Feb 1980).

MacKellar Inlet

56. Klekowski Crag, coastal cliff — 2250–2290/80 (20 Feb 1980).
57. Klekowski Crag, summit ridge — 2290–2312/80 (20 Feb 1980).
58. Misty Nunatak — 2030–2034/80 (16 Feb 1980).
59. Admiralen Peak — 2022–2029/80 (16 Feb 1980).
60. Komandor Peak — 1928–1976/80 (16 Feb 1980).
61. Crépin Point — 2035–2049/80 (16 Feb 1980) and 2696–2697/80 (14 Mar 1980).
62. Kapitan Peak — 1898–1927/80 (16 Feb 1980) and 2691–2695/80 (14 Mar 1980).
63. Rymarz Pass — 1977–1982/80 (16 Feb 1980)
64. Wegger Peak — 1983–2010/80 (16 Feb 1980).
65. Garnuszewski Peak — 2011–2021/80 (16 Feb 1980).

Keller Peninsula

66. Ore Point — 447–452/80 (9 Jan 1980) and 501–528/80 (10 Jan 1980).
67. Speil Point — 529–539/80, 556/80 and 602/80 (10 Jan 1980).
68. Round Hill — 540–549 (10 Jan 1980)
69. Harpoon Point — 550–555 (10 Jan 1980).
70. Plaza Point — 556 (10 Jan 1980).
71. British Point — 453–461/80 and 557–558/80 (10 Jan 1980).
72. Moraine Point — 462–492/80 (10 Jan 1980).
73. Yellow Point — 493–500/80 (10 Jan 1980).
74. Mount Flagstaff — 414–427/80 (9 Jan 1980).
75. Tyrrell Ridge — 428–430/80 (9 Jan 1980).
76. Piasecki Pass — 431–437/80 (9 Jan 1980).
77. Rolnicki Pass — 438–440 (9 Jan 1980)
78. Mount Birkenmajer — 441–446/80 (9 Jan 1980).

Martel Inlet

79. Shark Fin — 2633–2656/80 (12 Mar 1980).
80. Stenhouse Bluff — 2579–2628/80 (5 Mar 1980).
81. Ullman Spur — 559–601/80 (11 Jan 1980).
82. Precious Peaks — 2657–2668/80 (12 Mar 1980).
83. Ternyck Needle — 1833–1837/80 (12 Feb 1980).
84. Szafer Ridge — 2553–2578/80 (5 Mar 1980).
85. Tern Nunatak — 2501–2524/80 (5 Mar 1980).
86. Warkocz — 2525–2552/80 (5 Mar 1980).
87. Smok — 2050–2112/80 (18 Feb 1980).
88. Point Hennequin — 2238–2248/80 (18 Feb 1980).
89. Basalt Point — 2198–2237/80 (18 Feb 1980).
90. Mount Wawel — 2113–2197/80 (18 Feb 1980).
91. Bell Zygmunt — 2669–2688/80 (12 Mar 1980).

Viéville Glacier

92. Rembiszewski Nunataks — 2719–2761/80 (16 Mar 1980).
93. Puchalski Peak — 2698–2718/80 (16 Mar 1980).
94. Vauréal Peak — 5236–5260/79 (31 Dec 1979)
95. Cape Vauréal — 5229–5235/79 (31 Dec 1979)
96. Chabrier Rock — 1873–1893/80 (12 Feb 1980).
97. Cape Syrezol — 1851–1885/80 (12 Feb 1980).
98. Harnasie Hill — 1838–1850/80 (12 Feb 1980).
99. Martins Head — 1866–1872/80 (12 Feb 1980).

Fildes Peninsula

100. West Foreland — 2470– 2472/80 (2 Mar 1980)
101. Gemmel Peaks — 2473–2480/80 (2 Mar 1980).
102. Bellingshausen Station — 2401–2433/80 (1 Mar 1980).
103. Ardley Island — 2481–2500/80 (2 Mar 1980).
104. Suffield Point — 2434–2453/80 (2 Mar 1980).
105. Lake Kitezh — 1254–1269/80 (2 Mar 1980).

Potter Peninsula

106. Florence Nunatak — 1310–1319/80 (29 Jan 1980).

Chapter 4

THE ISLAND'S VEGETATION

There is not a tree, not a bush, not a shrub, not a flower, in all the islands. There is a little coarse moss here and there, and in Potter's Cove there is a small plot of land with a little grass of a small kind, and very short.

R. Sherratt, *Observations on South Shetland*, 1821

INTRODUCTION

The vegetation of the Antarctic biome is markedly affected by the geographical isolation of the continent as well as the prevailing climate. It is at best a poorly developed, predominantly cryptogamic tundra, with mosses and lichens being the principal components of the plant communities. The vascular flora is represented by only two native species (Greene & Greene, 1963; Greene & Holtom, 1971; Greene & Walton, 1975), the Antarctic hair grass *Deschampsia antarctica* Desv. (Poaceae) and the Antarctic pearlwort *Colobanthus quitensis* (Kunth) Bartl. (Caryophyllaceae). They occur exclusively in the maritime Antarctic, extending south as far as lat. 68°42′S in the Tierra Firma Islands group at Marguerite Bay (Lewis-Smith, 1982; Lewis-Smith & Poncet, 1985, 1987; Komárková *et al.*, 1985).

Since the first account of Antarctic vegetation (Skottsberg, 1912), a great body of information has accumulated, relating to the description of the plant communities as well as to the physical and environmental factors which are responsible for their development. A comprehensive summary of most the descriptive accounts of the vegetation in a wide range of localities in both maritime and continental Antarctica has been provided by Seppelt *et al.* (1998).

Many authors have paid special attention to the problem of a vegetation classification in the Antarctic biome. The procedures of the Braun-Blanquet method, which have gained wide acceptance in Europe, have been used on a limited scale in the Antarctic (Kappen, 1985) and Subantarctic (Gremmen, 1982). Initially, I also attempted to delimit some plant associations on King George Island by using this quantitative analysis (Furmańczyk & Ochyra, 1982). It has proved, however, that the principal foundation of the method, i.e. the recognition of a hierarchical system of syntaxa on the basis of the character species concept, cannot be successfully applied to vegetation analysis in this biome. This is mainly because the Antarctic terrestrial vegetation lacks any great complexity, either in physiognomy or in species diversity. Accordingly, many species with a broad ecological amplitude, become the major components of a variety of plant associations of different physiognomy which develop in different habitat conditions, for example *Sanionia georgico-uncinata*, *S. uncinata*, *Polytrichastrum alpinum*, *Bryum pseudotriquetrum* and *Pohlia nutans*. In addition, its use is dramatically limited by poor knowledge of bryophytes and lichens taxonomically, which is essential in any quantitative analysis of phytosociological relevés.

Much more effective and practical has proved to be the system proposed and developed by British workers (Holdgate, 1964; Longton, 1967, 1973, 1979, 1988; Gimingham & Lewis-Smith, 1970; Lewis-Smith, 1972; Lewis-Smith & Gimingham, 1976). In contrast to the Braun-Blanquet system, the major units in this system are defined by placing emphasis on the growth forms of certain indicative species which are often a reflection of their ecology; lower units then reflect floristic composition. Associations are characterized by a small group of constant species, while sociations are recognized by their dominants or codominants. This system makes it possible to describe accurately all the vegetation types found in the Antarctic and is therefore applied in the characterization of vegetation in the present study area.

GENERAL FEATURES OF THE VEGETATION

The first broad description of the vegetation of King George Island was given by Lindsay (1971). He described the general characteristics of the plant cover at some sites on the north coast, for instance at False Round and North Foreland, and of some localities on the south coast including Turret Point and the Barton Peninsula, as well as Point Thomas, Crépin Point, Keller Peninsula, Ullman Spur, Point Hennequin and Sphinx Hill in Admiralty Bay. Later, a detailed description of the plant communities of the swampy area called 'Jasnorzewski Gardens' close to the Arctowski Station was presented by Furmańczyk and Ochyra (1982). They provided a detailed map of the distribution of the plant communities prepared on the basis of a computer analysis of multispectral air photographs. It was the first use of this method for mapping vegetation in the Antarctic. A general overview of the vegetation of King George Island, with special reference to the presence and role of liverworts in the plant communities, was subsequently outlined by Ochyra and

Váňa (1989b). Additionally, Myrcha *et al.* (1991) surveyed the main plant communities of the western shore of Admiralty Bay from the Arctowski Station to Bransfield Strait, an area designated as SSSI No. 8 (Bonner & Lewis-Smith, 1985). Some peat forming plant communities in the Admiralty Bay area were studied by Fabiszewski and Wojtuń (1993, 1997), while Zarzycki (1993) described terrestrial biotopes dominated by the two vascular plants in the vicinity of the Arctowski Station. A provisional vegetation map of SSSI No. 34 at Lions Rump on the west coast of King George Bay was published by Olech (1994) but this unfortunately lacked a description of the recognized communities and lichen assemblages. Finally, the main moss community types were reviewed for southern Fildes Peninsula (Hu, 1998).

The vegetation of King George Island is relatively well-known and the present account focuses on a description of the role of mosses in the main types of plant community. The island exhibits strong affinities with others in the northern part of the maritime Antarctic including Elephant Island in the South Shetland Islands (Allison & Lewis-Smith, 1973; Lewis-Smith, 1979), and the South Orkney Islands (Lewis-Smith, 1972). The region is devoid of extensive closed phanerogamic vegetation and only communities dominated by cryptogamic plants, developed under the cold oceanic conditions prevailing there, dominate the landscape. However, the island's vegetation differs somewhat from that which has developed on the still active volcanic islands such as the South Sandwich Islands (Longton & Holdgate, 1979) or Deception Island in the South Shetlands (Lewis-Smith, 1984b, 1984c, 1988a). On these islands peculiar communities associated with heated ground around fumaroles are commonly found, dominated by moss species unknown elsewhere in the Antarctic including *Campylopus* spp., *Anisothecium hookeri* and *Philonotis polymorpha*, as well as the large thallose hepatic *Marchantia berteroana*.

The salience of the vegetation of King George Island is the much greater development of vegetation cover on the southern than on the northern coast. In the latter area there are many rocky promontories with penguin rookeries. Consequently, the amount of lichen vegetation, especially various ornithocoprophilous communities, considerably exceeds the moss growth which is often restricted to small patches and mats at the periphery of the penguin rookeries. The two species of vascular plant are almost absent from the northern coast, but they form luxuriant and lush growth in the sheltered area of Admiralty Bay, especially in the vicinity of the penguin rookery at Rakusa Point near Arctowski Station. In other sites on the south side of the island, for example at Turret Point and Potter, Barton and Keller Peninsulas, the two flowering plants are fairly infrequent and usually occur as struggling tufts in the moss carpets dominated by *Sanionia georgico-uncinata* or in pockets of soil at low elevations, especially on raised beaches.

The most luxuriant vegetation cover on King George Island is found in the Admiralty Bay area which is the largest embayment on the island. Its topography, especially the protection on three sides from the prevailing westerlies by high mountain ranges, contributes very much to the creation of the microclimatic conditions which are favourable for the development of plant communities. Additionally, this area has a considerable amount of ice- and snow-free terrain available for plant colonization. As a result, Admiralty Bay has the richest moss flora, not only on King George Island, but in the entire the Antarctic, except for Signy Island in the South Orkney Islands.

Despite the existence of a wide range of rock types exposed on the island and available for plant colonization, the saxicolous vegetation seems to be developed in a more or less similar way throughout the island. The lack of base rich rocks certainly affects the abundance of some species which are less frequent on King George Island than, for example, on Signy Island (Lewis-Smith, 1972). Consequently some plant communities and moss assemblages which develop on calcareous soil and in base rich rock fissures occupy small areas and are not dominant in the island's landscape.

In practice, almost all types of plant community distinguished in the maritime Antarctic (Gimingham & Lewis-Smith, 1970; Lewis-Smith, 1972) have been found on King George Island, although some of them are very rare and localized. This is especially true for moss peat banks which are widespread in areas with a prevailing oceanic climate, for example in the South Orkney Islands, on Elephant Island in the South Shetlands and at various sites along the west coast of the Antarctic Peninsula as far south as the Argentine Islands (Lewis-Smith, 1972, 1979; Allison & Lewis-Smith, 1973; Lewis-Smith & Corner, 1973; Collins, 1976; Fenton, 1980, 1982; Fenton & Lewis-Smith, 1982). In the study area they are exceedingly rare and have so far been found only on the small Ardley Island near the Fildes Peninsula. In the Admiralty Bay area they are replaced by peat mounds (Fabiszewski & Wojtuń, 1993, 1997).

REVIEW OF THE PLANT COMMUNITIES

Although no quantitative analysis of the moss-dominated communities has been undertaken for King George Island, a quantitative description of the vegetation can be presented, with particular emphasis on the role of moss species in the various units. Based on the widely accepted system of classification of the vegetation types in the maritime Antarctic (Gimingham & Lewis-Smith, 1970), two formations and six subformations can be recognized on King George Island. These broad physiognomic units can be subdivided into smaller units, associations and sociations, based upon the dominance of moss species. Several small moss assemblages of rather limited occurrence are present in rock fissures and/or on rock ledges but they are not discussed here.

Grass and cushion chamaephyte subformation

This is the only subformation recognized within the Antarctic herb tundra formation and it is characterized by the dominance of the two native flowering plants. As mentioned above, they are widespread in the Admiralty Bay area, with particular frequency and abundance in the vicinity of the penguin rookeries at Rakusa and Llano Points and this is their largest stand in the Antarctic (Komárková *et al.*, 1985). They grow at low elevations, usually up to 50 m, and only occasionally the grass *Deschampsia antarctica* ascends as high as 330 m on Dutkiewicz Cliff in Ezcurra Inlet, while *Colobanthus quitensis* has been found at 160 m, below the summit of Krzesanica Cliff above Point Thomas (Zarzycki, 1993). Both species usually form extensive swards, mostly in sheltered sites, on level or, more typically, gently sloping ground on north-facing slopes and they often occur in moist soil-filled depressions and on rock ledges (Figs 21–22). Sometimes they grow on stonier and drier ground and in places the grass is an associate in open bryophyte and lichen communities. Individual tufts of *D. antarctica* are up to 15 cm tall and 30–40 cm in diameter with about 15–20 cm of peat accumulation beneath them (Fig. 20). *C. quitensis* occurs over a wide area but has no tendency to form pure stands.

The flowering plants seem to tolerate a fairly high concentration of nitrogen and phosphorus because their lush growth can often be found below seabird colonies or in the proximity of penguin rookeries. Isolated tufts of the grass are often frequent among bryophytes, especially *Sanionia georgico-uncinata* or, less frequently, *Polytrichastrum alpinum* and *Bryum pseudotriquetrum.* In addition, other moss species can be found as associates in stands of this association including *Brachythecium austrosalebrosum* and *Syntrichia filaris*. Occasionally *Andreaea* species, *Bartramia patens*, *Pohlia nutans* and *Syntrichia saxicola* occur in stands gradually merging with sociations of the fruticose lichen and moss cushion subformation, while *Warnstorfia sarmentosa* and *W. laculosa* are found in wetter sites bordering stands of the moss carpet subformation.

Crustose lichen subformation

This and succeeding subformations all represent the Antarctic cryptogam tundra formation. The main components of its communities are epipetric or, less frequently, dwarf fruticose lichens. This subformation is very diverse floristically, comprising at least three associations which are very widespread on King George Island on exposed rock faces on the sea stacks and rocky headlands, and locally also inland where rock outcrops are used as bird perches, namely the *Caloplaca regalis–Xanthoria elegans*, *Buellia–Lecanora–Lecidea* and *Placopsis contortuplicata* associations. Because of unresolved taxonomic problems in most Antarctic lichen genera, the list of species which constitute these associations is not exhaustive.

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A characteristic feature of this subformation is the almost total absence of mosses. The only species which is consistently associated with the *Caloplaca–Xanthoria* association is the halophilous *Muelleriella crassifolia*. This small, blackish moss growing in cushions is known to be one of the very few mosses which can tolerate high concentrations of marine salt. Therefore it grows exclusively in the *Verrucaria* sociation which occupies a distinct zone on coastal rocks immediately above high-water mark. Although the *Verrucaria* sociation is common on rocks and skerries in the littoral zone, *M. crassifolia* is rare on the island, being recorded at only a few stations.

Another frequent associate of the *Caloplaca-Xanthoria* association is the nitrophilous *Hennediella antarctica* which often grows in rock crevices and on ledges. Other species such as *Syntrichia princeps*, *S. filaris*, *Schistidium antarctici* and *Andreaea regularis* may occur coincidentally and sparsely in various sociations of this association. Associations of this subformation elsewhere in the Antarctic have a similar bryophyte composition, although locally, for example in the Argentine Islands, *Sarconeurum glaciale* and *Schizymenium austrogeorgicum* (Müll. Hal.) Shaw may occur in niches similar to those occupied by *Hennediella antarctica* (Lewis-Smith & Corner, 1973).

FRUTICOSE LICHEN AND MOSS CUSHION SUBFORMATION

This subformation, comprising communities dominated by various species of macrolichen and short turf- and small cushion-forming mosses, is the most widespread and extensive on the island, especially on the south coast. It occupies most of the rock exposures of the inland and upland areas unaffected by seabird and seal colonies or salt spray, and includes scree, windswept hillsides, plateaux, inland boulders and cliffs, moraines, ridges, knolls and rock faces as well as finer mineral soils. It extends from near sea level to the summits of the highest nunataks (433 m) and develops in a wide range of habitats, mostly in the driest places and where the moss cushions are usually interspersed with patches of bare ground. Therefore this type of vegetation, composed of communities of this subformation, may be regarded as a typical cryptogamic fellfield (Longton, 1988; Lewis-Smith, 1993a).

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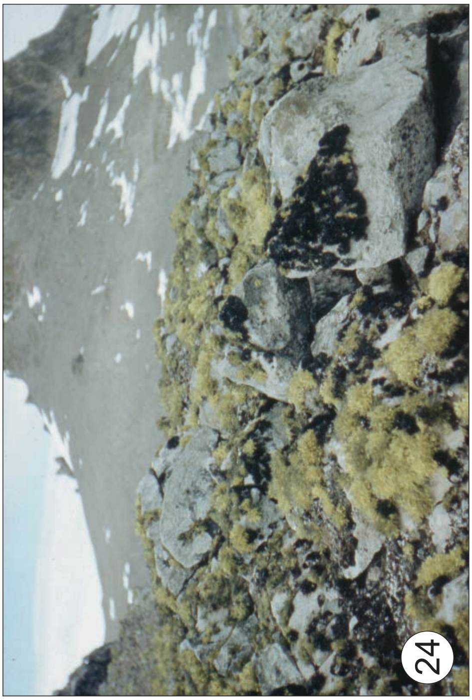
FIGURES 20–23. — **20**. Tufts of *Deschampsia antarctica* showing peat accumulation on the rock ledge at Rakusa Point (altitude ca 15 m) at the margin of a seal-wallow area. (Photograph by Jacek Siciński, Jan 1980.) — **21**. Extensive pure stand of coalesced tufts of *Deschampsia antarctica* near the breeding gentoo penguin colony at Rakusa Point (altitude ca 10 m). (Photograph by Andrzej Kozik, Jan 1980.) — **22**. Extensive mixed sward of *Deschampsia antarctica* and *Sanionia georgico-uncinata* at the locality shown in Fig. 21. (Photograph by Jacek Siciński, Jan 1980.) — **23**. An *Usnea antarctica* sociation on a windswept plateau on Penguin Ridge south of the Arctowski Station (altitude ca 45 m). (Photograph by Ryszard Halba, Jan 1980.)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The fruticose lichen and moss cushion subformation is very rich floristically, resulting in its considerable diversification into several associations within which severeal sociations can be recognized. Those dominated by mosses usually develop in the more stable sheltered sites, either very dry or moister, where there is some accumulation of organic matter or soil. Depending on the situation, moss species may remain as solitary cushions scattered amongst boulders and gravel, or the moss colonies may coalesce to form closed stands.

Andreaea–Usnea is the commonest and most important and widespread association of this subformation. It is typified by large species of fruticose lichens including *Usnea antarctica*, *U. aurantiaco-atra* (=*U. fasciata*) and *Himantormia lugubris*, foliose *Umbilicaria* and numerous epipetric microlichens of the difficult genera *Lecidea*, *Lecanora*, *Rhizocarpon* and *Buellia*, forming a rich understorey beneath the macrolichens. Mosses are very varied in this association and show great ecological amplitude with the most frequent associates being cushion-forming species of such genera as *Andreaea*, *Dicranoweisia*, *Syntrichia* and *Schistidium*, and less frequently species of *Ceratodon* and *Pohlia* forming short turfs.

This association comprises numerous of sociations, some of which have similar species compositions. At lower elevations, usually below 100 m in the Admiralty Bay area, occurs the widely distributed *Usnea antarctica* sociation. It covers large expanses of the less exposed areas on moraines, windswept ridges and hilltops which are sometimes slightly irrigated by melt-water trickles, and where the cover of the dominant species often exceeds 90 per cent (Fig. 23). It tends to avoid stony ground and prefers a finer and looser substratum. This community is rather poor bryologically, and the cover of moss species such as *Dicranoweisia brevipes*, *D. crispula*, *Andreaea depressinervis*, *Ceratodon purpureus* and *Pohlia nutans*, increases as melt-water becomes more available.

Another widespread and common sociation is that dominated by *Usnea aurantiaco-atra* and *Himantormia lugubris*, occurring on stony hillsides, exposed knolls, ridges and plateaux (Figs 15, 24). In the Admiralty Bay area it most often occurs at the higher altitudes, usually above 100 m, but, for example, on the Barton Peninsula it occurs also at lower elevations, covering much of the terrain with what looks

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FIGURES 24–27. — **24**. A well-developed *Himantormia lugubris–Usnea aurantiaco-atra* sociation dominated by *Himantormia lugubris* (black fruticose) and *Usnea aurantiaco-atra* (yellow fruticose), with various grey and white crustose lichens, on exposed basalt rocks on a slope of the Jersak Hills west of the Arctowski Station (altitude ca 140 m). (Photograph by Ryszard Halba, Feb 1980.) — **25**. A stand of *Andreaea gainii* and *A. regularis* on moist stony ground (altitude ca 130 m) on the Jersak Hills west of the Arctowski Station. (Photograph by Ryszard Halba, Feb 1980.) — **26**. An extensive stand of *Sanionia georgico-uncinata* on gently sloping ground at Hala west of the Arctowski Station (altitude ca 40 m). (Photograph by Jacek Siciński, Jan or Feb 1980.) — **27**. *Brachythecium austrosalebrosum* lining a melt-water channel (altitude ca 30 m) at Hala. (Photograph by Jacek Siciński, Jan or Feb 1980.)

like partially burnt grass because of the shaggy growth of the two dominant species. A consequence of the somewhat stonier substratum with less soil accumulation is that mosses afford rather small cover, which accounts for only about 10–15 per cent, the predominant species being *Andreaea gainii*, *A. regularis*, *A. depressinervis*, *Distichium capillaceum* and *Dicranoweisia brevipes*.

In dry rock fissures, depressions and on ledges with small quantities of mineral soil and sheltered from the wind, patches of the *Andreaea* sociation dominate. In favourable habitats individual cushions of *A. gainii* or *A. depressinervis* may coalesce to form extensive carpets (Fig. 25). *Ceratodon purpureus* and *Schistidium antarctici* are frequent associates of this sociation. On dry, fairly exposed soils or gravels on level or gently sloping ground and on scree slopes this sociation is usually invaded by a variety of lichens, some of which, for example *Ochrolechia frigida*, grow epiphytically on *Andreaea*.

Other sociations are generally local and their stands occupy limited areas, for example the fairly large patches of the *Andreaea regularis–Racomitrium sudeticum* sociation which occur on the raised marine beach between Ore and Speil Points on the west coast of the Keller Peninsula. The small cushions of *R. sudeticum* coalesce to form extensive pure stands having as associates *Kiaeria pumila*, *Polytrichastrum alpinum* and *Sanionia georgico-uncinata*.

Many moss species may be found among the boulders of scree, in crevices and on rock face ledges where soil and moisture have accumulated and some protection has been afforded from the wind. These moss assemblages, occurring in such microhabitats, exhibit very diverse species composition in the different sites and are difficult to classify. The fissure flora is generally more or less transitory since the rock is liable to be shattered by frost. In practice, the majority of moss species which occur on King George Island may be encountered in such habitats. *Andreaea* species, *Bartramia patens*, *Dicranoweisia brevipes*, *D. crispula*, *D. grimmiacea*, *Pohlia cruda*, *Ceratodon purpureus*, *Sanionia uncinata*, *Stegonia latifolia*, *Orthotheciella varia* and *Hypnum revolutum* appear to be very frequent in these crevice communities while some, for example *Platydictya jungermannioides* and are virtually confined to them. In crevices and on ledges of basic rocks which are rare or non-existent in some parts of the island, *Encalypta rhaptocarpa* and *Didymodon gelidus* are exclusive to this type of microhabitat.

In some areas with an extremely base rich substratum, for example on Signy Island in the South Orkney Islands, the interesting association *Syntrichia–Schistidium antarctici* has been recognized (Lewis-Smith, 1972). On King George Island, due to the non-existence or limited occurrence of a substratum of this type, this association occurs only in fragmentary form. Small stands dominated by *Schistidium antarctici*, *Syntrichia saxicola*, *S. princeps*, *Bryum amblyodon* and *B. pseudotriquetrum* are scattered but they are not prominent in the landscape, although the principal species of the association are themselves common components of the island's moss flora. They occur on the slopes of moist hollows, on dry, sandy or gravelly soils and morainic debris, which are often disturbed by frost action.

Lewis-Smith (1972) recognized on Signy Island the separate association dominated by *Hennediella antarctica* (=*Pottia austrogeorgica*). This species is also common on King George Island, at least in the Admiralty Bay area, but its stands are seldom extensive. They occur on fine, moist, clayey or gravelly soils, usually enriched with nitrogen and disturbed by gulls, terns and elephant seals, most often on ledges and patches of soil within the *Xanthoria–Caloplaca* association. Therefore the independence of this association, at least in the study area, may be questioned.

Moss turf subformation

This subformation comprises two associations best developed on well-drained level to gently sloping stony ground irrespective of aspect. They are typical peat forming associations which build up peat of variable depth. Semi-ombrogenous banks of the tall turf forming species, *Chorisodontium aciphyllum* and *Polytrichum strictum*, are exceedingly rare on King George Island and occur almost exclusively on the small Ardley Island near the Fildes Peninsula, and some small stands are also found on the Fildes Peninsula near its connection to Ardley Island and around Three Brothers Hill on the Potter Peninsula. The two co-dominant species form closed, often shallow undulating stands of a deep mixed turf which are usually colonized by a number of epiphytic crustose and fruticose lichens. The association is practically free of other moss species and only occasionally *Sanionia georgico-uncinata* is found in small quantities. On the other hand, constant associates of this community are the liverworts, *Cephaloziella varians* and *Barbilophozia hatcheri*.

The second association of this subformation is dominated by *Polytrichastrum alpinum* which forms shorter and less dense turfs. This species forms pure coalesced circular colonies which are seldom more than 1 m in diameter and are generally restricted to broad rock ledges and moist stony soil which has accumulated below rock faces. On drier stony ground these stands are often heavily colonized by epiphytic lichens. Peat accumulation is less beneath the moss and therefore the association does not form characteristic peat banks, although occasionally at Llano Point it forms typical peat mounds with peat about 90 cm thick. In fairly moist places below cliff-breeding bird colonies the sociation with the co-dominant *Sanionia georgico-uncinata* develops frequently and *Deschampsia antarctica* may be an occasional associate.

Moss carpet subformation

This subformation is largely restricted to areas with a permanent supply of standing water such as hollows, depressions between raised beaches, edges of snow patches, melt-water channels, and so is encountered more frequently in flat coastal areas than inland. It comprises a single association dominated by species which form thin mats of more or less prostrate shoots, namely *Warnstorfia laculosa*, *W. sarmentosa* and *Sanionia georgico-uncinata* which develop a shallow peat beneath the living moss. In the older Antarctic literature these species were referred to as *Brachythecium* cf. *antarcticum*, *Calliergon* cf. *sarmentosum* and *Drepanocladus uncinatus* but recent taxonomic studies have established their true identities. These species form more or less pure stands typified by one particular species with prominent zonations separating them.

Pure stands of *Warnstorfia laculosa* are quite common in the wettest areas and form saturated spongy carpets, which may exceed 15 cm in depth. They develop in swampy places traversed by melt-water channels, at the edges of pools and on flat areas bordering lakes. *Warnstorfia sarmentosa* and *Sanionia georgico-uncinata* are occasional associates.

Stands dominated by *Warnstorfia sarmentosa* are locally common, occurring in habitats similar to those occupied by the preceding sociation, or on wet, gravelly sloping ground or along melt-water runnels. The most prominent sociation is formed by *Sanionia georgico-uncinata* which may cover considerable areas of flat ground along the coasts (Fig. 26). Stands of this sociation occur on the relatively dry margins of swampy areas, usually on well-drained or permeable stony ground. In addition, some mixed stands of these species may be found in various combinations in similar habitats. In many places on the Fildes Peninsula *Campylium polygamum* occurs as a frequent associate of this association and it too, often forms pure stands.

Moss hummock subformation

In contrast to the preceding subformation, associations of the moss hummock subformation develop chiefly in places with running water. The principal species of this subformation grow in tall loose cushions (*Brachythecium austrosalebrosum*, *Syntrichia filaris*), tall compact cushions (*Bryum pseudotriquetrum*) or in deep undulating carpets (*Sanionia georgico-uncinata*). The *Brachythecium austrosalebrosum* association (Fig. 27) forms prominent golden-green hummocks which coalesce to produce locally undulating stands which are seldom extensive. They occur at the margins of melt-water channels on stony ground and on wet sloping rocks and are generally restricted to low-lying flushed areas.

The *Bryum pseudotriquetrum–Sanionia georgico-uncinata* association, which is better known as the *Bryum algens–Drepanocladus uncinatus* association (Lewis-Smith, 1972), is represented by small stands developed on flushed soils and along melt-water channels. Apart from the two co-dominant species, *Syntrichia filaris* is a constant associate, with the additional associates *Brachythecium austrosalebrosum*, *Warnstorfia sarmentosa* and *Syntrichia princeps* frequently present as well.

Chapter 5

BRYOGEOGRAPHY

> In any discussion of phytogeographic problems one must keep in mind that the field is bedevilled with a phenomenal number of variables and uncertainties. Some of the biological variables are intrinsic (inadequacy of fossil records, especially of delicate plants like the hepatics, most of which are readily subject to decay); others are extrinsic (inadequacy of our taxonomic understanding ....)
>
> R. M. Schuster, *Generic and familial endemism in the hepatic flora of Gondwanaland: origin and causes*, 1982

PHYTOGEOGRAPHICAL ELEMENTS

Recognition of the geographical elements is essential for a relational assessment of the flora of a given area from the geobotanical and historical points of view. They make possible a comparison of the floras of different geographical regions and the evaluation of their affinities and origins. Additionally, the geographical elements may serve as a good basis for dividing a region into subordinate geobotanical units.

The moss flora of King George Island is composed of several distinct floristic elements, most of which show a clearly disjunct pattern in their total geographical distribution. Knowledge of the disjunct geographical distributions of austral mosses is generally still incomplete and fragmentary. This is closely associated with the lack of modern taxonomic studies of many families and genera. It is the history of bryological exploration that has hampered considerably the acquisition of knowledge of the Subantarctic and Antarctic mosses. All early moss collections had been made as a sideline by phanerogamic botanists or, more often, naturalists to various exploratory expeditions who were primarily concerned with other groups of organisms. Their gatherings have subsequently been identified and described by various bryologists, usually without reference to previously recognized species. As a result, the same species from the Auckland Islands, Campbell Island, Îles Kerguelen, Heard Island, Marion Island, Îles Crozet, South Georgia or Antarctica might well have been described under different names. The confusion was compounded by the fact that many Subantarctic and Antarctic species were first described from South America and/or New Zealand.

The paucity of resident professional bryologists in austral countries, who are deeply involved in taxonomy, has also been responsible for the poor knowledge of antipodal mosses. The general situation in moss taxonomy in the austral polar regions is that there are a great number of moss taxa, described mostly in the late nineteenth and early twentieth centuries, which have never been revised or critically examined taxonomically. In addition, there are many areas which are strongly undercollected bryologically, especially some Subantarctic islands and this results in artificial gaps in the distribution of species. Therefore some of the floristic and phytogeographical elements are difficult to interpret and it is likely that the present status of several species will change as more data become available as a result of progress in taxonomic and field investigations. Even though the categories in which the species are currently placed may change for individual taxa, the broad overview will probably remain similar to that outlined here.

The bryological literature yields only two papers presenting phytogeographical analyses, one concerning the moss floras of the Auckland Islands, a small archipelago lying in the cool temperate zone in the Australasian sector (Vitt, 1979) and the other dealing with the Aisén Province of West Patagonia in Chile (Seki, 1974). On the other hand, detailed phytogeographical reviews of the liverwort flora have been produced for the Brunswick Peninsula on the southernmost part of the South American mainland (Engel, 1978), and for the Falkland Islands (Engel, 1990). The system of phytogeographical categories outlined in these studies was adopted for the hepatic flora of the Antarctic (Ochyra & Váňa, 1989a) and, with some minor modifications, for the mosses of this biome as well (Ochyra *et al.*, 1998). It is also followed in the present work and this is the first attempt to summarize the phytogeographical problems of the moss flora in Antarctica.

All moss species occurring on King George Island can be classified into eleven floristic elements (Table 1). Their distribution ranges were obtained primarily from specimens examined personally; however, various monographs and floristic treatments were also consulted extensively, although detailed information on the geographical ranges of particular species is not included here.

ANTARCTIC ELEMENT

As in the Subantarctic, endemism of mosses in Antarctica is low. The flora of this continent, together with the offshore archipelagoes, was almost completely eradicated by continental glaciations during the Pleistocene. Just as with mites and

TABLE 1. Conspectus of geographical elements.

Category	Number of Species	Percentage of Total Flora
Antarctic	**5**	**8.2**
Pan-Antarctic	2	3.3
West Antarctic	3	4.9
Subantarctic	**13**	**21.3**
Amphiatlantic Subantarctic	8	13.1
Circumsubantarctic	2	3.3
American Subantarctic	3	4.9
South-Temperate	**11**	**18.0**
American South-Temperate	2	3.3
Amphipacific South-Temperate	1	1.6
Amphiatlantic South-Temperate	3	4.9
Pan-South-Temperate	5	8.2
Bipolar	**30**	**49.2**
Pan-Continental	**2**	**3.3**

lichens, it is believed that some moss species may have survived the Pleistocene catastrophe *in situ* in glacial refuges on high-altitude nunataks and other exposed rock outcrops (Lamb, 1970; Dodge, 1973). Most of the endemic mosses inhabit the upper elevations of the Antarctic, suggesting that they were not entirely eliminated during the Pleistocene glaciation and have reinvaded lower elevations since. However, the possibility cannot be excluded that some moss endemics might have evolved in recent times, although mosses are generally considered to show a slow rate of evolution and/or limited dispersal.

Over the 170 year history of bryological exploration there have been 47 species and 14 infraspecific taxa described from the Antarctic as new to science. Only a few of the species originally described from this biome appear to have a wider range, having been subsequently been found outside the Antarctic. The best example of these, *Sarconeurum glaciale*, was long considered to be an endemic genus and species. It was first described from Cockburn Island (Wilson & Hooker, 1847) and later proved to have a circumantarctic distribution (Greene *et al*., 1970), but recently it has also been reported from Tierra del Fuego (Greene, 1975). The same is true for *Ditrichum lewis-smithii* which was recently described from the collections from King George Island and Livingston Island in the South Shetland Islands and Signy Island in the South Orkney Islands (Ochyra, 1996a). It has also recently been found amongst the collections from Joinville Island off the Trinity Peninsula and South Georgia, preserved in the British Antarctic Survey herbarium (AAS).

The great majority of the assumed Antarctic "endemics" proved to be identical to taxa known from more northerly areas after further collections had been examined. However, Antarctica as a whole does possess seven species which have not been found elsewhere. Five of them (8.2% of the flora) occur on King George Island. In general, Antarctic endemics exhibit three distribution patterns, pan-Antarctic, continental and West Antarctic. Of these, only the continental one is absent from the study area.

It is quite plausible that at least some endemics have evolved *in situ* in Antarctica after it separated from South America. The justification for this assumption would seem to be strongest in the case of *Schistidium*, a genus which appears to possess great potential for developing a large number of narrow endemics in the Northern Hemisphere (Blom, 1996, 1998). The same may be true also in the austral regions when the genus is revised taxonomically. Further, *Andreaea gainii* [1] is very closely related to *A. alpina* Hedw. which is widespread in southern South America and on the Subantarctic islands (Greene, 1968; Ochyra, 1996b). It could be that Antarctic populations have evolved into a separate sibling species when they became isolated at least 60 million years ago.

Pan-Antarctic. — Two species (3.3% of the flora), namely *Didymodon gelidus* and *Schistidium antarctici* (Fig. 28), are widespread both in West and East Antarctica. Of these, only *D. gelidus* needs further taxonomic investigation which is likely to reveal it to be conspecific with other species, whereas the other two seem to be distinct and well-defined taxa.

West Antarctic. — Three species (4.9% of the flora) including *Andreaea gainii* (Fig. 29), *Schistidium halinae* (Fig. 30) and *S. steerei*, appear to be restricted to the northern part of the West Antarctic. They represent very distinct taxa which are unknown elsewhere in the Southern Hemisphere or in the Northern Hemisphere under different names, although their discovery in the Subantarctic or South America is still probable. It is worth noting that both have been described from material from King George Island and *Schistidium steerei* has not been found at all beyond the island.

Subantarctic element

The delimitation of the south-temperate and Subantarctic elements is one of the main difficulties in the evaluation of the phytogeographical relationships of Antarctic mosses. Because these elements merge imperceptibly, they become confused

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[1] Greene (1968) and Selkirk *et al.* (1990) reported *Andreaea gainii* from South Georgia and Macquarie Island, respectively, but these records need careful taxonomic assessment.

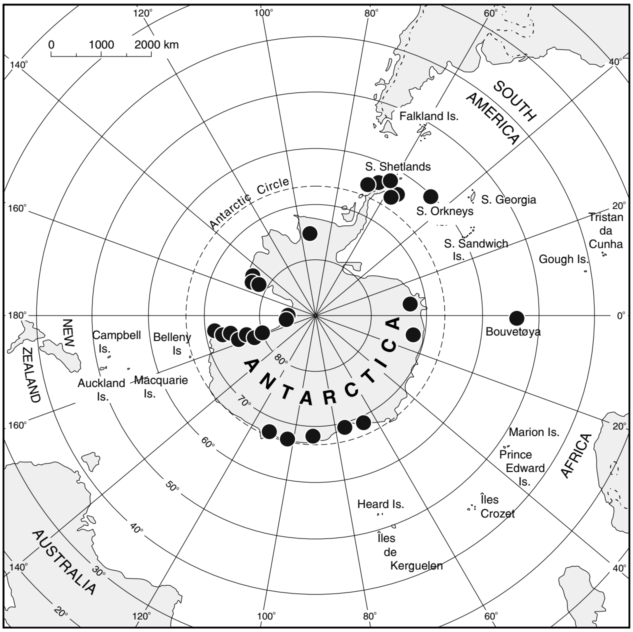


FIGURE 28. Distribution of the pan-Antarctic endemic *Schistidium antarctici* (Card.) L. I. Savicz & Smirnova.

and consequently some authors have not recognized them, considering species with these distribution patterns under the single category of 'antipodal' (Schuster, 1963, 1969b, 1979, 1982), 'subantarctic' (Grolle, 1969) or simply 'antarctic' (Fulford, 1963, 1966) element. A detailed analysis of the distributions of the various species confirms that recognition of austral temperate and subantarctic elements is entirely justified, and, although the differences are small, they are very distinct phytogeographical entities (Engel, 1978, 1990).

Thirteen species (21.3%) have the major part of their range on Subantarctic islands, sometimes with northward extensions, but only at higher elevations. There is wide variation in the degree to which the Subantarctic distribution patterns are discontinuous, this discontinuity being physically imposed by the remote separation of land masses by the wide oceanic basins in between. Nonetheless, it seems reasonable to suggest that the major discontinuities between Australasia, South America and the Kerguelenian region could be the result of an older more continuous distribution which would reflect the disposition of the Gondwanan blocks by the end of the Cretaceous. This element is heterogeneous and at least three subelements can be recognized within it.

Amphiatlantic Subantarctic subelement. — This category comprises species occurring within the South American, Atlantic and occasionally South Indian Ocean sectors of Subantarctica. It is represented by eight species on King George Island (13.1% of the flora), namely *Notoligotrichum trichodon*, *Dicranoweisia grimmia-*

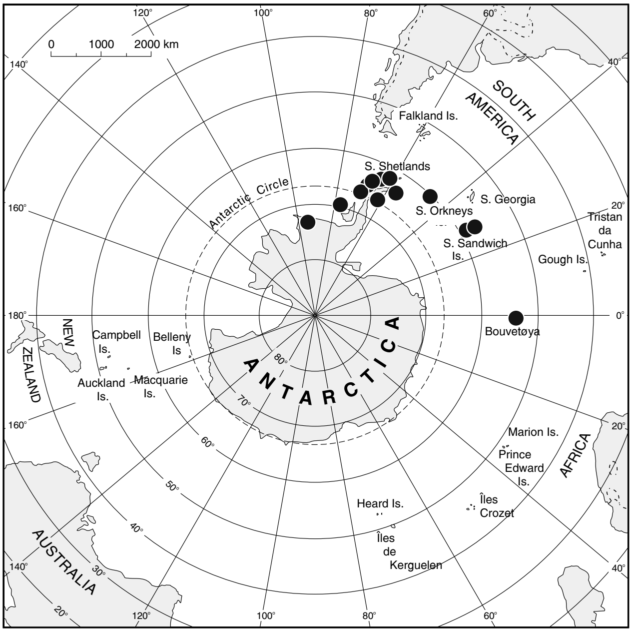


FIGURE 29. Distribution of the West Antarctic endemic *Andreaea gainii* Card.

cea, *Holodontium strictum* (Fig. 31), *Schistidium amblyophyllum*, *S. cupulare*, *S. falcatum* (Fig. 32), *Syntrichia filaris* and *S. saxicola*.

Circumsubantarctic subelement. — The species representing this subelement have their maximum occurrence on all or most of the Subantarctic islands and occur infrequently at higher elevations on the southern tips of South America and

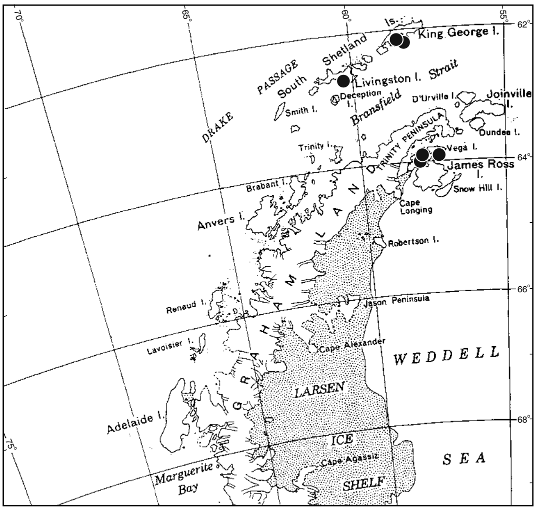


FIGURE 30. Distribution of the West Antarctic endemic *Schistidium halinae* Ochyra.

FIGURE 31. Distribution of the amphiatlantic Subantarctic *Holodontium strictum* (Hook. f. & Wils.) Ochyra.

New Zealand. Only two species (3.3% of the flora), namely *Muelleriella crassifolia* (Fig. 33) and *Warnstorfia laculosa*, are known to occur on King George Island.

American Subantarctic subelement. — Three species (4.9% of the flora) are restricted in their distribution to the Subantarctic island of South Georgia and the maritime Antarctic. These are *Andreaea depressinervis*, *Ditrichum lewis-smithii* (Fig. 34), and *Schistidium urnulaceum*. It is perhaps reasonable to speculate that these species are the remnants of the rich and diversified cool-adapted moss flora which existed in Antarctica prior to the Oligocene (about 60 million years ago). When continental glaciations and associated cooling of the climate began, some

FIGURE 32. Distribution of the amphiatlantic Subantarctic *Schistidium falcatum* (Hook. f. & Wils.) B. Bremer.

species might have continued to exist in coastal fringes on nunataks, and species such as *Andreaea depressinervis* and *Ditrichum lewis-smithii* may have survived until today. It is worth noting that they are taxonomically isolated species and the former has very reduced means of dispersal, being entirely sterile.

SOUTH TEMPERATE ELEMENT

Eleven species (18.0%) of the King George Island moss flora are restricted in distribution to the cool temperate zone. These are generally found in New Zealand, south-eastern Australia, Tasmania, and disjunctively in southern South America. Rarely some of them extend into southern Africa and, occasionally, to more north-

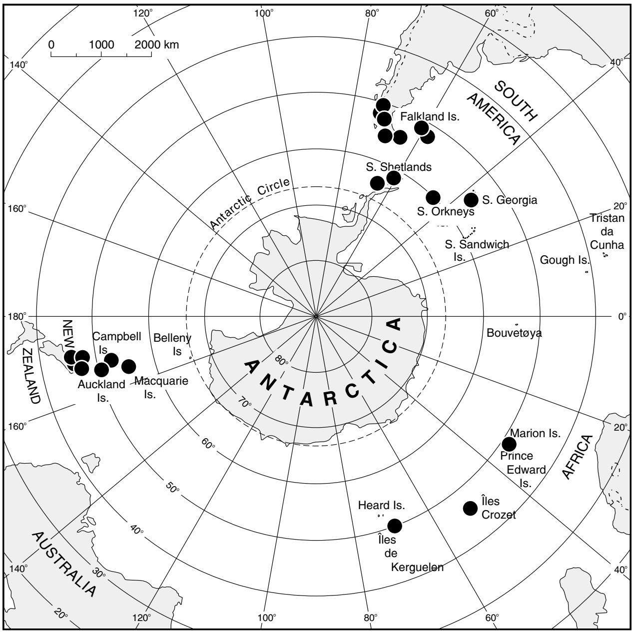


FIGURE 32. Distribution of the circumsubantarctic *Muelleriella crassifolia* (Hook. f. & Wils.) Dusén.

erly latitudes, especially along the Andean chain. This is a broad phytogeographical element which can be further subdivided according to the ranges of species below the equator and Antarctic species fall well within the following four subelements.

American South-Temperate subelement. — This subelement consists of two species (3.3% of the total flora) occurring in southern South America, including the Falkland Islands and South Georgia, and extending northward to the Valdivian region and, occasionally, to the northern Andes at high elevations. These are

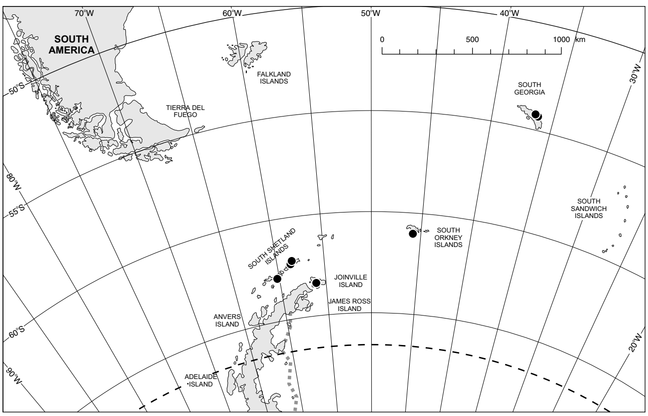


FIGURE 34. Distribution of the American Subantarctic *Ditrichum lewis-smithii* Ochyra.

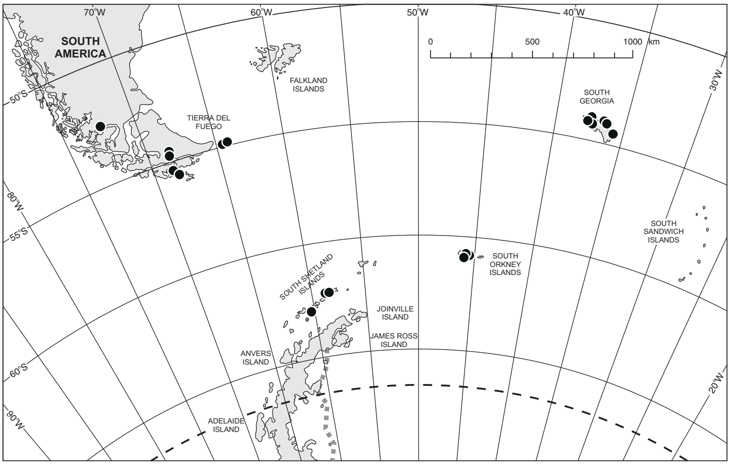


FIGURE 35. Distribution of the American south-temperate *Conostomum magellanicum* Sull.

Conostomum magellanicum (Fig. 34) and *Schistidium occultum*. It seems plausible that these species have evolved after the separation of South America from the Australasian block and subsequently could have dispersed to West Antarctica via the Scotia Arc which existed "unbroken" up to the Oligocene (Seyfert & Sirkin, 1979). After its fragmentation West Antarctica became progressively more isolated and consequently dispersal for land plants would have become more and more difficult. Again, it is likely that these species could have had a wider distribution when the land bridge between South America and West Antarctica existed.

Amphipacific South-Temperate subelement. — Only one species (1.6%), *Ditrichum hyalinum* (Fig. 36), is distributed in the temperate regions of southern South America, and disjunctively in the Australasian sector. This distribution pattern is sometimes called the *Nothofagus* type (Seki, 1974) since the distribution of taxa which display it shares broadly the range of southern beeches. It could have arisen either by evolution of the species in southern South America after the separation of this continent from the Antarctic and Australasian blocks and subsequent long-distance dispersal to south-eastern Australia and New Zealand (or vice versa), or by earlier evolution before the separation of these continental blocks (most probably more than 80–100 million years ago), with little dispersal since. The species' absence on Subantarctic islands would seem to indicate the latter explanation.

Amphiatlantic South-Temperate subelement. — This subelement comprises three species (4.9% of the flora), namely *Andreaea regularis*, *Bartramia patens* (Fig. 37) and *Bryum orbiculatifolium*, which are distributed mainly in the temperate regions of southern South America and South Africa, including Tristan da Cunha, and extend to the Subantarctic islands of the Indian Ocean sector. They are not considered as Subantarctic species because their northward extensions from the Subantarctic are not restricted to higher elevations.

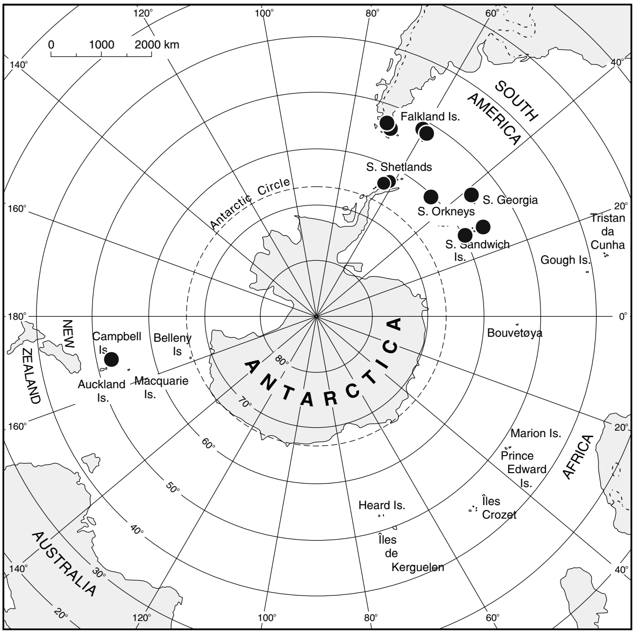


FIGURE 36. Distribution of the amphipacific south-temperate *Ditrichum hyalinum* (Mitt.) Kuntze.

Pan-South-Temperate subelement. — Five species (8.2% of the flora) are widespread and locally common and abundant throughout all the temperate regions of the Southern Hemisphere. They are generally found in southern South America and disjunctively in New Zealand, south-eastern Australia, Tasmania, southern Africa and on islands in the Subantarctic and cool temperate zone. This distribution pattern is characterized by the frequent deep penetration of species into the tropics along mountain chains in South America, East Africa and the Malesian region. The occurrence of some pan-temperate species in Africa may suggest the ancient origin

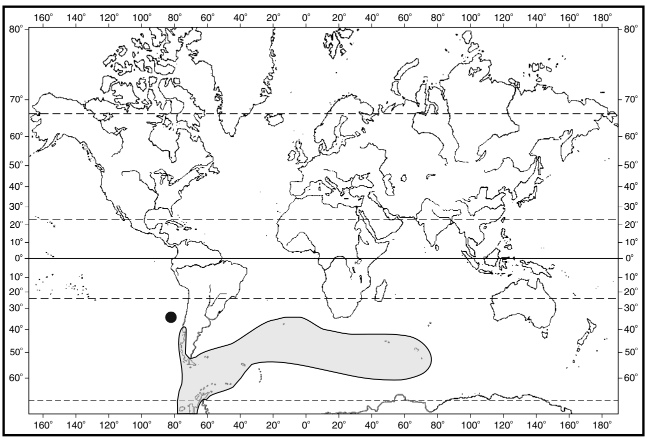


FIGURE 37. Distribution of the amphiatlantic south-temperate *Bartramia patens* Brid.

FIGURE 38. Distribution of the pan-south-temperate *Anisothecium cardotii* (R. Br. ter.) Ochyra.

of this distribution pattern, before the separation of Gondwana. This subelement is represented by *Anisothecium cardotii* (Fig. 38), *Brachythecium austrosalebrosum*, *Chorisodontium aciphyllum* (Fig. 39), *Dicranoweisia brevipes* and *Kiaeria pumila*.

BIPOLAR ELEMENT

Almost half of the moss flora of King George Island (30 species – 49.2%) is composed of species which are widely distributed in the Northern Hemisphere and disjunctively in southern South America, Antarctica and/or portions of Australasia.

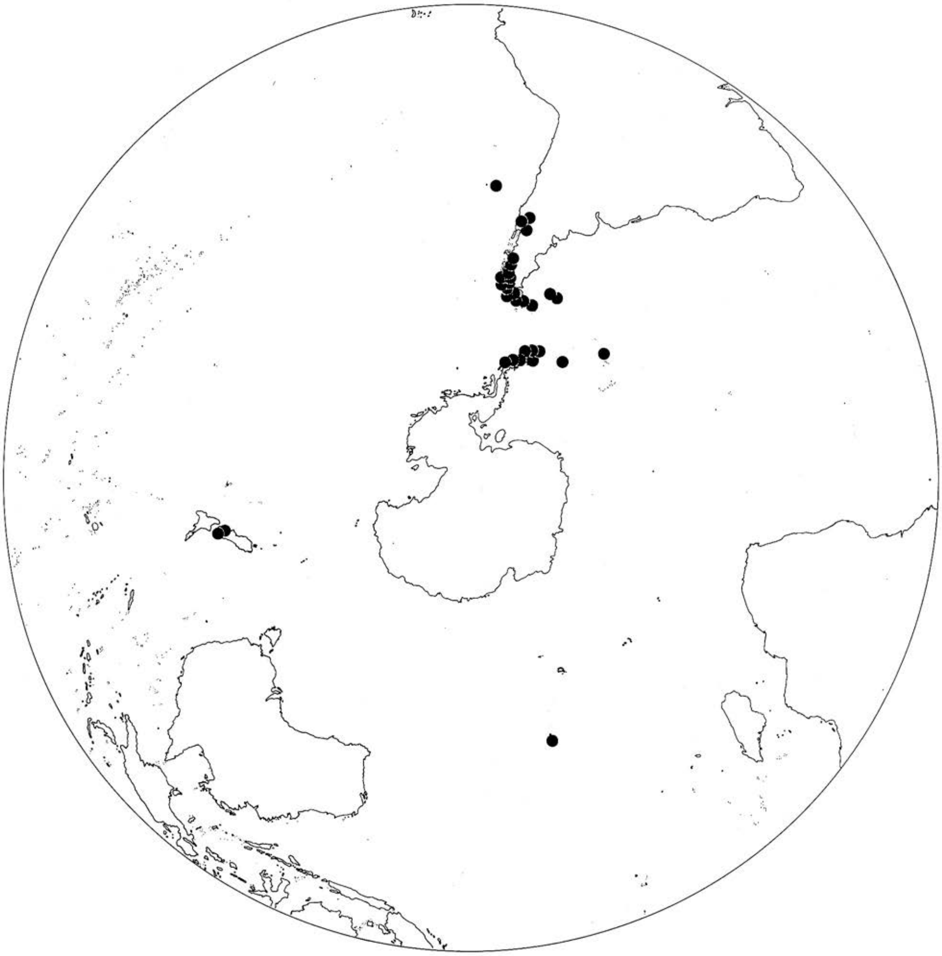


FIGURE 39. Distribution of the pan-south-temperate *Chorisodontium aciphyllum* (Hook. f. & Wils.) Broth.

Many of these species have transitional localities at high elevations in equatorial areas (these are marked by a 'T' in the list below). The problem of bipolar distribution of mosses has been discussed by many authors (Du Rietz, 1940; Schuster, 1969b, 1983; Schofield & Crum, 1972; Schofield, 1974; Ochyra, 1992; Ochyra & Lewis-Smith, 1996) who have emphasized the striking discrepancy between the bipolar ranges of mosses and hepatics. The bipolar mosses are not particularly primitive and it is likely that they reached their southern ranges by long-distance dispersal via land-bridges and mountain chains rather than from the break-up of earlier continuous ranges. They are mostly somewhat drought tolerant taxa which are able to undergo long-distance dispersal more effectively than the generally

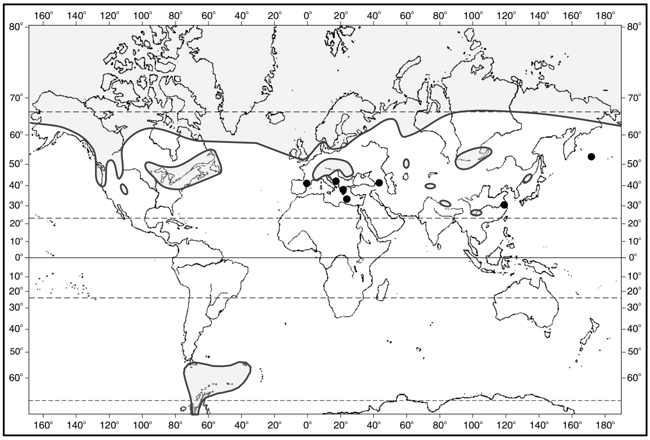


FIGURE 40. Distribution of the bipolar *Platydictya jungermannioides* (Brid.) Crum, a species with no intermediate stations in the tropics.

more mesophytic liverworts. Even so, the possibility cannot be excluded that at least some species are relicts of ancient origin, although most evidence suggests that they represent relatively recent invasions by long-distance dispersal from the Northern Hemisphere, or from remote localities.

The Antarctic flora is an exceptional example of the dominance of the northern element in a Southern Hemisphere biome. The percentage of bipolar mosses in other areas in the austral regions is much lower, for example in the Auckland Islands they contribute only 5% to the total flora (Vitt, 1979), while in Aisén Province in West Patagonia – 8.9% (Seki, 1974). Even if bipolar species are pooled with pan-continental ones in the latter area, they represent merely 14.1% of the whole flora. This is not, however, a unique situation as bipolar species constitute a relatively high 25% of the total lichen flora of this region (Jørgensen, 1983; Seppelt, 1995).

The bipolar element of King George Island is represented by the following species: *Brachythecium glaciale*, *Bryum amblyodon* (T), *B. pallescens* (T), *B. pseudotriquetrum* (T), *Campylium polygamum* (T), *Dicranoweisia crispula* (T), *Distichium capillaceum* (T), *Encalypta rhaptocarpa*, *Grimmia reflexidens* (T), *Hennediella antarctica*, *H. heimii*, *Hypnum revolutum*, *Meesia uliginosa*, *Orthotheciella varia* (T), *Platydictya jungermannioides* (Fig. 40), *Pohlia cruda* (T), *P. drummondii*, *P. nutans*, *P. wahlenbergii* (T), *Polytrichastrum alpinum* (T), *Polytrichum juniperinum* (T), *P. piliferum* (T), *P. strictum*, *Racomitrium sudeticum*, *Sanionia georgico-uncinata*, *S. uncinata* (T), *Schistidium rivulare* (T), *Stegonia latifolia*, *Syntrichia princeps* (T), *Warnstorfia sarmentosa* (T) (Fig. 41).

PAN-CONTINENTAL ELEMENT

Two species (3.3% of the flora), namely *Bryum argenteum* and *Ceratodon purpureus*, have almost cosmopolitan ranges. They are very widespread and "weedy"

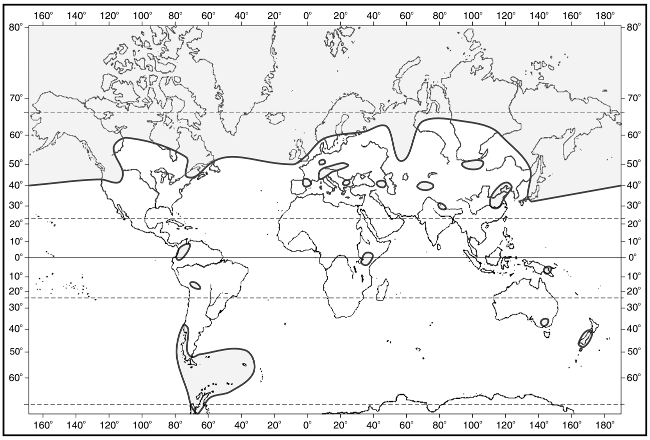


FIGURE 41. Distribution of the bipolar *Warnstorfia sarmentosa* (Wahlenb.) Hedenäs, a species with many intermediate stations in the tropics.

species, often growing on disturbed and open sites, which are not restricted to higher elevations in the tropics. Sometimes *Polytrichum juniperinum* is also considered as a cosmopolitan species, but it occurs at rather high elevations in tropical mountains and therefore it is interpreted here as a bipolar species with intermediate stations in the tropical regions.

GENERAL FEATURES OF THE MOSS FLORA

A striking feature of the moss flora of King George Island is the high proportion of the bipolar element which, together with the pan-continental, constitutes more than half the total number of species. The second largest group is the austral temperate, which together with the Subantarctic species makes up nearly 40% of the total flora. It is worth noting that similar proportions are obtained for the Antarctic moss flora as a whole (Ochyra *et al.*, 1998). The low endemism and high percentage of bipolar species suggest that the moss flora of King George Island is relatively young, a conclusion that is supported by the geological history of the island. It is not clear just how much of the island was ice-covered during the various glacial maxima, but, because of the precipitous topography, there were probably some exposed rocks. However, the range of habitats may have been restricted, and some species have probably arrived fairly recently. Therefore the moss flora of the island (and other parts of Antarctica) may be considered to be a mixture of relict endemic and/or cool-adapted Subantarctic species which survived the Pleistocene glaciations *in situ*, and immigrant elements that recolonized the continent from adjacent areas.

The recorded moss flora of King George Island consists of 61 species belonging to 33 genera and 15 families. This number may appear to be low, especially to botanists from the Northern Hemisphere, who, even at far higher latitudes in the

Arctic, may observe much richer and diversified moss floras in the corresponding biome. It is well-known fact that the floras of the northern and southern polar regions are very disproportionate and the considerable paucity of species in the Southern Hemisphere applies equally to all groups of plants (Bliss, 1979). For example, the Antarctic and Subantarctic vascular flora comprises approximately 70 species (Greene & Walton, 1975), the Auckland Islands – 187 species (Johnson & Campbell, 1975) and the Falkland Islands – ca 170 species (Moore, 1968). In contrast, Greenland has about 500 species (Böcher *et al.*, 1968), and the Canadian Arctic Archipelago contains more than 340 species (Porsild, 1957).

An assessment of the richness of cryptogamic floras is admittedly hampered by taxonomic uncertainties and inadequate knowledge of many areas and genera, especially in austral regions. Even so, the moss floras of north and south differ greatly both in species diversity and overall size, much to the south's disadvantage. From Arctic Alaska 415 moss species have been reported (Steere, 1978), from the High Arctic Svalbard archipelago 288 species (Frisvoll & Elvebakk, 1996), and from northern Ellesmere Island and Axel Heilberg Island, both in the Canadian Arctic Archipelago, lying at latitudes from 76°N to 83°N, 151 (Brassard, 1971a, 1971b) and 131 (Kuc, 1973), respectively. In contrast, from the Auckland Islands 145 species have been recorded (Vitt, 1979), from Campbell Island 119 (Vitt, 1974), Macquarie Island 83 (Seppelt, 1981; Selkirk *et al.*, 1990), Heard Island 49 (Bergstrom & Seppelt, 1988; Bergstrom & Selkirk, 1997), Marion and Prince Edward Islands 85 (Zanten, 1971; Ochyra & Hertel, 1990) and South Georgia which is the bryologically best known in the Subantarctic, about 115 species (Greene, 1973 and unpublished data). On the other hand, the Antarctic moss flora appears to be richer than that of some of the Subantarctic islands and 104 species have so far been recorded from this biome (Ochyra *et al.*, 1998).

Thus, if austral standards of diversity are accepted, the moss flora of King George Island is relatively rich and probably represents one of the most muscologically diverse areas in the Antarctic. The richest moss flora, comprising at least 65 species, occurs on the much smaller Signy Island, South Orkney Islands (R. I. Lewis-Smith, pers. comm.). However, this island is more diversified geologically, being especially rich in basic rocks which are almost absent from King George Island, thus creating a broader range of habitats available for mosses. On the other hand, this island is slightly colder and drier than the South Shetland Islands, although one could expect here a milder and wetter oceanic climate because of the ameliorating effects of the surrounding ocean. It is necessary to add that Signy and King George Islands have been the most intensively explored bryologically and this surely must have contributed to the high numbers of species recorded. The richness of the moss floras diminishes considerably southwards and, although only approximate numbers can be given, it is worth quoting them for comparison (the numbers cited in the respective publications are a little changed because of the addition of unpublished data). Thus Elephant, Livingston and Deception Islands in the the South Shetland Islands contain, respectively, 25 (Allison & Lewis-Smith, 1973; Lewis-Smith, 1979), 42 (Schulz, 1993) and 40 (Lewis-Smith, 1984b, 1984c, 1988a) species, the South Sandwich Islands ca 30 (Longton & Holdgate, 1979) but the unpublished collection of P. Convey yielded 37 species, Bouvetøya 20 (Bell & Blom, 1986), while from Alexander and Charcot Islands 31 species are known (Lewis-Smith, 1988b and unpublished data). In contrast, 23 species have been recorded from East Antarctica (Ochyra *et al.*, 1998).

About one third of the total number of moss genera found on King George Island consist of a single species. Five genera (*Ditrichum*, *Hennediella*, *Sanionia*, *Warnstorfia* and *Brachythecium*) comprise two species each, while four (*Andreaea*, *Polytrichum*, *Dicranoweisia* and *Syntrichia*) contain three species each. *Pohlia* and *Bryum* are relatively rich, consisting of four and five species each, respectively, but the record is held by *Schistidium* which has nine species out of the ten known from the Antarctic as a whole.

The mean number of species per genus is 1.87. This ratio is quite typical for the polar regions of both hemispheres, although some subtle differences in its value may arise as a result of the acceptance of different generic concepts. Thus, on northern Ellesmere Island and Devon Island, both in the High Arctic in the Canadian Arctic Archipelago, there are 1.7 and 1.9 species per genus, respectively (Brassard, 1971a; Vitt, 1975), and exactly the same ratios are found in Campbell Island and the Auckland Islands, respectively, in the cool temperate zone in the austral region (Vitt, 1979). Similar or lower ratios have also been calculated for the Juan Fernandez Islands (1.8), Aisén Province in West Patagonia (2.4), the Marion and Prince Edward Islands (1.9), Îles Kerguelen (1.3) and Macquarie Island (1.6) (Vitt, 1979). Although these ratios may change a little as a result of progress in the taxonomic study of the moss floras of the respective areas, this set of values will probably be only slightly modified. It is worth noting that for the whole of Antarctica this ratio is a little higher

All Antarctic species (104) are classified into 48 genera (Ochyra *et al.*, 1998), this giving a moss species to genus ratio of 2.17. This difference is caused by the occurrence, in some restricted areas, of genera having two or more species and/or the greater number of species in some of the genera which are known from King George Island, for example *Ditrichum* (5), *Brachythecium* (5), *Dicranoweisia* (4), *Syntrichia* (4), *Campylopus* (3), *Anisothecium* (3), *Plagiothecium* (2) and *Leptobryum* (2).

Another interesting feature of the moss flora of King George Island (and Antarctica too) is the supremacy of acrocarpous species over pleurocarps. Out of the 61 species comprising the island's flora, only ten are pleurocarps, giving a ratio of 5:1 for the two growth forms. A very similar ratio, 5.1:1 is found in the Antarctic flora as a whole. This tendency for high numbers of acrocarpous species and low numbers of pleurocarpous taxa is also evident in other polar regions of both hemispheres and the ratio clearly increases towards the south. Even so, nowhere does the ratio reach the extremely high values found in the Antarctic, for example in Devon Island it is 2.6:1, in the Juan Fernandez Islands 1.37:1, Auckland Islands 1.86:1, Campbell Island 2:1, Macquarie Island 2.3:1 and the Marion and Prince Edward Islands 3.17:1. Despite their poor species diversity, some pleurocarpous mosses are locally very abundant and play an important role in the Antarctic tundra vegetation.

Fewer than half of all the mosses (29 species) have been found with sporophytes, although only about 18 of these have produced fully mature capsules. In the remainder sporophytes fail to mature or abort, e.g. in *Sanionia* or *Bryum* spp. In general, almost all the species of *Schistidium* have been collected with sporophytes and only in *S. falcatum* and *S. cupulare* have few mature capsules been observed, but the populations of these species are small anyway. Also, species of *Dicranoweisia*, in particular *D. brevipes* and *D. grimmiacea*, produce ripe sporophytes abundantly, but in *D. crispula* they do not often mature. The formation of normally developed sporophytes in these genera is of paramount importance for their accurate determination, because taxonomic characters in *Schistidium* and *Dicranoweisia* refer mostly to sporophyte features. This is also true for *Bryum*, another large genus whose species occur abundantly in a variety of habitats. Alas, they are usually sterile or produce immature capsules and this contributes very much to the serious taxonomic problems and well-known difficulties in the recognition of *Bryum* species.

Sporophytes also provide key characters in *Sanionia*, which dominates in some types of plant community where, generally, two species of the genus are very common and locally abundant. Until recently all Antarctic plants were classified as *S. uncinata*, although considerable variation had been demonstrated in the morphological characters of the plants (Stark, 1993). Sporophyte characters are crucial for the positive determination of the two species of *Sanionia* occurring in Antarctica. Unfortunately they are unavailable in practice, the vast majority of plants being sterile, and for *S. georgico-uncinata* only immature sporophytes have once been found on King George Island. Fortunately, the two species may be distinguished fairly easily by the shape of their alar cells.

Only two mosses on King George Island utilize special methods of vegetative reproduction, *Platydictya jungermannioides* and *Didymodon gelidus*, which fairly frequently produce axillary gemmae. However, fragmentation, especially in winter when the leaf or shoot fragments can be blown for considerable distances, is likely to be a common means of vegetative dispersal.

DISTRIBUTION OF SPECIES WITHIN KING GEORGE ISLAND

The distribution of each species recorded from the island is shown on a dot map in the "Systematic treatment" section (pp. 73–252). The information presented regarding the local distributions of species and their frequency and abundance are of necessity incomplete because the island's flora has not been surveyed accurately in all parts. Also, the literature data cannot always be fully credited because examination of voucher specimens of some species reported from the Fildes Peninsula has shown many misidentifications. Nevertheless some general features of the moss flora can easily be outlined on the basis of the present data.

The Admiralty Bay area has the richest moss flora on the island and perhaps in the Antarctic as a whole, with the exception of Signy Island. Altogether 56 species have been recorded there, and only five others (*Notoligotrichum trichodon*, *Polytrichum strictum*, *Holodontium strictum*, *Bryum orbiculatifolium* and *Campylium polygamum*), discovered elsewhere on the island (Potter and Fildes Peninsulas). This is perhaps not surprising because of the favourable climatic conditions in this area which is well protected from the prevailing westerlies and has large range of habitats suitable for colonization by mosses.

The great diversity of the moss flora in this area provides a strong case for the designation of the western shore of Admiralty Bay as an SSSI (Bonner & Lewis-Smith, 1985). In the area stretching from Arctowski Station to Bransfield Strait 42 species of moss have been recorded. Some of these have their only Antarctic localities in the Admiralty Bay area including *Schistidium urnulaceum*, *S. cupulare*, *S. falcatum* and *S. steerei*, the last being one of the very few Antarctic endemics. Additionally, some species appear to have the main centre of their Antarctic distribution here, for instance *Ditrichum lewis-smithii* and *Schistidium halinae*, while the majority of stations of *Meesia uliginosa* occur in the Admiralty Bay area. It is also worth mentioning such species as *Stegonia latifolia* and *Anisothecium cardotii* which are exceedingly rare in the Antarctic and their first Antarctic records came from this area.

The second richest area bryologically is the Fildes Peninsula, the largest ice-free area on the island. In total, 40 species have been recorded there, and for *Holodontium strictum* it is its only known place of occurrence in the Antarctic. Further, *Bryum orbiculatifolium* is elsewhere recorded only from the South Sandwich Islands. The other areas are less diverse bryologically and only the Potter Peninsula possesses one species, *Notoligotrichum trichodon*, exclusively found there. It is worth noting the occurrence of *Ditrichum lewis-smithii* on the Barton Peninsula, and a quite rich colony of *Meesia uliginosa* on the Potter Peninsula where it was first recognized as a separate species, *Ceratodon kinggeorgicus* (Kanda, 1986).

The north coast of the island has a far poorer moss flora and this is clearly correlated with the generally much greater development of bryophyte communities on the south rather than on the north coast. Also, the two species of flowering plant seem to be absent from the north coast and this clearly confirms the much poorer conditions for moss life in this part of the island.

FREQUENCY AND ABUNDANCE OF THE KING GEORGE ISLAND MOSSES

One of the most important bryogeographical criteria which may serve for the characterization of a local flora is the frequency and abundance of moss species (Preston, 1962). It is true that, for any given species, it is not an easy task to evaluate or express its degree of frequency in an exact or quantitative manner, either on King George Island or anywhere else. A reasonably clear impression of these important factors is given by the entries in the catalogue of species under the two separate headings, "Specimens examined" and "Literature records". In the case of an area adequately surveyed for its mosses, and at least the Admiralty Bay area may be considered as such, the number of localities and collected samples seem to characterize quite well both frequency and abundance.

Frequency is a measure of the number of times a species occurs. Thus, a species collected in a single locality, of all those available, may be considered as "very rare" or even a misidentification. When a species is represented in collections from five localities or fewer, it is classed as "rare"; from six to fifteen localities as "occasional"; from 16 to 49 localities as "common"; and from 50 or more as "very common". In fact many species which should fall into this last category tend to be disproportionately rare in herbaria, mainly because experienced collectors try not to overcollect weedy and ubiquitous species. This is especially true for species of *Sanionia*. They are very common and abundant throughout a wide range of habitats. However, until now it was commonly believed that a single, polymorphous species occurred in the Antarctic. Later, Hedenäs (1989) recognized in high latitudes of Fennoscandia *S. nivalis*, a very distinct species also differing from *S. uncinata* ecologically. It was also found to occur in the Antarctic (as *S. georgico-uncinata)*, but during fieldwork it had not been recognized, so it is likely that *S. uncinata* is undercollected on King George Island. Sometimes rarity or frequency was difficult to ascertain, for example, when records came from within close proximity of one another or only literature data were available. Then an intermediate category from among these degrees was used.

The frequency or rarity of all the species collected on King George Island has been evaluated and is shown in Table 2. Eleven species (18.0% of the total flora) can be classified as "very common", comprising *Syntrichia princeps* (103 records), *Schistidium antarctici* (93), *Sanionia georgico-uncinata* (86), *Polytrichastrum alpinum* (75), *Bryum pseudotriquetrum* (74), *Andreaea gainii* (73), *Ceratodon purpureus* (72), *Bartramia patens* (70), *Andreaea regularis* (68), *Dicranoweisia brevipes* (59) and *Syntrichia saxicola* (56). At the opposite extreme there is a group of nine "very rare" species (14.8% of the flora) known from single collections (*Notoligotrichum trichodon*, *Polytrichum strictum*, *Anisothecium cardotii*, *Kiaeria pumila*, *Holodontium strictum*, *Stegonia latifolia*, *Schistidium cupulare*, *S. occultum* and *S. rivulare*). "Rare" species comprise a relatively large group of 16 species

TABLE 2. Distribution of mosses on King George Island.

Species	Admiralty Bay	SE & E coast	Drake Passage coast	Fildes Peninsula	Maxwell Bay coast	SSSI No. 8	Status[a]	Fertility[b]	Geographical element[c]
Andreaeaceae									
Andreaea depressinervis	+	+	+	+	+	+	C	0	S–AM
A. gainii	+	+	+	+	+	+	VC	3–4	A–WA
A. regularis	+			+	+	+	VC	3–4	T–AA
Polytrichaceae									
Notoligotrichum trichodon					+		VR	0	S–AT
Polytrichastrum alpinum	+	+	+	+	+	+	VC	1	BIP
Polytrichum juniperinum	+			+		+	O–C	0	BIP
P. piliferum	+	+		+		+	O	0	BIP
P. strictum				+			VR	0	BIP
Ditrichaceae									
Ceratodon purpureus	+	+		+	+	+	VC	0	C–PA
Distichium capillaceum	+			+	+	+	C	2	BIP
Ditrichum hyalinum	+	+		+	+	+	C	1	T–AP
D. lewis-smithii	+				+		R	4	S–AM
Dicranaceae									
Anisothecium cardotii	+						VR	0	T–PA
Chorisodontium aciphyllum	+	+		+	+	+	O	0	T–PA
Kiaeria pumila	+				L		VR	0	T–PA
Seligeriaceae									
Dicranoweisia brevipes	+			+	+	+	VC	4	T–PA
D. crispula	+			+	+	+	O	3	BIP
D. grimmiacea	+	+	+			+	O–R	3–4	S–AT
Holodontium strictum				+			VR	2	S–AT
Encalyptaceae									
Encalypta rhaptocarpa	+			L	+	+	R	3	BIP
Pottiaceae									
Didymodon gelidus	+			+			VR	0	A–PA
Hennediella antarctica	+		+	L	+	+	C	3–4	BIP
H. heimii	+			L	+	+	O–R	2	BIP
Stegonia latifolia	+					+	VR	1	BIP
Syntrichia filaris	+	+	+	+	+	+	C	0	S–AT
S. princeps	+	+	+	+	+	+	VC	2	BIP
S. saxicola	+	+		+	+	+	VC	0	S–AT

(cont.)

TABLE 2. *Continued.*

Species	Admiralty Bay	SE & E coast	Drake Passage coast	Fildes Peninsula	Maxwell Bay coast	SSSI No. 8	Status[a]	Fertility[b]	Geographical element[c]
Grimmiaceae									
Grimmia reflexidens	+						VR–R	4	BIP
Racomitrium sudeticum	+			+		+	O	0	BIP
Schistidium amblyophyllum	+	+		+	+	+	O–R	3–4	S–AT
S. antarctici	+			+		+	VC	4	A–PA
S. cupulare	+						VR	3–4	S–AT
S. falcatum	+					+	R	2–3	S–AT
S. halinae	+						R	4	A–WA
S. occultum	+					+	VR	4	T–SA
S. rivulare	+			+			VR	4	BIP
S. steerei	+						R	4	A–WA
S. urnulaceum	+						R	4–3	S–AM
Bryaceae									
Bryum amblyodon	+			L		+	O	2	BIP
B. argenteum	+	+					VR–R	0	BIP
B. orbiculatifolium				+			R	0	T–AA
B. pallescens	+			+			R	0	BIP
B. pseudotriquetrum	+	+	+	+	+	+	VC	2–3	BIP
Pohlia cruda	+	+		+	+	+	C	0	BIP
P. drummondii	+			L		+	R–O	0	BIP
P. nutans	+	+	+	+	+	+	O	0	BIP
P. wahlenbergii	+						R	0	BIP
Meesiaceae									
Meesia uliginosa	+			+	+	+	O	0	BIP
Bartramiaceae									
Bartramia patens	+	+	+	+	+	+	VC	4	T–AA
Conostomum magellanicum	+			+		+	O	0	T–SA
Orthotrichaceae									
Muelleriella crassifolia	+		+			+	R	0	S–PA
Amblystegiaceae									
Campylium polygamum				+			R	0	BIP
Orthotheciella varia	+			+		+	R	0	BIP
Sanionia georgico-uncinata	+	+	+	+	+	+	VC	1	BIP
S. uncinata	+	+		+	+	+	C	1–2	BIP

TABLE 2. *Continued.*

Species	Admiralty Bay	SE & E coast	Drake Passage coast	Fildes Peninsula	Maxwell Bay coast	SSSI No. 8	Status[a]	Fertility[b]	Geographical element[c]
Warnstorfia laculosa	+	+	+	+	+	+	O	0	S–PA
W. sarmentosa	+			+	+	+	C	0	BIP
Brachytheciaceae									
Brachythecium austrosalebrosum	+	+	+	+	+	+	C	0	T–PA
B. glaciale	+					+	O–R	0	BIP
Hypnaceae									
Hypnum revolutum	+			+		+	C	0	BIP
Platydictya jungermannioides	+						R	0	BIP

L – literature reports or oral communication.

[a]Status: **C** – common; **O** – occasional; **R** – rare; **VR** – very rare.

[b]Fertility: **4** – sporophytes common; **3** – occasional; **2** – rare; **1** – very rare; **0** – unknown.

[c]Geographical elements: **T –** south-temperate: **T–SA** – American, **T–AP** – amphipacific, **T–AA** – amphiatlantic, **T–PA** – pan-temperate. **S** – Subantarctic: **S–AT** – amphiatlantic, **S–PA** – circumsubantarctic, **S–AM** – American. **A** – Antarctic: **A–PA** – pan-Antarctic, **A–WA** – West Antarctic. **BIP** – bipolar. **C–PA** – pan-continental.

(26.2% of the flora), whereas the other two groups, "occasional" and "common", comprise 13 (21.3% of the total flora) and 12 species (19.7% of the flora), respectively.

In contrast to frequency or rarity, abundance or sparsity is a measure of the biomass and the resultant conspicuousness of any species in a particular locality. This obviously determines or even controls its frequency of collection in any one locality. As a result, a species may become so abundant under optimum conditions that every collector to the locality will sample it. Because in the Antarctic some species form monospecific aggregations covering a relatively large piece of area, especially some species forming communities of the moss carpet, hummock or turf subformations, almost every casual collector gathers in the first place large specimens of *Sanionia georgico-uncinata*, *Polytrichastrum alpinum*, *Bryum pseudotriquetrum* and/or *Brachythecium austrosalebrosum*, avoiding or overlooking small but much more interesting mosses growing in rock crevices or on soil. The abovementioned species certainly belong within the most abundant mosses in the maritime Antarctic, although others, such as *Andreaea gainii*, *A. regularis*, *Bartramia patens*, *Ceratodon purpureus*, *Dicranoweisia brevipes*, *Schistidium antarctici*, *Syntrichia princeps* and *S. saxicola* are also locally very abundant. It is worth noting that these are also mostly species classed as "very common". Obviously, there exists a full spectrum between, on the one hand, "common and abundant or dominant species", and "rare and sparse" species. Some species are known so far from a single area, and so must be classed as "rare" or "very rare", for example *Polytrichum strictum* on Ardley Island or *Campylium polygamum* in the flooded area from Lake Kitezh to Gemmel Peaks on the Fildes Peninsula. However, in their respective areas the two species must be considered as locally abundant and dominant.

It is necessary to emphasize that both frequency and abundance are influenced by natural variations in the kinds of habitat available to species in any individual locality. One example which may serve here is *Muelleriella crassifolia*, a species ecologically restricted to coastal rocks in the tidal zone, which obviously can only be found in localities where such habitats exist but, even then, may be overlooked or simply absent. For this reason, this species is environmentally excluded from inland sites because of the lack of suitable habitat.

Chapter 6

SYSTEMATIC TREATMENT

... it might be assumed that knowledge of Antarctic bryophytes rests on a good foundation and that it is comparatively simple for the specialist to identify, with certainty, most of the taxa. Unfortunately, this is far from being the case and the group presents an all too familiar set of problems.

S. W. Greene, *Problems and progress in Antarctic bryology*, 1964

INTRODUCTORY REMARKS

The sequence of families follows the system of classification adopted by Brotherus (1924, 1925) in his treatment of the Musci in Engler's *Die Natürlichen Pflanzenfamilien*, with some minor exceptions, for instance the placement of the Polytrichidae before the Bryidae. The genera are arranged in alphabetical order within the families and the species also alphabetically within the genera. To conform with the latest taxonomic concepts, some genera have been realigned in families other than those in Brotherus (1924, 1925). Because of the considerable limitations of the taxonomic objectives of the present flora, bibliographic data are cited only for accepted generic and species names, not for synonyms, unless the taxonomic discussion requires full citations. Although I examined the type of every taxon described from Antarctica, type specimens have not been cited, either for accepted species or synonymous names. The only exceptions are the types of the names which have been reduced to synonymy for the first time. Heterotypic and homotypic synonyms are provided only for species reported or described from material collected within the Antarctic.

Authors' names are mostly abbreviated to conform with traditional bryological usage, although in some cases, for example Karl Müller of Halle, the abbreviations proposed by Brummitt and Powell (1992) have been adopted.

Species descriptions are short and emphasize only characters critical for recognition. For every species a plate is provided with illustrations of habit and some diagnostic features. Habitat notes are short and concise and are based on my field experience with the species or, exceptionally, have been taken from the specimen labels.

The distribution of all species on King George Island has been determined by examination of relevant herbarium specimens. The specimens I have collected personally are indicated by number only, without citation of collector. Those specimens which have been distributed in the *Bryophyta Antarctica Exsiccata* (Ochyra, 1984b; Ochyra *et al.*, 1986) are indicated by the abbreviation ‘BAE’ in parantheses, followed by the relevant taxon number.

For two collectors, Bolesław Jabłoński and Vera Komárková, who provided rich collections of bryophytes from the island, the collecting number is preceded by the abbreviations of their names, ‘BJ’ and ‘VK’, respectively. The first set of these specimens is preserved in the Bryological Herbarium of the Institute of Botany of the Polish Academy of Sciences in Cracow (KRAM). For other specimens, collectors, and numbers if present, are cited, followed by the acronym of the herbarium in which they are preserved. Herbarium citations follow the abbreviations in Holmgren *et al*. (1990).

For common and abundant species the local range on King George Island is, in general, presented on large maps showing their occurrence in the Admiralty Bay area. They are accompanied by smaller maps in inset which illustrate the distribution of the species in question over the rest of the island. The range of rare and widely scattered species is given on a single map. An indication of the Antarctic distribution of each species is provided, based on data gathered from specimens which I have personally examined. Information about the world distribution of a given species is extracted from reliable literature reports or based on personal studies of relevant collections, especially in the Southern Hemisphere.

I have also listed the King George Island literature records. Unfortunately, in most cases, they are very general and cannot be shown precisely on a map.

KEY TO GENERA OF KING GEORGE ISLAND MOSSES

The key comprises all genera known to be present on King George Island. I refrained from adding genera which are known from other parts of the Antarctic. This obviously would have increased the usefulness of the treatment and would have allowed the user to determine, to generic level, all mosses presently known from the Antarctic biome. However, this does not seem necessary at present because the key covering all genera and species will be published soon in the *Illustrated Moss Flora of Antarctica* which is under preparation (Ochyra *et al.*, 1997; Lewis-Smith *et al.*, 1998).

The generic key refers mostly to local species, not to the genera as a whole. This is because about half of the total number of moss species in the Antarctic do not produce sporophytes at all and sporophyte features are often essential for the circumscription of genera. Therefore, in the keys, gametophyte characters are often emphasized and sporophyte features are used when the species concerned is known to form fully mature capsules.

1. Capsules dehiscing by 4(–8) slits; plants saxicolous, red to brown; leaf cell walls incrassate, reddish to brownish; if sterile, acrocarpous mosses with ecostate leaves or with an indistinct broad bistratose costa gradually merging into the laminal cells .... ***Andreaea***
1. Capsules dehiscing by an operculum; plants not as above 2
    2. Plants acrocarpous 3
    2. Plants pleurocarpous 38
3. Leaves distichous .... ***Distichium***
3. Leaves arranged in 3 or more ranks 4
    4. Leaves with lamellae on the ventral surface 5
    4. Leaves without lamellae on the ventral surface 7
5. Leaves without well-differentiated sheathing base; ventral lamellae segmented, wavy .... ***Notoligotrichum***
5. Leaves divided into broad sheathing base and narrow limb; ventral lamellae not segmented, straight 6
    6. Leaf margin entire, broadly involute and concealing the upper leaf surface ... ***Polytrichum***
    6. Leaf margin dentate or serrate, plane or incurved but not involute .... ***Polytrichastrum***
7. Leaves with a distinct border of narrow and elongated or otherwise different cells 8
7. Leaves without a distinct border 10
    8. Leaves abruptly narrowed from a sheathing base to a linear subula largely filled by the costa .... ***Ditrichum***
    8. Leaves not sheathing, more gradually narrowed to a broader acumen 9
9. Leaf margin plane, irregularly toothed towards the apex; laminal cells usually distinctly papillose .... ***Hennediella***
9. Leaf margin recurved, minutely serrulate or entire towards the apex; laminal cells smooth .... ***Bryum***
    10. Costa very broad, 1/3 or more of width of leaf near base 11
    10. Costa narrower 13
11. Leaves linear- to lingulate-lanceolate, obtuse or rounded-obtuse at the apex .... ***Meesia***
11. Leaves narrowly lanceolate, long subulate 11
    12. Laminal cells entirely smooth; leaves straight .... ***Chorisodontium***
    12. Laminal cells appearing papillose in cross-section due to longitudinal cuticular ridges covering the lumina; leaves falcato-secund .... ***Holodontium***
13. Alar cells differentiated, inflated or not, usually coloured 14
13. Alar cells not differentiated 15
    14. Leaves crisped when dry; laminal cells pseudopapillose due to numerous longitudinal cuticular ridges over the lumina .... ***Dicranoweisia***
    14. Leaves not crisped; laminal cells smooth .... ***Kiaeria***

15. Leaf apex hyaline, whitish when dry 16
15. Leaf apex not hyaline 23

16. Upper laminal cells papillose 17
16. Upper laminal cells smooth 19

17. Upper laminal cells frequently with poorly developed or almost absent papillae; areolation lax, upper cells more than 15 µm wide . . . . ***Hennediella***
17. Upper laminal cells densely papillose; areolation not lax, upper cells usually less than 15 µm wide 18

18. Upper laminal cells very obscure, bulging with dense multifid papillae; calyptra mitriform, cylindrical, covering capsule . . . . ***Encalypta***
18. Upper laminal cells opaque, not or weakly bulging, covered with bifid papillae; calyptra cucullate . . . . ***Syntrichia***

19. Leaves ovate to broadly ovate or nearly orbicular 20
19. Leaves lanceolate to ovate-lanceolate 21

20. Leaves acuminate; basal leaf cells reddish . . . . ***Bryum***
20. Leaf apex broadly acute to rounded; basal cells of similar colour to the cells above . . . . ***Stegonia***

21. Laminal cells with strongly thickened, nodose-sinuate cell walls; central strand absent . . . . ***Racomitrium***
21. Laminal cells straight-walled, occasionally nodulose-walled but then capsules immersed; central strand present or if absent then capsules immersed 22

22. Capsules immersed . . . . ***Schistidium***
22. Capsules exserted . . . . ***Grimmia***

23. Leaves in 5 distinct ranks . . . . ***Conostomum***
23. Leaves not in distinct ranks 24

24. Leaves abruptly narrowed from a clasping base into a widely spreading, linear subula 25
24. Leaves without clasping bases gradually narrowed to the acumen 27

25. Upper cells strongly papillose at the ends on both surfaces; leaf margins serrulate . . . . ***Bartramia***
25. Upper cells smooth or mamillose; leaf margins entire 26

26. Costa in cross-section with 2 strong, dorsal and ventral stereid bands; leaf apex denticulate . . . . ***Ditrichum***
26. Costa in cross-section with 2 weak or only one dorsal stereid band; leaf apex entire or mamillose . . . . ***Anisothecium***

27. Leaves orbicular to very broadly ovate, strongly concave 28
27. Leaves ovate, lanceolate to lingulate, flat or weakly concave 29

28. Upper laminal cells thick-walled, in cross-section very thick dorsally; basal leaf cells of similar colour to the cells above . . . . ***Stegonia***
28. Upper laminal cells thin-walled, in cross-section thin-walled on both surfaces; basal leaf cells reddish . . . . ***Bryum***

29. Upper laminal cells bistratose; leaf margins bordered above with multistratose, swollen limbidium . . . . ***Muelleriella***
29. Upper laminal cells unistratose; leaf margin unistratose or bistratose in places 30

30. Laminal cells smooth 31
30. Laminal cells papillose 34

31. Laminal cells subquadrate 32
31. Laminal cells rhomboid-hexagonal to linear 33

32. Laminal cells sinuose, opaque; costa without internal differentiation; leaf margins plane to recurved . . . . ***Schistidium***
32. Laminal cells straight-walled, pellucid; costa with a row of large guide cells; leaf margins strongly reflexed to revolute . . . . ***Ceratodon***

33. Costa ending below the apex, occasionally percurrent . . . . ***Pohlia***
33. Costa excurrent . . . . ***Bryum***

34. Leaves ovate to ovate-lanceolate 35
34. Leaves spathulate to oblong-lanceolate 36

35. Basal leaf cells lax, rectangular, thin-walled; upper laminal cells large, more than 15 µm wide . . . . ***Hennediella***
35. Basal leaf cells quadrate to short-rectangular, thick-walled; upper laminal cells small, to 12 µm wide . . . . ***Didymodon***

36. Upper laminal cells often slightly papillose to almost smooth, more than 15 µm wide . . . . ***Hennediella***
36. Upper laminal cells densely papillose, usually less than 15 µm wide 37

37. Upper laminal cells distinctly bulging; calyptra cylindrical, covering capsule . . ***Encalypta***
37. Upper laminal cells not or slightly bulging; calyptra cucullate . . . . ***Syntrichia***

38. Costa lacking or double 39
38. Costa single 41

39. Plants very slender, filamentous; leaves rarely more than 0.3 mm long . . . . ***Platydictya***
39. Plants medium-sized, not filamentous; leaves more than 0.5 mm long 40

40. Leaves falcato-secund; leaf apex flat; angular cells small, thick-walled; costa very short . . . . ***Hypnum***
40. Leaves erect-spreading; leaf apex canaliculate; angular cells large, hyaline; costa often extending to mid-leaf . . . . ***Campylium***

41. Costa strong, usually excurrent, seldom percurrent; paraphyllia present, filiform . . . . ***Orthotheciella***
41. Costa ending well below apex; paraphyllia absent 42

42. Leaves falcato-secund, narrowly lanceolate . . . . ***Sanionia***
42. Leaves straight, broadly lanceolate to ovate- or oblong-lanceolate 43

43. Rhizoid-initials present at the leaf apex . . . . ***Warnstorfia***
43. Rhizoid-initials always absent 44

44. Leaves erect-spreading, gradually tapering into a fine channelled acumen; costa often branched . . . . ***Campylium***
44. Leaves erect to erecto-patent, gradually or abruptly narrowed into a plane acumen; costa unbranched . . . . ***Brachythecium***

DESCRIPTIONS OF SPECIES AND THEIR LOCAL DISTRIBUTION

ANDREAEACEAE

This family represents the separate class Andreaeopsida. It is characterized by the thalloid protonema and dehiscence of the capsule by 4–8 longitudinal slits. In the absence of a seta, the sporophyte is elevated at maturity on a pseudopodium. The Andreaeaceae are pan-continental in distribution. *Andreaea* has approximately 50 species and exhibits greater diversity in the Southern Hemisphere than in the North. The southern South American and South Georgian *Neuroloma* is monotypic.

ANDREAEA

Andreae Hedw., Spec. Musc. Frond.: 47. 1801.

The genus occurs primarily in the cool temperate and polar regions of both hemispheres and in the tropics it is common on the highest mountains. In the Antarctic it is represented by three species which are widely distributed and abundant in the Antarctic Peninsula region and its offshore archipelagoes and very rare on the continent. Records of *Andreaea parallela* Müll. Hal. (Greene *et al.*, 1970; Ochyra, 1996c) from the region are based on misidentifications. Species of *Andreaea* are very important constituents of the impoverished Antarctic terrestrial vegetation, both in terms of frequency and cover, being primarily associated with various communities of the fruticose lichen and moss cushion subformation. Useful taxonomic treatments of the Antarctic and Subantarctic species of *Andreaea* have been published by Greene (1968), Greene *et al.* (1970) and Schultze-Motel (1970).

KEY TO THE KING GEORGE ISLAND SPECIES OF *ANDREAEA*

1. Leaves with a bistratose strip of cells in centre base, forming an indistinct costa .... ***A. depressinervis***
1. Leaves unistratose throughout, without costa 2
    2. Leaves obovate-spathulate to panduriform; leaf margin crenate to weakly denticulate in the lower half .... ***A. gainii***
    2. Leaves narrowly ovate to ovate-lanceolate; leaf margin entire throughout .... ***A. regularis***

Andreaea depressinervis Card., Rev. Bryol. 27: 43. 1900. FIG. 42

Andreaea depressinervis Card. var. *compacta* Card.
A. depressinervis Card. fo. *robusta* Card.

Brownish or olive-green to blackish-brown, profusely branched plants up to 5 cm tall forming hummocky cushions or low turfs. Leaves imbricate when dry, erecto-patent when moist, 1.0–1.3 mm long, 0.3–0.7 mm wide, ovate or ovate-lanceolate, gradually tapering to an acumi-

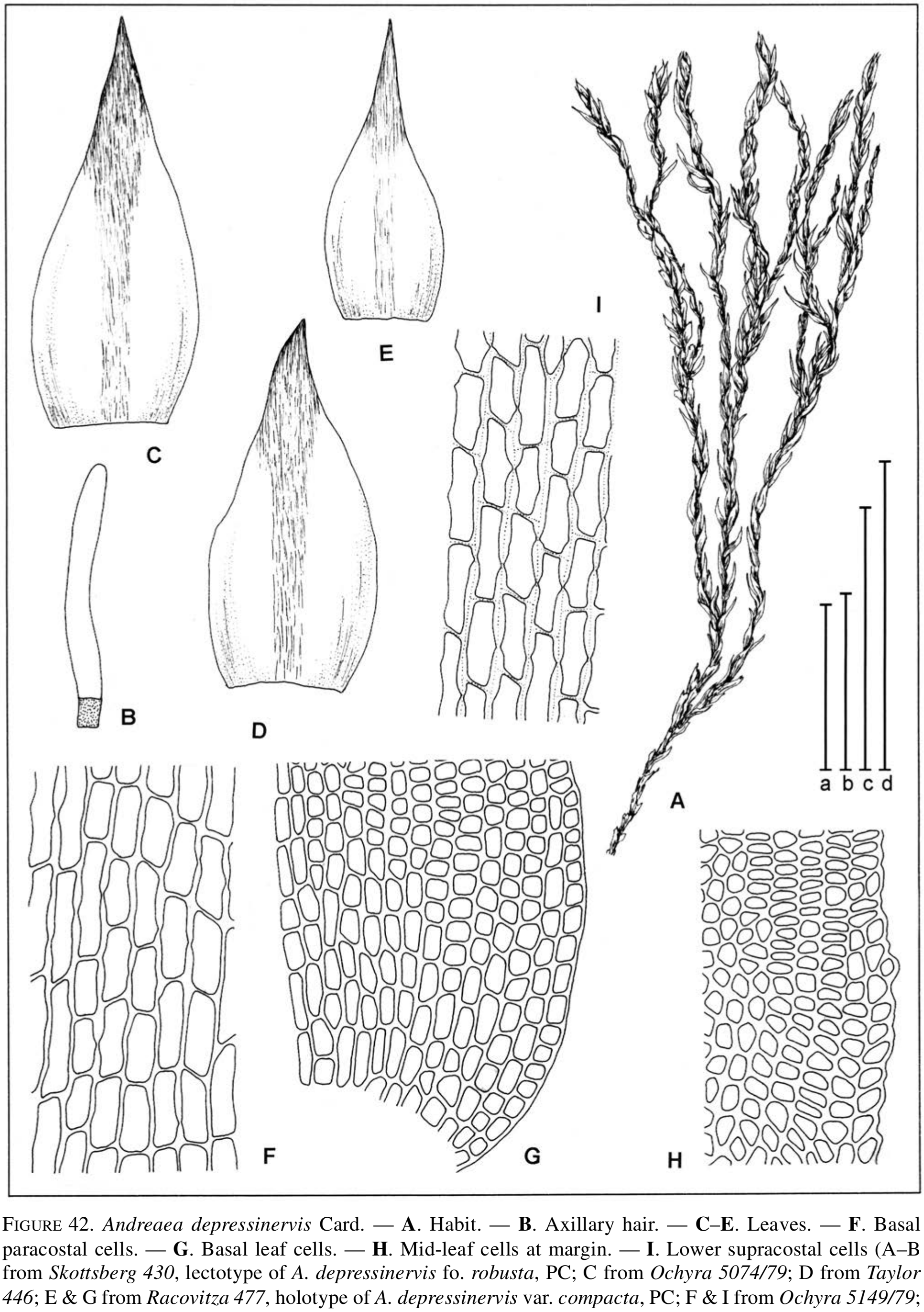


FIGURE 42. *Andreaea depressinervis* Card. — **A**. Habit. — **B**. Axillary hair. — **C**–**E**. Leaves. — **F**. Basal paracostal cells. — **G**. Basal leaf cells. — **H**. Mid-leaf cells at margin. — **I**. Lower supracostal cells (A–B from *Skottsberg 430*, lectotype of *A. depressinervis* fo. *robusta*, PC; C from *Ochyra 5074/79*; D from *Taylor 446*; E & G from *Racovitza 477*, holotype of *A. depressinervis* var. *compacta*, PC; F & I from *Ochyra 5149/79*; H from *Corner 731*; all in KRAM unless otherwise stated). Scale bars: a – 50 µm (B, F, I); b – 100 µm (G–H); c – 0.5 cm (A); d – 1 mm (C–E).

nate apex, margin plane, entire or occasionally wavy; costa single, bistratose, extending up to the acumen, occupying 1/3–1/4 of the leaf base, in the lower part composed of elongate cells; laminal cells mostly isodiametric, rounded or elliptic, with rather thick and sometimes porose walls, smooth or moderately to strongly papillose on both sides. Apparently dioecious. Sporophytes unknown.

Ecology. — Rather frequent on dry, exposed acidic rock outcrops, boulders and stony ground, sometimes on soil or humus.

Phytogeography. — **American Subantarctic** – South Orkney Is.; South Shetland Is.; West Antarctic Peninsula from the Palmer Coast south to Marguerite Bay; Trinity Peninsula on the East Antarctic Peninsula; South Georgia.

Distribution on King George Island. — The rarest of all species of the genus, occurring mostly on the western shore of Admiralty Bay, with particular frequency in the area from Point Thomas to Demay Point (Fig. 43), extending from sea level to about 100 m and only occasionally found as high as 275 m. Outside Admiralty Bay occasional to frequent along the south-western coast from the Fildes Peninsula to the Potter Peninsula, very rare elsewhere.

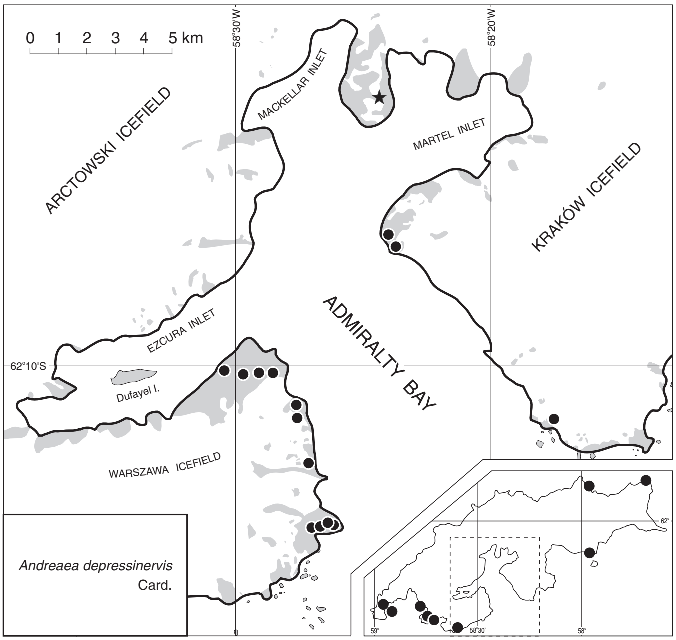


FIGURE 43. Distribution map for *Andreaea depressinervis* Card. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – inexact locality.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Demay Point, 30 m, *1321/80*, 50 m, *1323/80* and 60 m, *1385/80* [BAE-17]; Creeping Slopes, 10 m, *1236/80*, 90 m, *1243/80 & 1294/80*. ***Ecology Glacier***: Sphinx Hill, 70 m, *4834/79*; Rescuers Hills, 45 m, *173/80* and 90 m, *174/80*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 30 m, *695/80*; Penguin Ridge, 45 m, *1417/80 & 1434/80*; Ubocz, 110 m, *4928/79* [BAE-151], 120 m, *2376/80* and 125 m, *2374/80*; Jersak Hills, 140 m, *5074/79* and 170 m, *5074/79*; Jardine Peak, 275 m, *5149/79* [BAE-1]. ***Keller Peninsula***: without specific locality, *VK-941*. ***Martel Inlet***: Point Hennequin, *Lindsay 847a* (BM); Basalt Point, 5 m, *2217/80* and 6 m, *2216/80*. ***Viéville Glacier***: Vauréal Peak, 40 m, *5260/79* [BAE-101]. KING GEORGE BAY. Turret Point, *BJ-138*. VENUS BAY. North Foreland, *Lindsay 653* (AAS, KRAM). DRAKE PASSAGE. Pyrites Island, 15 m, *BJ-37*. FILDES PENINSULA. Ardley Island, 25 m, *2490/80* and *Kühnemann 1954/23 & 1954/81* (AAS); Bellingshausen Station, 15 m, *2427/80* [BAE-26] *& 2431/80*. MARIAN COVE. North Spit, *BJ-148*. BARTON PENINSULA. Winship Point, *BJ-190*; Noel Hill, *BJ-202*. POTTER PENINSULA. Without specific locality, *Kühnemann 1955/1* (AAS); Stranger Point, *BJ-107*.

Literature records. — Fildes Peninsula (Greene *et al.*, 1970; Pizarro & Sáiz, 1977; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998; Hu, 1998); Admiralty Bay (Greene *et al.*, 1970; Czeczuga *et al.*, 1982; Kuta *et al.*, 1982; Lindsay & Ochyra, 1984; Ochyra, 1984b; Ochyra *et al.*, 1986; Myrcha *et al.*, 1991; Olech, 1992, 1993; Okada & Kanda, 1994); Venus Bay (Greene *et al.*, 1970).

Andreaea gainii Card., Compt. Rend. Ac. Sc. Paris 153: 602. 1911. FIG. 44

Andreaea parallela Müll. Hal. var. *gainii* (Card.) Ochyra

Medium-sized to relatively large, fastigiately branched plants, 1–5 cm tall, forming loose, dark purplish-red, brown to blackish tufts or patches. Leaves imbricate when dry, patent to widely spreading or squarrose when wet, obovate-spathulate to panduriform, broadest at or above a mid-leaf constriction, 0.8–1.2 mm long, 0.2–0.6 mm wide, symmetrical, tapering to a short or long apex; margins plane, entire above, variably crenulate to denticulate from a short distance above the base up to the constriction; costa absent; laminal cells rounded to elliptical, strongly thickened, particularly at cell corners, smooth or papillose on the back, basal elongate, sinuose, porose. Autoecious. Capsules exserted, dehiscing by 4 valves extending about half way down from the apex. Spores shrivelled, brown, 17–28 µm or turgid, green, 26–38 µm in diameter.

Ecology. — Common on dry, exposed acidic rocks, on boulders on stony ground, scree, rock ledges and outcrops, sometimes on soil or humus in rock crevices.

Phytogeography. — **Antarctic Endemic** – Bouvetøya; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula (from Danco Coast to Adelaide I.); Charcot I.; East Antarctic Peninsula (Trinity Peninsula, Foyn Coast); Ellsworth Land (Fig. 29).

Distribution on King George Island. — A very common and locally abundant species, occurring throughout the Admiralty Bay area and known from almost all ice-free places and nunataks (Fig. 45). Its altitudinal range extends from sea level to summits of the highest nunataks (433 m).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1107/80 & 1121/80*; Blue Dyke, 90 m, *1184/80* and 135 m, *1149/80 & 1178/80*; The Tower, 320 m, *1028/80* and 340 m, *1027/80*; Bastion, 240 m, *979/80, 996/80 & 1004/80* and 280 m, *1013/80*; Demay Point, 35 m, *1372/80*; Creeping Slopes, 105 m, *1260/80*, 115 m, *1265/80*

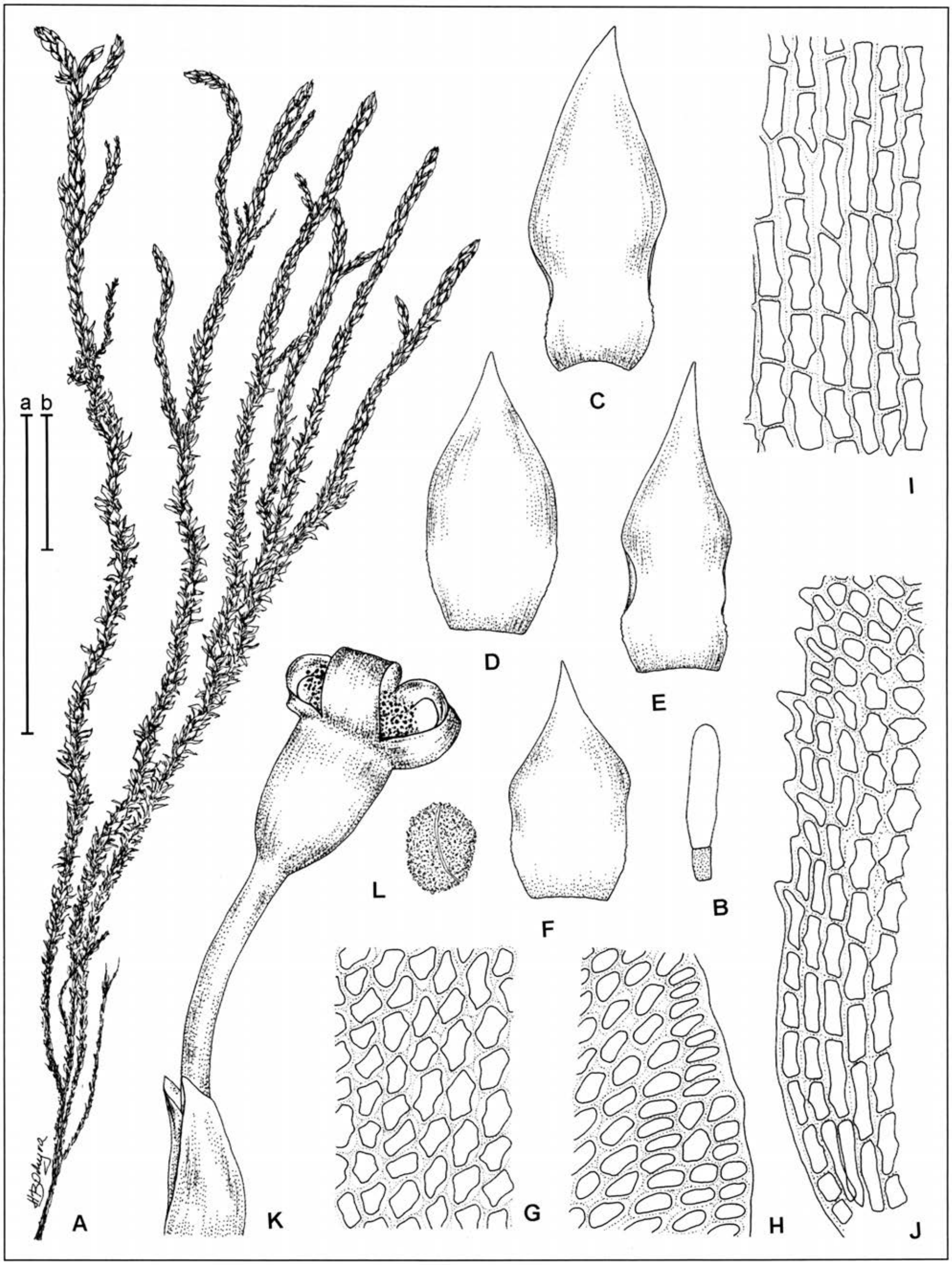


FIGURE 44. *Andreaea gainii* Card. — **A**. Habit. — **B**. Axillary hair. — **C**–**F**. Leaves. — **G**. Mid-leaf cells. — **H**. Marginal cells at widest part of leaf. — **I**. Cells in middle of leaf base. — **J**. Basal cells at margin. — **K**. Sporophyte. — **L.** Spore (A–C & G–I from *Ochyra 30/80*; D–E from *Gain 209*, holotype of *A. gainii*, PC; F & J from *Ochyra 1964/80*; K–L from *Ochyra 596/80*; all in KRAM unless otherwise stated). Scale bars: a – 1 mm (C–F, K); b – 0.5 cm (A) and 50 μm (B, G–I, L).

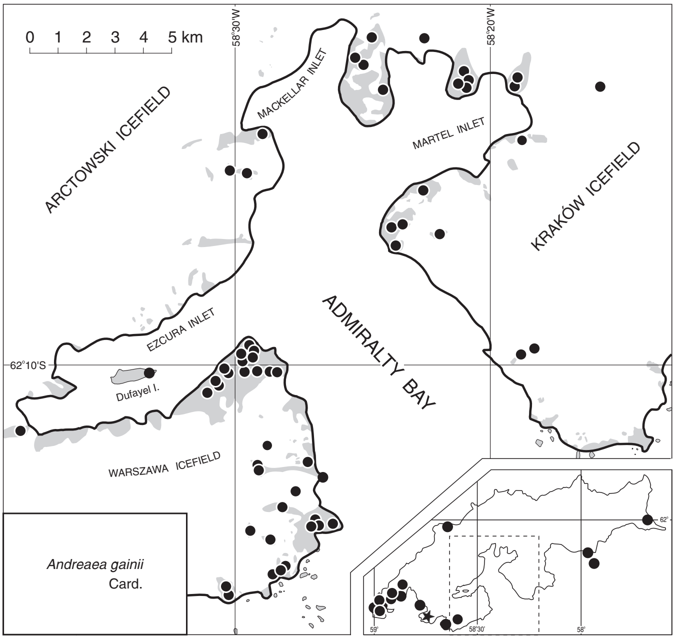


FIGURE 45. Distribution map for *Andreaea gainii* Card. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – inexact locality.

[BAE-76] and 140 m, *1280/80*; Brama, 200 m, *788/80*. ***Ecology Glacier***: Siodło, 125 m, *744/80* and 130 m, *737/80, 747/80, 757/80 & 777/80* [BAE-2]; Agat Point, 25 m, *352/80*; Zamek, 330 m, *1/80*, 335 m, *29/80*, 336 m, *8/80*, 360 m, *30/80* and 365 m, *32/80 & 35/80* [BAE-52]; Sphinx Hill, 95 m, *228/80*, 100 m, *259/80* and 125 m, *194/80 & 196/80*; Czajkowski Needle, 230 m, *686/80* and 240 m, *694/80*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 170 m, *156/80*; Ornithologists Creek, 165 m, *101/80*; Hala, 25 m, *5217/79*; Upłaz 174 m, *1663/80*. Krzesanica, 120 m, *1662/80*; Ambona, 80 m, *1620/80* and 85 m, *1605/80 & 1607/80*; Ubocz, 100 m, *4969/79*, 125 m, *2368/80*, 120 m, *4929/79* and 175 m, *5124/79*; Krokiew, 165 m, *1670/80*; upper part of Ornithologists Creek, 180 m, *126/80*; Jersak Hills, 170 m, *5147/79*, and ca 200 m, *5108/79 & 5149/79*; south-western branch of Panorama Ridge, 130 m, *1712/80*. ***Ezcurra Inlet***: Jardine Peak, 180 m, *5151/79*, 275 m, *5154/79 & 5160/79* and 280 m, *5181/79*; Kasprowy Hill, 270 m, *75/80*; Italia Valley, 100 m, *98/80* and 120 m, *102/80*; Belweder, 150 m, *1589/80*. ***Dufayel Island***: Gdynia Point, 95 m, *1766/80*. ***MacKellar Inlet***: Admiralen Peak, 305 m, *2024/80*; Komandor Peak, 230 m, *1974/80* and 240 m, *1964/80*; Crépin Point, 10 m, *2041/80*. ***Keller Peninsula***: without specific locality, *Taylor 306* (BM) and *Schuster 69-949 p.p. & 69-957* (US); Ore Point, 15 m, *511/80*; Moraine Point, 35 m, *465/80* and 60 m, *476/80*; Piasecki Pass, 200 m, *432/80*; Mount Birkenmajer, 270 m, *446/80* and 290 m, *438/80 & 439/80*. ***Martel Inlet***: without specific locality, *Disc. Invest. St. 1481/5* (BM); Shark Fin, 130 m, *2643/80*, 150 m, *2640/80*, 160 m, *2635/80* and 170 m, *2642/80*; Ullman Spur, 15 m, *574/80*, 40 m, *575/80*, 45 m, *587/80*, 50 m, *580/80*, 60 m, *577/80, 596/80 & 597/80* [BAE-27], 80 m, *588/80* and 90 m, *570/80*; Precious Peaks, 100 m, *2663/80* and 120 m, *2664/80*; Ternyck Needle, 433 m, *1833/80*; Szafer Ridge, 250 m, *2567/80*; Smok, 10 m, *2060/80*; Basalt Point, 20 m, *2205/80* [BAE-152]; Mount Wawel, 40 m, *2142/80* and 120 m, *2174/80*; Bell Zygmunt, 300 m, *2673/80, 2681/80 & 2686/80*. ***Viéville Glacier***. Rembiszewski Nunataks, 150 m, *2721/80* and 200 m, *2724/80 & 2736/80*. KING GEORGE BAY. Turret Point, *BJ-132*; Penguin Island, *BJ-63*.

DESTRUCTION BAY. Wrona Buttress, *BJ-177*. **DRAKE PASSAGE**. Davey Point, 60 m, *BJ-44*. **FILDES PENINSULA**. Gemmel Peaks, 100 m, *2472/80* and 120 m, *2470/80*; Flat Top Peninsula, *John & Sudgen 40B* (BM) *& 47* (AAS); Horatio Stump, 285 m, *John & Sudgen 47* (AAS, KRAM); Ardley Island, *Kühnemann 1954/16 & 1954/61* (AAS); Bellingshausen Station, 15 m, *2413/80 & 2419/80*; Suffield Point, 30 m, *2448/80*, 35 m, *2440/80* and 60 m, *2436/80*; Lake Kitezh, 25 m, *2457/80*; Nebles Point, 10 m, *BJ-23 & BJ-54*; Green Point, 10 m, *BJ-43*. **MARIAN COVE**. North Spit, *BJ-146*. **BARTON PENINSULA**. Without specific locality, *Lindsay 720* (BM). **POTTER PENINSULA**. Without specific locality, *Kühnemann 1955/48* (AAS); Three Brothers Hill, *BJ-167* and *Lindsay 680* (AAS, KRAM); Florence Nunatak, 340 m, *1310/80*.

Literature records. — Fildes Peninsula (Greene *et al.*, 1970; Bonner & Lewis-Smith, 1985; Putzke & Pereira, 1990; Wu & Hu, 1990 as *A. obovata*; Chen *et al.*, 1993, 1995; Li *et al.*, 1998; Hu, 1998); Barton Peninsula (Greene *et al.*, 1970); Potter Peninsula (Greene *et al.*, 1970; Kanda, 1987b); Admiralty Bay (Greene *et al.*, 1970; Lindsay, 1971; Robinson, 1972; Czeczuga *et al.*, 1982; Kuta *et al.*, 1982; Ochyra, 1984b; Lindsay & Ochyra, 1984; Ochyra *et al.*, 1986; Kanda, 1987b; Myrcha *et al.*, 1991; Olech, 1992, 1993; Okada & Kanda, 1994).

Andreaea regularis Müll. Hal. *in* Neum., Deutsch. Exped. Int. Polarforsch. 2: 286. 1890. FIG. 46

Andreaea pycnotyla Card.

A. regularis var. *pycnotyla* (Card.) Card.

A. pygmaea Card.

Small to medium-sized, profusely branched plants, 1.0–2.5 cm or more tall, growing in low dense cushions, rarely turfs, dark or reddish-brown, sometimes almost blackish. Leaves erect when dry, erect-spreading when wet, narrowly ovate to ovate-lanceolate, gradually narrowed into a long acumen, less commonly abruptly short-acuminate, acute or rounded at the apex, symmetrical, 0.5–1.0 mm long, 0.2–0.5 mm wide, plane to concave; margins plane, entire throughout or occasionally slightly crenulate just above the base; costa absent; laminal cells unistratose, upper rounded to oval, thick-walled, sometimes porose, often papillose, basal rectangular to long rectangular, thick-walled, usually porose. Autoecious. Perichaetia 2–4 times as long as the leaves. Capsules exserted only slightly beyond the bracts, valves splitting to about halfway down from the apex. Spores shrivelled, brown, 17–28 μm, or turgid green, 26–38 μm in diameter.

Ecology. — On the surface and in fissures of rocks, sometimes on the ground between boulders and stones, usually in exposed habitats.

Phytogeography. — **Amphiatlantic South-Temperate** – Bouvetøya; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula (from Davis Coast to northern Marguerite Bay); Charcot I.; East Antarctic Peninsula (Trinity Peninsula, Oscar II Coast); Ellsworth Land; Tristan da Cunha; Prince Edward and Marion Is.; South Georgia; Falkland Is.; Tierra del Fuego; Magellanian Channels; Valdivian region.

Distribution on King George Island. — A very common and locally abundant

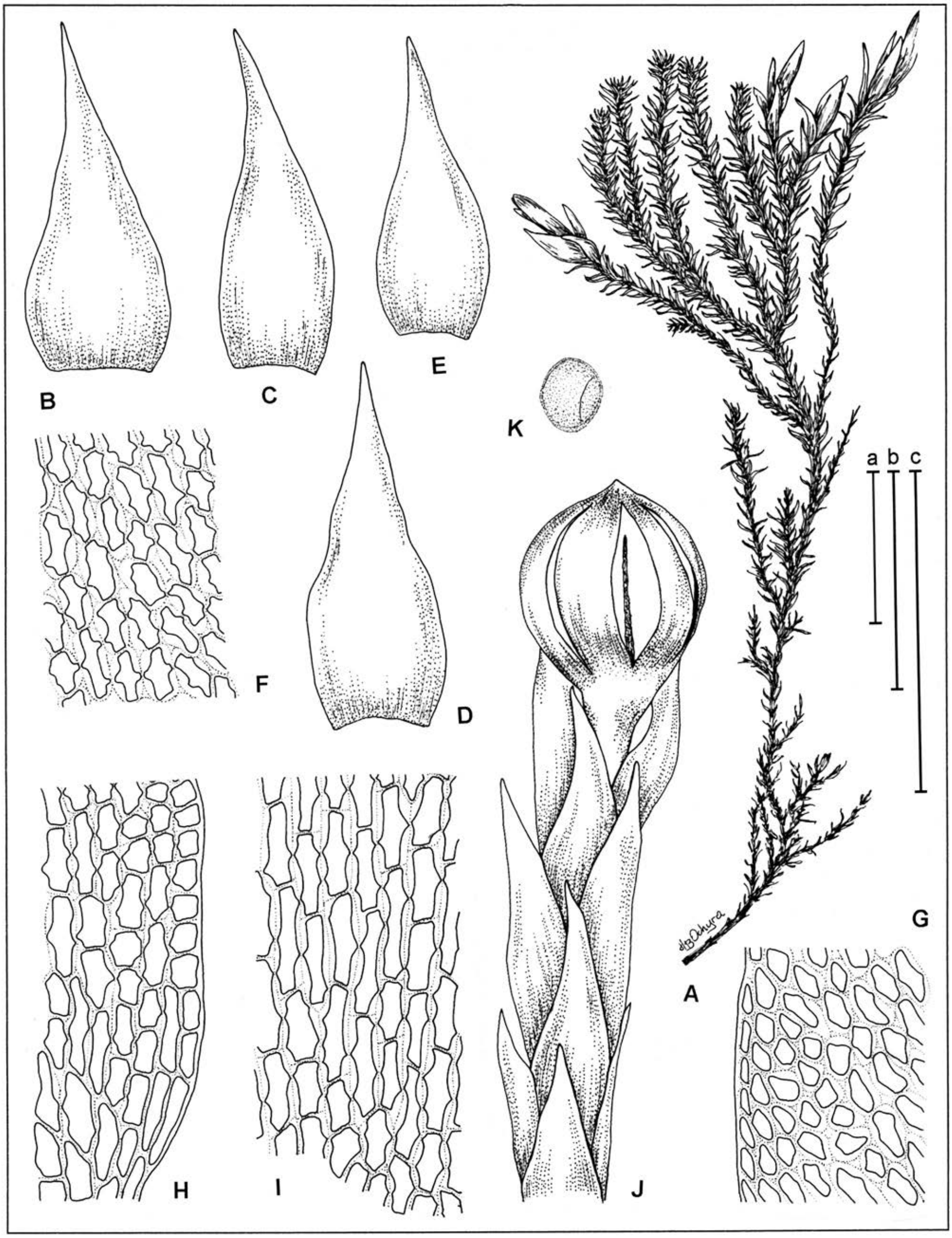


FIGURE 46. *Andreaea regularis* Müll. Hal. *in* Neum. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Mid-leaf cells. — **G**. Upper marginal cells of perichaetial leaf. — **H**. Basal marginal cells. — **I**. Cells in middle of leaf base. — **J**. Sporophyte. — **K**. Spore (A, C–D & I from *Will s.n.*, 17.ii.1883, lectotype of *A. regularis*, HBG; B & H from *Racovitza 270a*, lectotype of *A. pycnotyla*, BR; E from *Ochyra 1926/80*; F from *Racovitza 252a*, lectotype of *A. pygmaea*, BR; G & K from *Ochyra 418*; J from *Ochyra 622/80*; all in KRAM unless otherwise stated). Scale bars: a – 50 μm (F–I, K); b – 0.5 cm (A); c – 1 mm (B–E, J).

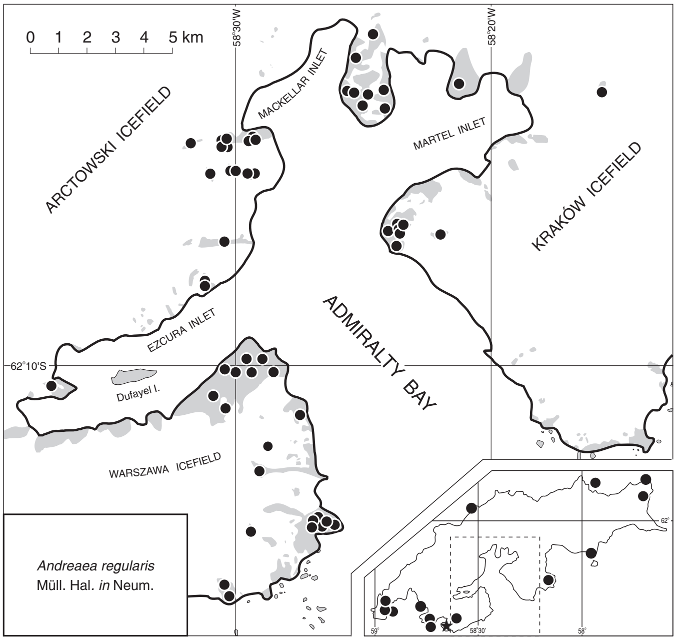


FIGURE 47. Distribution map for *Andreaea regularis* Müll. Hal. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – inexact locality.

species, widespread throughout the Admiralty Bay area and known from almost all ice-free places and nunataks (Fig. 47), occurring from sea level to 433 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***. Red Hill, 100 m, *477/80* [BAE-153] *& 1094/80*; The Tower, 340 m, *811/98*; Demay Point, 55 m, *1386/80* [BAE-28]; Creeping Slopes, 60 m, *1229/80*, 115 m, *1265/80 & 1266/80*, 160 m, *1291/80 & 1299/80* and 170 m, *1296/80*. ***Ecology Glacier***: Zamek, 335 m, *21/80*; Czajkowski Needle, 240 m, *649/80* and 245 m, *650/80*; Rescuers Hills, 45 m, *168/80*. ***Point Thomas***: Penguin Ridge, 85 m, *4963/79*; Hala, 30 m, *5208/79*; Skua Cliff, 45 m, *622/80*; Ubocz, 110 m, *4941/79 & 4961/79* [BAE-126]; Jersak Hills, 200 m, *5093/79* [BAE-154]. ***Ezcurra Inlet***: Jardine Peak, 275 m, *5168/79*; Italia Valley, 70 m, *42/80*; unnamed hills on Wróbel Glacier, 160 m, *137/80*; Pond Hill, 40 m, *1825/80* and 50 m, *879/80*; Urbanek Crag, 120 m, *2328/80* and 130 m, *2336/80*. ***MacKellar Inlet***: Klekowski Crag, 230 m, *2264/80*; Misty Nunatak, 280 m, *2032/80*; Admiralen Peak, 305 m, *2023/80*; Komandor Peak, 230 m, *1970/80*, 250 m, *1963/80* and 270 m, *929/80*; Kapitan Peak, 190 m, *1902/80* and 200 m, *1926/80* and 210 m, *1911/80*; Wegger Peak, 290 m, *1993/80, 2007/80* [BAE-3] *& 2008/80*, 300 m, *1992/80 & 2011/80* and 320 m, *1985/80*; Garnuszewski Peak, 290 m, *2021/80* and 300 m, *2018/80*. ***Keller Peninsula***: Ore Point, 4 m, *503/80 & 505/80* [BAE-177]; Speil Point, 15 m, *537/80* [BAE-53]; Round Hill, 50 m, *546/80*; British Point, 70 m, *558/80* [BAE-77]; Moraine Point, 3 m, *471/80*, 45 m, *464/80*, 50 m, *472/80* and 60 m, *475/80*; Mount Flagstaff, 100 m. *420/80* and 230 m, *418/80*; Mount Birkenmajer, 300 m, *440/80*. ***Martel Inlet***: Ullman Spur, 70 m, *579/80*; Ternyck Needle, 433 m, *1834/80*; Point Hennequin, 6 m, *2245/80* and 15 m, *2238/80*; Basalt Point, 15 m, *2227/80*; Mount Wawel, 20 m, *2188/80*, 40 m, *2126/80*, 50 m, *2162/80* and 90 m, *2179/80*; Bell Zygmunt, 300 m, *2676/80*. KING GEORGE BAY. Lions Rump, *BJ-95*; Turret Point, *BJ-139*. DESTRUCTION BAY. Faraway Nunataks, *BJ-172*. VENUS BAY. North Foreland, *BJ-102*; Pyrites Island, *BJ-36*. DRAKE PASSAGE. Davey Point, *BJ-45*. FILDES PENINSULA. Bellingshausen Station, 10 m, *2426/80*; Ardley Island, 5 m, *2481/80* [BAE-78], *Booth RILS 5297* (AAS, KRAM) and *Kühnemann 1854/20, 1954/62, 1954/63, 1954/76 & 1954/77* (AAS); Lake Kitezh, 25 m, *2467/80 & 2468/80*. **MARIAN COVE**. North Spit, *BJ-147* and *Lindsay 782* (AAS, KRAM) *& 783* (BM). **BARTON PENINSULA**. Without specific locality, *Lindsay 766 & 776* (BM); Noel Hill, *BJ-204* and *Lindsay 731A* (AAS, KRAM); Winship Point, *Lindsay 715* (AAS, KRAM, NY) and *BJ-192*. **POTTER PENINSULA**. Without specific locality, *Kühnemann 1855/3 & 1955/82* (AAS); Florence Nunatak, *1311/80*.

Literature records. — Fildes Peninsula (Greene *et al.*, 1970; Pizarro & Sáiz, 1977; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Barton Peninsula (Greene *et al.*, 1970); Potter Peninsula (Greene *et al.*, 1970; Kanda, 1987b); Admiralty Bay (Czeczuga *et al.*, 1982; Kuta *et al.*, 1982; Lindsay & Ochyra, 1984; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Olech, 1992, 1993; Okada & Kanda, 1994).

ANDREAEA SPECIES EXCLUDED FROM KING GEORGE ISLAND

Andreaea obovata Thed.

Reported for King George Island by Wu and Hu (1990). It constitutes the only record of this species from the Antarctic and the Southern Hemisphere, but is based upon a misdetermination and the voucher specimen (Fildes Peninsula, on roadside between Marsh Base and restaurant, *Wei* 8003, KRAM) is actually *A. gainii*. *A. obovata* is an arctic-alpine species of the Northern Hemisphere (Murray, 1987) which is known also from altimontane elevations in East and Central African mountains (De Sloover, 1977).

POLYTRICHACEAE

The Polytrichaceae are one of two families of the subclass Polytrichidae. They are characterized by multicellular peristome teeth, roughly 32 to 64 in number, which are formed from four concentric layers of cells located beneath the operculum. Additionally, the apex of the columella is expanded to form a membrane like an epiphragm that almost closes the sporangium mouth. The stem has a well-defined conducting system, and the adaxial surface of the leaf bears few to many longitudinal lamellae which are richly filled with chlorophyll, this considerably increasing the photosynthetic area of the leaf. The family is distributed throughout the world from the High Arctic to Antarctica, from sea level to high alpine elevations. It consists of at least 19 genera and approximately 370 species. There are three genera and five species in Antarctica: *Notoligotrichum* is basically an antipodal genus of ten species, of which *N. trichodon* (Hook. f. & Wils.) G. L. Sm. occurs in the South Sandwich, South Orkney Islands and South Shetland Islands, while *Polytrichum* and *Polytrichastrum* are pancontinental in distribution. The Antarctic taxa of the Polytrichaceae have been revised by Greene *et al.* (1970). Additionally, a useful taxonomic treatment of the Fuegian Polytrichaceae has been published by Schiavone (1993).

KEY TO THE KING GEORGE ISLAND GENERA OF THE POLYTRICHACEAE

1. Leaves without well-differentiated sheathing base; ventral lamellae segmented, distinctly undulate . . . . *Notoligotrichum*
1. Leaves differentiated into a broad sheathing base and narrow limb; ventral lamellae not segmented, straight 2
   2. Leaf margin entire, broadly involute and concealing the upper leaf surface . . . ***Polytrichum***
   2. Leaf margin dentate or serrate, plane or incurved but not involute . . . . ***Polytrichastrum***

NOTOLIGOTRICHUM

Notoligotrichum G. L. Sm., Mem. New York Bot. Gard. 21(3): 50. 1972.

A small antipodal genus of ten species having a pan-south-temperate disjunct distribution, with some species extending along the Cordillera as far north as Mexico. It has only recently been segregated from the Holarctic *Psilopilum* on the basis of its tapering, sharp-pointed and distant or occasionally absent peristome teeth. One species, *N. trichodon* (Hook. f. & Wils.) G. L. Sm., is known to occur in the Antarctic, in the South Sandwich, South Orkney Islands and South Shetland Islands. It is readily distinguished from other Antarctic mosses by the segmented wavy lamellae on the ventral surface of the costa.

Notoligotrichum trichodon (Hook. f. et Wils.) G. L. Sm., Mem. New York Bot. Gard. 21(3): 51. 1972. FIG. 48

Polytrichum trichodon Hook. f. et Wils.
Psilopilum trichodon (Hook. f. et Wils.) Mitt.

Plants medium-sized, 1–2 cm tall, simple, forming loose turfs or gregarious. Leaves imbricate and weakly curled when dry, erect-spreading when wet, oblong with weakly differentiated sheathing base, 2.5–4.0 mm long, concave, tapering from above mid-leaf to a cucullate apex, with or without a short apiculus; margin entire; costa narrow, subpercurrent; ventral lamellae 18–30 covering only the costa, 5–9 cells high; laminal cells isodiametric, rounded to quadrate, with pronounced corner thickenings; basal cells rectangular, thin-walled. Sterile.

Ecology. — Growing on wet clayey soil amongst other mosses and liverworts.

Phytogeography. — **Amphiatlantic Subantarctic** – Îles Kerguelen; South Georgia; Falkland Is.; South Sandwich Is.; South Shetland Is.; Tierra del Fuego; Colombia.

Distribution on King George Island. — Known only from a single locality on the Potter Peninsula from an elevation of 90 m (Fig. 48).

Specimen examined from King George Island. — POTTER PENINSULA. Three Brothers Hill, 90 m, 22 Dec 1993, *Schulz s.n.* (KRAM).

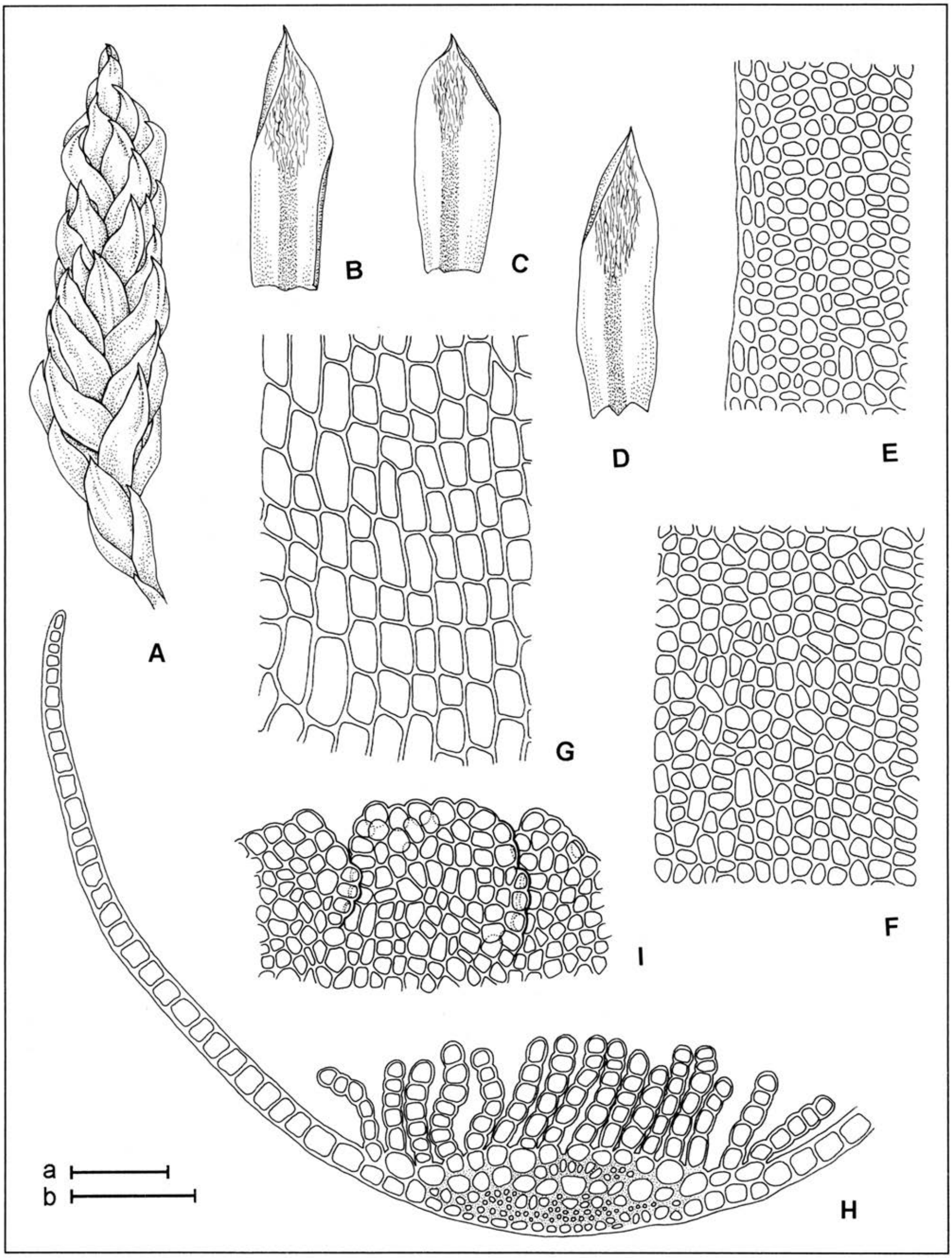
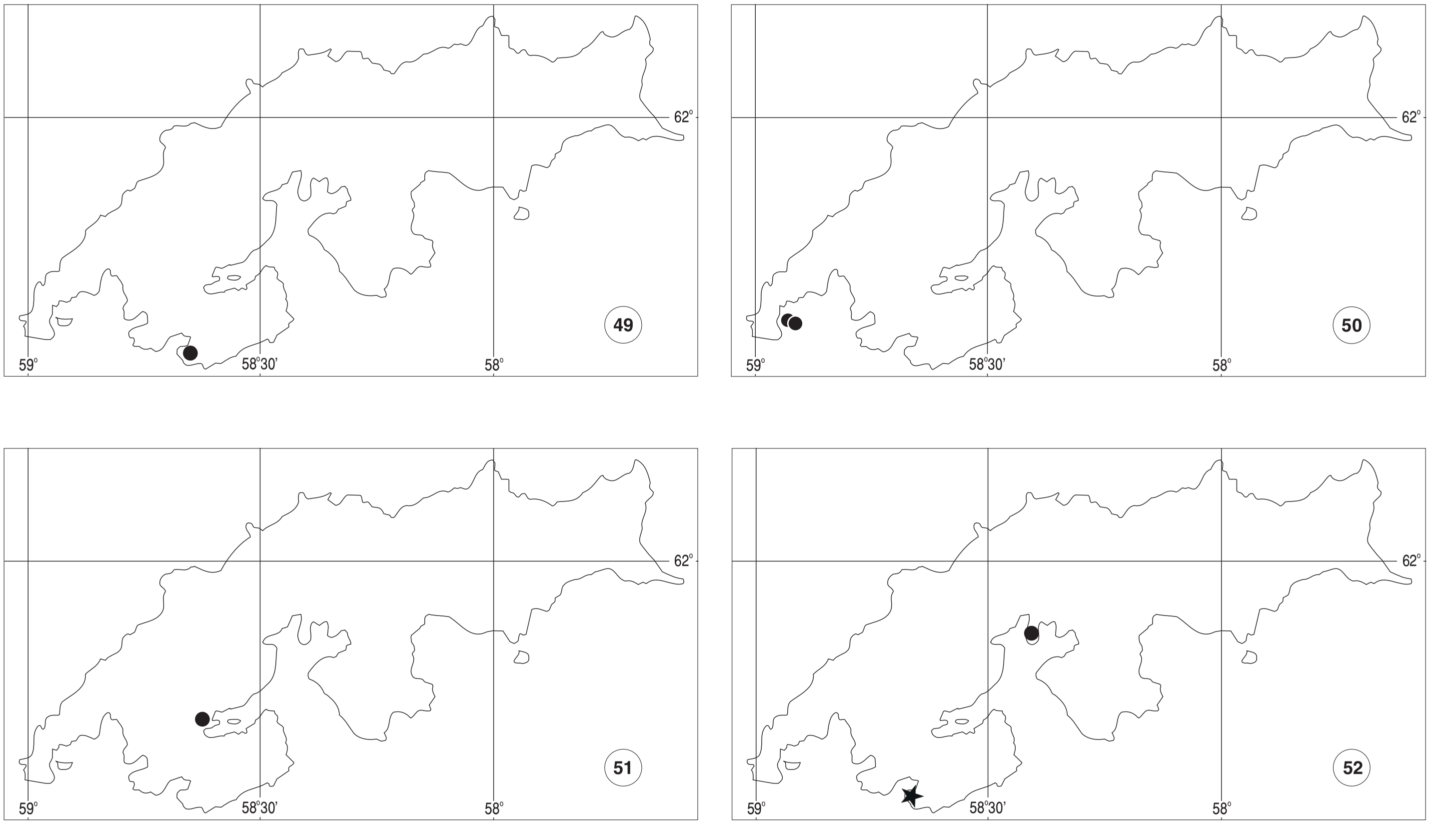


FIGURE 48. *Notoligotrichum trichodon* (Hook. f. & Wils.) G. L. Sm. — **A**. Habit. — **B–D**. Leaves. — **E**. Upper laminal cells at margin. — **F**. Mid-leaf cells. — **G**. Basal laminal cells. — **H**. Cross-section of leaf. — **I**. Side-view of lamella (all from *Schulz s.n.*, 22 Dec 1993, KRAM). Scale bars: a – 1 mm (B–D); b – 2 mm (A) and 100 μm (E–I).



FIGURES 49–52. Distribution maps for *Notoligotrichum trichodon* (Hook. f. & Wils.) G. L. Sm. (49), *Polytrichum strictum* Brid. (50), *Anisothecium cardotii* (R. Br. ter.) Ochyra (51) and *Kiaeria pumila* (Mitt. *in* Hook. f.) Ochyra (52) on King George Island. ★ – literature record.

POLYTRICHASTRUM

Polytrichastrum G. L. Sm., Mem. New York Bot. Gard. 21(3): 35. 1972.

This genus has only recently been segregated from the large genus *Polytrichum* (Smith, 1971) to accommodate 13 species having terete to obtusely 4–6-angled capsules with no constriction between the urns and hypophyses, smooth exothecial cells, thick epiphragms and the peristome teeth without internal wings or appendages. They occur mostly in the temperate and cool areas of both hemispheres and at high elevations in the tropics, and some of them have wide bipolar distributions. Two species are known to occur in Antarctica, but only *Polytrichastrum alpinum* is widespread in the maritime Antarctic, with *P. longisetum* (Brid.) G. L. Sm. having a restricted range on Signy Island in the South Orkney Islands. The Antarctic species of *Polytrichum* have been revised by Greene *et al.* (1970).

Polytrichastrum alpinum (Hedw.) G. L. Sm., Mem. New York Bot. Gard. 21(3): 35. 1972. FIG. 53

Polytrichum alpinum Hedw.
Pogonatum alpinum (Hedw.) Roehl.
P. alpinum (Hedw.) Roehl. fo. *elatum* Card.

Dark green or brownish, small to medium-sized plants, 1.5–6.5 cm or more tall, growing in dense or loose tufts. Leaves densely set above, erect-spreading and inrolled when dry, widely patent when wet, 2.5–4.5(–6.5) mm long, each abruptly narrowed from an elliptic to ovate sheathing base into a flat linear-lanceolate limb, with serrate, serrulate to almost entire margins, and terminating in a subulate apex, with incurved margins; costa excurrent as a brown, serrate to subentire awn; ventral lamellae 24–40, 6–8 cells high, end-cells ovoid in cross-section with strongly thickened, densely, finely papillose apices; laminae of limbs with narrow, erect wings, 2–6 cells broad at mid-limb; marginal teeth variable, acute, 1–4-celled. Dioecious. Setae brown, 1.3–1.8 cm long, Capsules weakly to strongly inclined, subglobose to shortly arcuate-cylindrical, terete; hypophyses distinct. Peristome teeth 40–55, irregularly developed. Spores 18–25 µm in diameter, finely papillose.

Ecology. — On rocky and stony ground, sometimes in rock fissures, less frequently on humus and soil on ledges, on windswept scree, in dry to moist or wet, exposed or sheltered situations. It has a wide ecological amplitude and is found as an associate in many different communities, but has optimum occurrence in various associations of the moss turf subformation.

Phytogeography. — **Bipolar** – In the Northern Hemisphere pan-arctic and high subarctic-subalpine to arctic-alpine (Long, 1985) extending south to Mexico and Guatemala. In the Southern Hemisphere, antarctic-temperate in distribution: Bouvetøya; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula (from Davis Coast to southern Marguerite Bay); Charcot I.; Subantarctica; Falkland Is.; Tierra del Fuego; Magellanian Channels; Valdivian region; SE Australia; Tasmania; New Zealand.

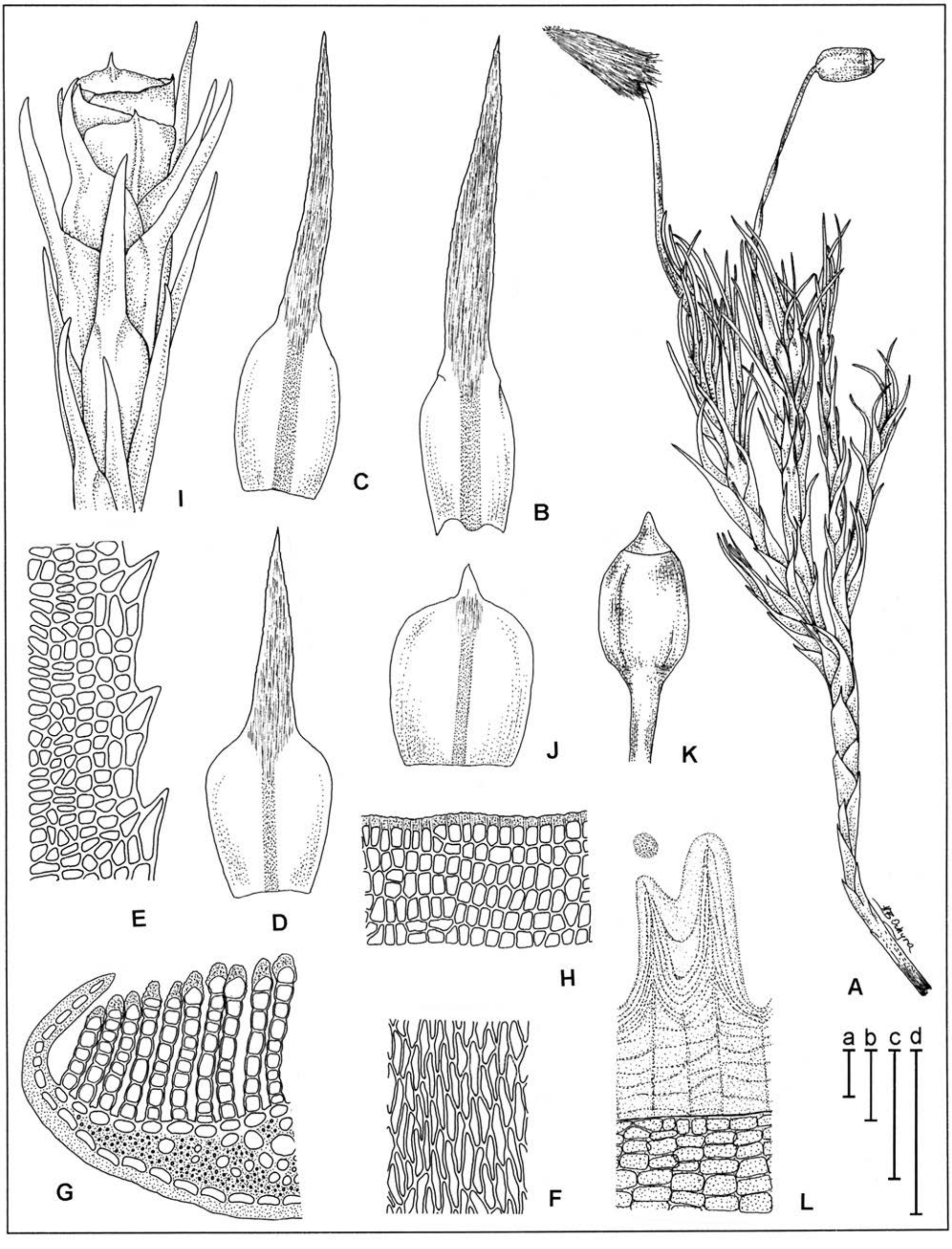


FIGURE 53. *Polytrichastrum alpinum* (Hedw.) G. L. Sm. — **A**. Plant with sporophytes. — **B**–**D**. Leaves. — **E**. Marginal leaf cells about 2/3 up the leaf. — **F**. Lamina cells in upper part of sheath. — **G**. Cross-section of leaf in upper part showing lamellae. — **H**. Side-view of lamella. — **I**. Perigonium, wet. — **J**. Inner perigonial bract. — **K**. Operculate capsule. — **L**. Portion of peristome with spore (A & G from *Ochyra 2375/80*; B & E from *Taylor 39*; C, F & H from *Ochyra 1381/80*; D & I–J from *Ochyra 516/80*; K from *Ochyra 1397/80*; L from *Lewis-Smith 3215*; all in KRAM). Scale bars: a – 1 mm (K); b – 1 mm (B–D, I–J); c – 100 μm (E–H, L).

Distribution on King George Island. — A very common species, occurring in the Admiralty Bay area in most ice-free areas, extending from sea level to ca 300 m (Fig. 54). Likewise, it is common in other parts of the island, with a particular concentration of localities in the south-west.

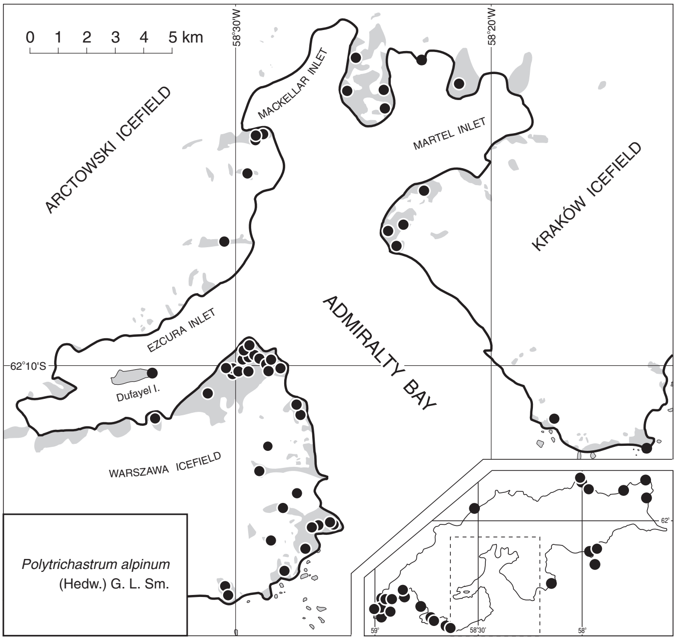


FIGURE 54. Distribution map for *Polytrichastrum alpinum* (Hedw.) G. L. Sm. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — Without specific locality, 1829–30*, Eights s.n.* (NY). ADMIRALTY BAY. Without specific locality, 15 Jan 1953, *Frödin s.n.* (S) and *Discovery Investigation D4* (BM). ***Bransfield Strait***: Red Hill, 100 m, *1098/80 & 1114/80*; Blue Dyke, 6 m, *1210/80*; Bastion, 290 m, *1017/80*; Uchatka Point, 15 m, *1056/80*; Demay Point, 45 m, *1381/80* (BAE-127), 50 m, *1328/80* and without elevation, *VK-387, 407 & 444*; Creeping Slopes, 135 m, *1264/80*; Brama, 200 m, *783/80*. ***Ecology Glacier***: Siodło, 105 m, *739/80*; Zamek, 335 m, *23/80*; Czajkowski Needle, 240 m, *692/80*; Rescuers Hills, 35 m, *4883/79* (BAE-155); Llano Point, 30 m, *4883/79*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 5 m, *723/80* and 15 m, *701/80*; Rakusa Point, 8 m, *302/80*; Penguin Ridge, 30 m, *1437/80*, 45 m, *1397/80* (BAE-4) and 50 m, *1402/80 & 1445/80*; Jasnorzewski Gardens, 3 m, *1497/80*; Hala, 20 m, *5211/79* and 25 m, *5198/79 & 2391/80*; Upłaz, 45 m, *1514/80*; Point Thomas, 5 m, *1745/80* and ca 15 m, *Discovery Investigations St. 1954/1* (PC); north-east branch of Panorama Ridge, 4 m, *1721/80*; Ambona, 85 m, *1648/80*; Skua Cliff, 106 m, *607/80*; Ubocz, 110 m, *4944/79* and 120 m, *2375/80*; upper part of Ornithologists Creek, 180 m, *152/80*; Jersak Hills, 90 m, *5100/79*, 140 m, *5063/79* and 180 m, *5143/79*; unnamed hill between Jersak Hills and Krokiew, 165 m, *154/80*. ***Ezcurra Inlet***: Jardine Peak, 275 m, *5157/79* and 280 m, *5178/79*; Italia Valley, 20 m, *50/80*; Breccia Crag, 200 m, *929/80*. ***Dufayel Island***: Gdynia Point, 20 m, *1773/80*. ***MacKellar Inlet***: Klekowski Crag, 230 m, *2308/80*; Komandor Peak, 280 m, *1939/80*;

Crépin Point, 5 m, *2043/80* and 20 m, *2047/80*. ***Keller Peninsula***: without specific locality, *Taylor 276* (AAS) *& 278A & 292* (BM), *Schuster 69-954* (US) and *Lindsay 838* (BM); Ore Point, 2 m, *502/80*, 7 m, *514/80 & 516/80* (BAE-102) and 15 m, *513/80*; Speil Point, 3 m, *532/80* and 5 m, *539/80*; Moraine Point, 30 m, *462/80*. ***Martel Inlet***: without specific locality, *FIDS G36/5* (BM, LE, PC); Stenhouse Bluff, 30 m, *2609/80*; Ullman Spur, 40 m, *584/80*, 50 m, *591/80* and 60 m, *573/80*; Smok, 25 m, *2055/80* and 50 m, *2064/80*; Point Hennequin, 5 m, *2246/80*; Basalt Point, 15 m, *2229/80*; Mount Wawel, 10 m, *2191/80* and 40 m, *2124/80*. ***Viéville Glacier***: Vauréal Peak, 35 m, *5237/79 & 5245/79* and 80 m, *5242/79*; Martins Head, *Discovery Investigation 1954/1* (BM, NY, S). **LEGRU BAY**. Low Head, *BJ-83*. **KING GEORGE BAY**. Turret Point, *BJ-127*; Penguin Island, *BJ-62 & BJ-67, Discovery Investigation 1951/1* (AAS, BM, LE), 11 Mar 1960, *Leech s.n.* (NY) and 11 Mar 1960, *Starr s.n.* (NY). **SHERRATT BAY**. Three Sisters Point, *BJ-117*. **DESTRUCTION BAY**. Faraway Nunataks, *BJ-174*. **VENUS BAY**. North Foreland, *BJ-101*; Esther Harbour, *Discovery Investigation 1949/2* (AAS, BM). **DRAKE PASSAGE**. Pyrites Island, 10 m, *BJ-34*; False Round, *BJ-74;* Ridley Island, *BJ-26*; Davey Point, *BJ-49*. **FILDES PENINSULA**. Gemmel Peaks, 140 m, *2480/80*; Flat Top Peninsula, *John & Sudgen 40A & 48* (AAS); Horatio Stump, 185 m, *John & Sudgen 40A* (AAS); Fildes Strait, *Discovery Investigation 1482/2 & 1483/1* (BM); Bellingshausen Station, 15 m, *2412/80* and without elevation, Dec 1968, *Zamoruev s.n.* (KRAM); Ardley Island, 10 m, *2483/80*, 25 m, *2495/80* and without elevation, *VK-281*, *John & Sudgen 48* (AAS) and *Booth RILS 5294* (AAS); Suffield Point, 50 m, *2443/80*; Lake Kitezh, 15 m, *2463/80*; Nebles Point, *BJ-53*; Green Point, *BJ-18*. **MARIAN COVE**. North Spit, *BJ-142*. **BARTON PENINSULA**. Noel Hill, *BJ-205*; Winship Point, *BJ-187*. **POTTER PENINSULA**. Without specific locality, *Kühnemann 1955/4, 1955/18, 1954/24 & 1954/253* (AAS); Three Brothers Hill, *BJ-160*; Stranger Point, *BJ-106*.

Literature records. — Fildes Peninsula (Greene *et al.*, 1970; Pizarro & Sáiz, 1977; Bonner & Lewis-Smith, 1985; Putzke & Pereira, 1990; Wu & Hu, 1990; Chen *et al.*, 1993, 1995; Zhou *et al.*, 1995; Li *et al.*, 1998; Hu, 1998); Barton Peninsula (Lindsay, 1971); Potter Peninsula (Greene *et al.*, 1970; Kanda, 1987b); Admiralty Bay (Greene *et al.*, 1970; Robinson, 1972; Kuta *et al.*, 1982; Lindsay & Ochyra, 1984; Ochyra, 1984b; Bonner & Lewis-Smith, 1985; Birkenmajer *et al.*, 1985; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Olech, 1992, 1993; Zarzycki, 1992, 1993; Fabiszewski & Wojtuń, 1992, 1993, 1997; Gumińska *et al.*, 1994; Okada & Kanda, 1994); Venus Bay (Greene *et al.*, 1970).

POLYTRICHUM

Polytrichum Hedw., Spec. Musc. Frond.: 88. 1801.

A cosmopolitan genus comprising about 80 species. It is closely allied to *Polytrichastrum* but differs in its sharply 4(–5)-angled capsules which are deeply constricted between the urns and hypophyses, the pitted exothecial cells and the thin epiphragm with sac-like ventral marginal lobes. Three species have been recorded from Antarctica, all confined to the maritime Antarctic (Greene *et al.*, 1970). They play an important role in the terrestrial vegetation in this biome as essential constituents in the various communities of moss turf subformation as well as in the fruticose lichen and moss cushion subformation.

KEY TO THE KING GEORGE ISLAND SPECIES OF *POLYTRICHUM*

1. Basal parts of leaves ovate; limbs abruptly contracted at the apices into long, entirely hyaline hair-points . . . . *P. piliferum*
1. Basal parts of leaves rectangular; limbs gradually narrowed at the apices into short, less than 1.1 mm, brown hair-points 2
   2. Stem naked below with pale brown tomentum only at base; leafy shoots thick, 8–11 mm broad when moist . . . . *P. juniperinum*
   2. Stem densely whitish tomentose below; leafy shoots thin, 2–7 mm broad when moist . . . . *P. strictum*

Polytrichum juniperinum Hedw., Spec. Musc. Frond.: 89. 1801. FIG. 55

Polytrichum subpiliferum Card.

Medium-sized plants, 1.5–5.5 cm tall, forming loose turfs or scattered in greyish-green patches. Leafy shoots 8–11 mm wide when wet, 2.2–4.0 mm when dry, not or scarcely brownish tomentose below. Leaves crowded in the upper part of stem, erecto-patent when moist, erect, straight or slightly recurved when dry, 4–6 mm, with oblong, hyaline, sheathing base and narrowly lanceolate limbs with broadly infolded wings; margins minutely crenulate; costa excurrent as a short awn, 0.4–1.0 mm, brown throughout or occasionally pale or hyaline at the extreme apex, with short teeth throughout to almost entire; ventral lamellae 26–38, borne only on the broad costae, 6–7 cells high, with end-cells pyriform in cross-section, weakly to strongly thickened, with large papilla-like apical thickening; laminae of limbs composed of unistratose wings 5–7 cells broad, abruptly infolded over the lamellae and almost totally obscuring them. Dioecious. Sporophytes unknown in the Antarctic.

Remark. — *Polytrichum subpiliferum* was considered to be a synonym of the present species by Greene *et al.* (1970). This name was used by Cardot (1900, 1901) for a species described from material collected from Tierra del Fuego and Antarctica. The Fuegian plant actually represents *P. strictum*, while the Antarctic one is *P. juniperinum*. Ochyra (1997a) lectotypified *P. subpiliferum* in a way which required it to become a synonym of *P. juniperinum*.

Ecology. — On soil, humus and rocky ground, on rock ledges and outcrops, generally in open situations.

Phytogeography. — **Bipolar** – Widely distributed in the temperate areas of both hemispheres, in the tropics less frequent, only at altimontane elevations in South and Central America, South Africa and New Guinea. Widespread in the maritime Antarctic: South Sandwich Is.; South Orkney Is.; South Shetland Is.; along the Antarctic Peninsula from the Davis Coast to the Loubet Coast in the northern part of Marguerite Bay.

Distribution on King George Island. — A relatively infrequent and occasional species, but quite abundant in places. It is scattered in the Admiralty Bay region, with particular frequency in the Point Thomas area, and on the Fildes Peninsula, especially on Ardley Island (Fig. 56). It occurs from sea level to 110 m.

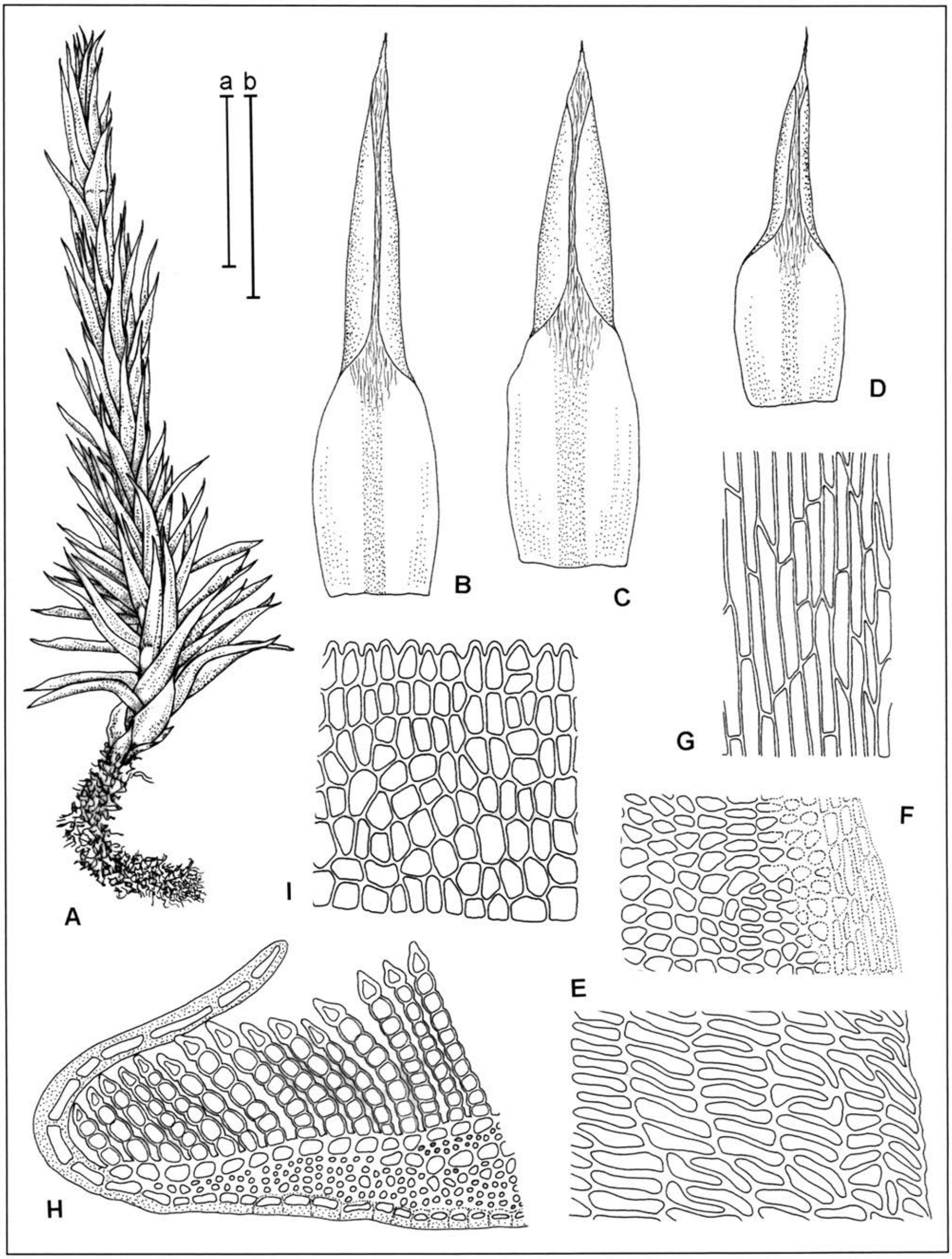


FIGURE 55. *Polytrichum juniperinum* Hedw. — **A**. Habit. — **B–D**. Leaves. — **E**. Marginal leaf cells about 2/3 up the leaf. — **F**. Cells at leaf shoulder. — **G**. Cells in middle of sheath. — **H**. Cross-section of leaf in upper part showing lamellae. — **I**. Side-view of lamella (A from *Ochyra 1521/80*; B–C & E–G from *Ochyra 1826/80*; D & H–I from *Ochyra 4995/79*; all in KRAM). Scale bars: a – 100 μm (E–H); b – 2 mm (B–C) and 0.5 cm (A).

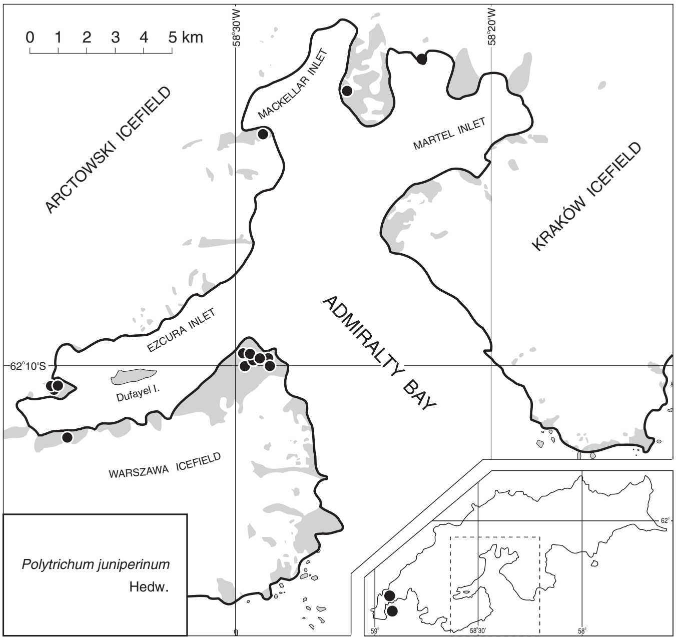


FIGURE 56. Distribution map for *Polytrichum juniperinum* Hedw. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — **ADMIRALTY BAY**. ***Point Thomas***: Penguin Ridge, 40 m, *1647/80*; Jasnorzewski Gardens, 4 m, *2352/80*; Hala, 30 m, *5220/79* (BAE-103) *& 2387/80*; Upłaz, 45 m, *1521/80 & 2395/80*; Ambona, 85 m, *1626/80*; Skua Cliff, 100 m, *626/80* and 105 m, *611/80*; Ubocz, 100 m, *4995/79* (BAE-156) and 110 m, *2362/80*. ***Ezcurra Inlet***: Cytadela, 5 m, *939/80*, 15 m, *969/80* and 40 m, *955/80*; Pond Hill, 40 m, *1826/80* (BAE-128), 50 m, *880/80* and 60 m, *888/80*. ***MacKellar Inlet***: Crépin Point, 25 m, *2039/80*. ***Keller Peninsula***: Speil Point, 2 m, *536/80*. ***Martel Inlet***: Stenhouse Bluff, 30 m, *2596/80* (BAE-5). **FILDES PENINSULA**. Gemmel Peaks, 145 m, *2475A/80*; Ardley Island, 5 m, *2482B/80*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Bonner & Lewis-Smith, 1985; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Admiralty Bay (Greene *et al.*, 1970; Ochyra 1984b; Ochyra *et al.*, 1986; Kuta *et al.*, 1982; Furmańczyk & Ochyra, 1982; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Olech, 1992, 1993; Gumińska *et al.*, 1994; Okada & Kanda, 1994).

Polytrichum piliferum Hedw., Spec. Musc. Frond.: 90. 1801. FIG. 57

Polytrichum antarcticum Card.

Small to medium-sized plants, 1–5 cm tall, growing in loose tufts or gregarious. Leaves crowded in the upper part of the stem, erect-spreading when wet, erect, straight or weakly upwardly curved and tightly appressed when dry, 3.0–4.5 mm long, rather abruptly narrowed from a hyaline, ovate or oblong, sheathing base into a linear-lanceolate limb with broadly infolded wings; leaf apex rounded with a long hyaline hair-point; costa smooth dorsally, excurrent as a long awn, 1.1–3.0 mm long, hyaline throughout and only brown at the extreme base; ventral

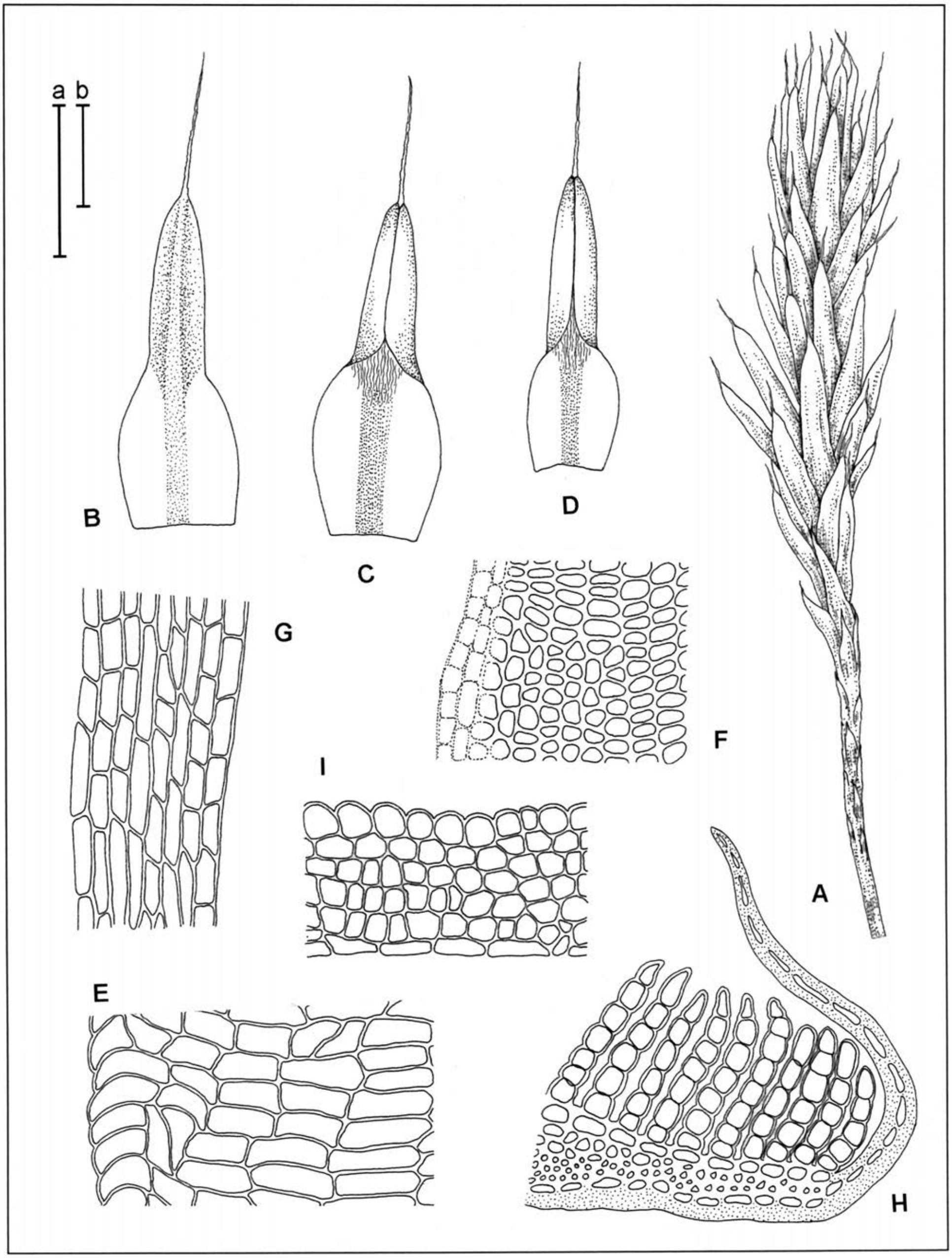


FIGURE 57. *Polytrichum piliferum* Hedw. — **A**. Habit. — **B–D**. Leaves. — **E**. Marginal leaf cells about 2/3 up the leaf. — **F**. Cells at leaf shoulder. — **G**. Basal cells of sheath. — **H**. Cross-section of leaf in upper part showing lamellae. — **I**. Side-view of lamella (A–C, E–G & I from *Ochyra 1466/80*; D from *Ochyra 5206/79*; H from *Ochyra 549/80*; all in KRAM). Scale bars: a – 100 µm (E–I); b – 1 mm (B–D) and 2 mm (A).

lamellae 25–32 borne only on the broad costa, 6–9 cells high, with end-cells pyriform in cross-section, subequal to lower cells, weakly to strongly thickened, with large papilla-like apical thickening; laminae of limbs composed of unistratose wings 5–7 cells broad, abruptly infolded over the lamellae and almost totally obscuring them. Dioecious. Sporophytes unknown in the Antarctic.

Ecology. — A pioneer species on dry gravelly ground in open and exposed situations, also on soil on rock ledges.

Phytogeography. — **Bipolar** – Widely distributed in temperate regions in the Northern and Southern Hemispheres, with many altimontane stations in Central, East and Southern Africa and in the Mascarenes as well as on the Hawaiian Islands. In the Antarctic widely distributed, but scattered, in the northern maritime Antarctic including the South Sandwich Is., South Shetland Is. south to the Argentine Is. on the West Antarctic Peninsula and to the Foyn Coast on the East Antarctic Peninsula, with an isolated occurrence on Charcot Island.

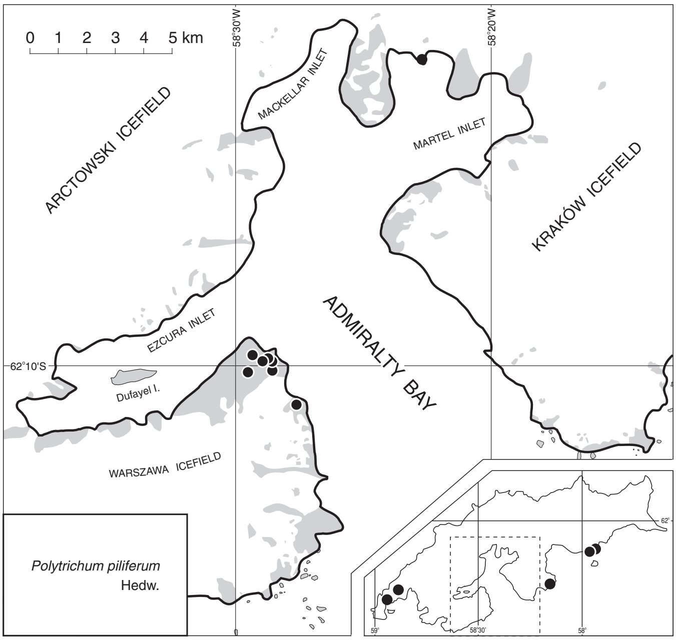


FIGURE 58. Distribution map for *Polytrichum piliferum* Hedw. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Distribution on King George Island. — A rare species recorded only in places along the Bransfield Strait coast of the Island, with a particular concentration of localities in the Point Thomas area of the Admiralty Bay region (Fig. 58). It occurs mostly at lower elevations, rarely exceeding 115 m.

Specimens examined from King George Island. — ADMIRALTY BAY. Without specific locality, *Bennett 37 & 1408* (BM). ***Ecology Glacier***: Llano Point, 10 m, *4864/79*. ***Point Thomas***: without specific locality, *Discovery Investigation 1954/3* (BM, NY, S); moraines by the northern edge of Ecology Glacier, 5 m, *717/80*; Penguin Ridge, 30 m, *1436/80*; Jasnorzewski Gardens, 4 m, *1466/80*; Hala, 25 m, *5206/79* (BAE-129) *& 2393/80*; Upłaz, 45 m, *2358/80* and 46 m, *1531/80*; Ubocz, 105 m, *4845/79* and 115 m, *2379/80*. ***Martel Inlet***: Stenhouse Bluff, 30 m, *2581/80*. **LEGRU BAY**: Low Head, *BJ-88*. **KING GEORGE BAY**. Turret Point, *BJ-128* and *Lindsay 819* (AAS, KRAM). **SHERRATT BAY**. Three Sisters Point, *BJ-118*. **FILDES PENINSULA**. Suffield Point, 10 m, *2438A/80*; Lake Kitezh, *2465A/80*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Admiralty Bay (Greene *et al.*, 1970; Lindsay, 1971; Ochyra 1984b; Ochyra *et al.*, 1986; Kuta *et al.*, 1982; Komárková *et al.*, 1985; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Olech, 1992, 1993; Okada & Kanda, 1994); King George Bay (Greene *et al.*, 1970); King George Bay (Lindsay, 1971).

Polytrichum strictum Brid., J. Bot. (Schrader) 1800(1–2): 286. 1801. FIG. 59

Polytrichum juniperinum Hedw. var. *strictum* (Brid.) Roehl.
P. juniperinum Hedw. subsp. *strictum* (Brid.) Nyl. & Sael.
P. alpestre Hoppe
P. strictum Brid. var. *alpestre* (Hoppe) Rabenh.

Tall plants, densely whitish tomentose in the lower part. Leafy shoots 2–7 mm wide when wet, 1–3 mm when dry. Leaves imbricate throughout when dry, erect-spreading when moist, 2–5 mm long, with well-defined, thin, oblong, hyaline, sheathing base and narrowly lanceolate limbs with broadly infolded wings; margins minutely crenulate; costa excurrent as a short awn, 0.3–0.6(–1.0) mm long, brown throughout or occasionally pale or hyaline at the extreme apices, with short teeth throughout to almost smooth; lamellae 21–28 borne only on the broad costa, 6–8 cells high, with end-cells pyriform in cross-section, with large papilla-like apical thickening; median cells of leaf bases narrowly rectangular, thin-walled; laminae of limbs composed of unistratose wings 6–7 cells broad, abruptly infolded over the lamellae. Dioecious. Sterile on King George Island, occasionally fruiting in Antarctica.

Ecology. — Typically growing in dense patches or hummocks with closely interwoven tomentum, on stony ground and on wet or moist slopes. It is the main constituent of extensive semi-ombrogeneous peat banks.

Phytogeography. — **Bipolar** – A common and widespread species in North America, Greenland, Europe, temperate Asia, Japan and North Africa in the Northern Hemisphere. In the Southern Hemisphere it occurs frequently in southern South America including the Patagonian Andes, Tierra del Fuego, the Falkland Islands and South Georgia. In the Antarctic it is widely distributed and locally common and abundant in the northern maritime Antarctic, from the South Sandwich to the Argentine Islands, and infrequent further south as far as the northern part of Marguerite Bay.

Distribution on King George Island. — Known only from Ardley Island near the Fildes Peninsula where it is abundant and common from sea level to about 15 m (Fig. 50). Reported also from the Barton Peninsula.

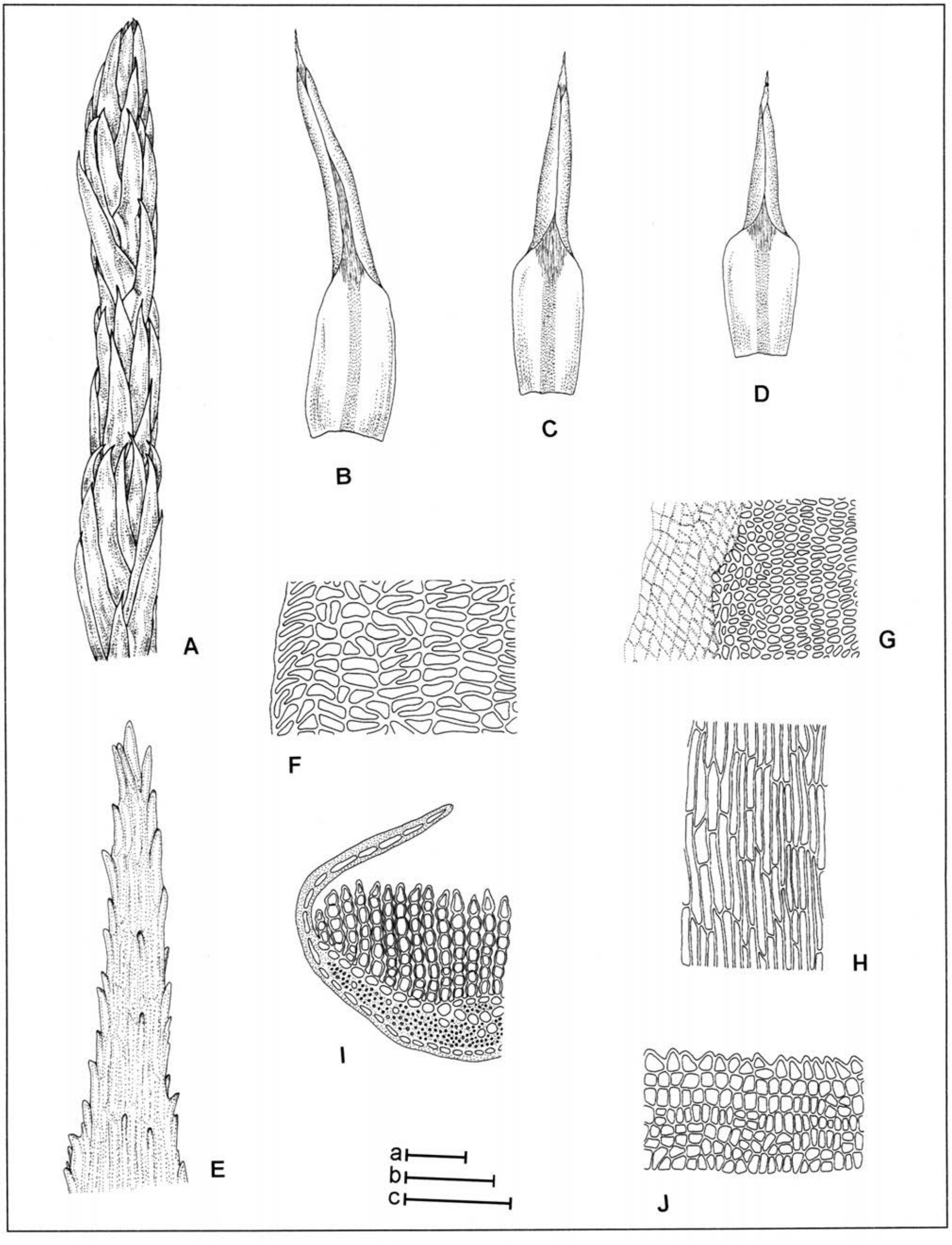


FIGURE 59. *Polytrichum strictum* Brid. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Tip of hair-point. — **F**. Marginal leaf cells about 2/3 up the leaf. — **G**. Cells at leaf shoulder. — **H**. Basal cells of sheath. — **I**. Cross-section of leaf in upper part showing lamellae. — **J**. Side-view of lamella (A from *Sladen 91/19*; B from *Racovitza 234a*, BR; C–G & J from *Taylor 130*; H from *Komárková 1078*; I from *Racovitza 238c*, syntype of *Polytrichum subpiliferum*, BR; all in KRAM unless otherwise stated). Scale bars: a – 1 mm (A); b – 1 mm (B–D); c – 100 µm (E–J).

Specimens examined from King George Island. — **FILDES PENINSULA**. Ardley Island, 15 m, *2494/80* (BAE-7) and without altitude, *Kühnemann 1954/22a* (AAS).

Literature records. — Fildes Peninsula (Greene *et al.*, 1970; Ochyra 1984b; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998).

DITRICHACEAE

Members of this family do not differ gametophytically from dicranaceous mosses except perhaps for the total absence of alar cells which are typical of many genera and species of the Dicranaceae. Therefore the Ditrichaceae are not universally recognized and are often merged with the Dicranaceae, making the latter a very large and awkward taxonomic unit. In the Ditrichaceae the peristome teeth, if present, are split into terete rather than flattened branches which, in addition, are not vertically pitted-striolate. This character justifies recognition of the Ditrichaceae as a family in its own right. The family is pan-continental in distribution and consists of no fewer than 25 genera and approximately 150 species. Most genera are small, mono- and oligotypic taxa, the largest of which, *Ditrichum*, has about 70 species and is well represented in the Southern Hemisphere (Seppelt, 1982). Three genera have been recorded from the Antarctic and three out of the four species contained within them have been found on King George Island.

KEY TO THE KING GEORGE ISLAND GENERA OF THE DITRICHACEAE

1. Leaves gradually narrowed from a non-sheathing base, ending in a broader, smooth acumen, not filled by the costa . . . . ***Ceratodon***
1. Leaves abruptly narrowed from a sheathing base to a wide-spreading subula, largely filled by the costa 2
   2. Leaves distichous . . . . ***Distichium***
   2. Leaves in many ranks . . . . ***Ditrichum***

CERATODON

Ceratodon (Hedw.) Brid., Bryol. Univ. 1: 480. 1826.

This cosmopolitan genus consists of two species, of which *Ceratodon purpureus* is very prominent in Antarctica. Because of its exceptional polymorphism and wide ecological amplitude, several phenotypes have been given the status of separate species and/or varieties (Horikawa & Ando, 1963; Kanda, 1986; Robinson, 1972; Burley & Pritchard, 1990). However, they are linked by numerous intermediate forms which cannot be satisfactorily separated and therefore all these taxa are amalgamated with *C. purpureus.*

Ceratodon purpureus (Hedw.) Brid., Bryol. Univ. 1: 480. 1826. FIG. 60

Ceratodon antarcticus Card.

C. grossiretis Card.

C. grossiretis Card. var. *validus* Card.

C. minutifolius Card.

C. validus (Card.) Horik. & Ando

Plants medium-sized, 1–2 cm tall, in loose or compact tufts, green to yellowish-green, sometimes brownish and often reddish at tips. Leaves loosely imbricate, erect and slightly altered when dry, ovate to ovate-lanceolate, gradually short-acuminate or short-cuspidate, 0.8–1.5(–1.8) mm long, 0.5–0.8(–1.0) mm wide, strongly concave, keeled, straight or weakly falcate at tips; mid-leaf cells subquadrate, firm- to thin-walled, large, (9–)12–16(–20) µm wide; basal cells short-rectangular to rectangular; margins recurved to strongly revolute, sometimes plane, entire or denticulate at the apex; costa single, strong, percurrent to excurrent as a stout cuspidate point, in cross-section with a central row of large guide cells and 2 stereid bands, at least in the lower part. Sporophytes unknown in Antarctic material.

Remarks. — The species is always sterile in Antarctica and therefore some populations may cause identification problems. The recurved or revolute margins are a good character separating the species from some smooth-celled phenotypes of *Hennediella heimii* for which it is often likely to be mistaken. The leaf characters suggest Pottiaceae genera such as *Barbula* or *Didymodon* but the only Antarctic *Didymodon* species has distinctly papillose laminal cells, in contrast to the entirely smooth cells in *Ceratodon purpureus.* The species is very variable and extreme phenotypes could be taken for distinct species. *C. antarcticus*, sometimes recognized as distinct from *C. purpureus*, seems to be merely a developmental phase of the latter with very large mid-leaf cells and plane leaf margins.

Ecology. — Found in various habitats, often on disturbed soil and stony ground on moraines, on rock ledges and in crevices, in open or sheltered situations, sometimes on nutrient rich sandy soil near penguin rookeries.

Phytogeography. — **Cosmopolitan** – Common in the maritime Antarctic and widely distributed but scattered on the continent.

Distribution on King George Island. — A very widespread and locally common species, abundant in most localities in Admiralty Bay as well as along the coasts of the island (Fig. 61). It usually occurs at lower elevations, preferring nutrient rich sandy soil and growing in various communities dominated by *Deschampsia antarctica* and *Colobanthus quitensis*; only rarely is it found on the higher nunataks, extending up to 250 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 90 m, *1088/80*; Blue Dyke, 4 m, *1205/80* (BAE-104); Bastion, 250 m, *1010/80*; Uchatka Point, 5 m, *1048/80*25 m, *1042/80*; Demay Point, 50 m, *1349/80*; Creeping Slopes, 120 m, *1288/80*. ***Ecology Glacier***: Siodło, 125 m, *741/80 & 774/80* and 130 m, *766/80*; Sphinx Hill, 6 m, *412a/80* and 95 m, *238/80*; Czajkowski Needle, 230 m, *684/80*; Rescuers Hills, 3 m, *4912/79* and 45 m, *188/80*; Llano Point, 20 m, *4877/79* and 25 m, *4887/79* (BAE-178 as *Desma-*

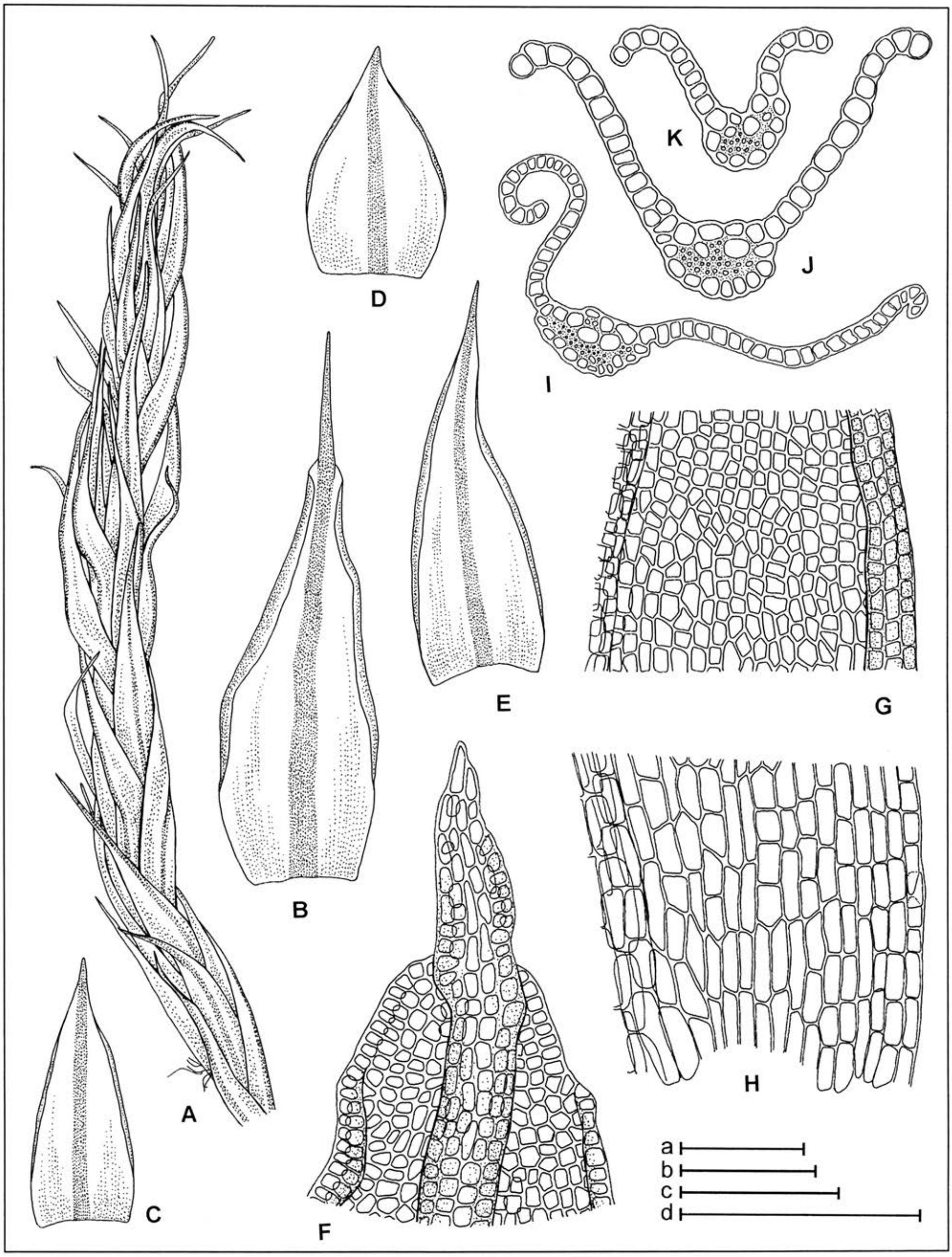


FIGURE 60. *Ceratodon purpureus* (Hedw.) Brid. — **A.** Habit. — **B–E.** Leaves. — **F.** Leaf apex. — **G**. Mid-leaf cells. — **H**. Basal leaf cells. — **I–K**. Cross-section of leaves (A from *Ochyra 966/80*; B from *Skottsberg 446*, type of *Ceratodon grossiretis* var. *validus*, PC; C from *Skottsberg 445*, type of *C. grossiretis*, S; D, F & J from *Ochyra 2728/80*; E, G–I & K from *Ochyra 744/80*; all in KRAM unless otherwise stated). Scale bars: a – 100 µm (F–H); b – 100 µm (I–K); c – 1 mm (A); d – 1 mm (B–E).

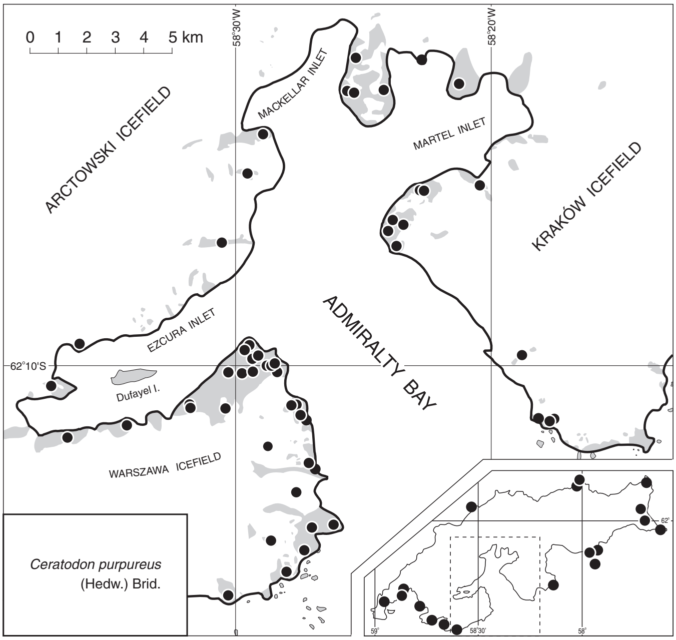


FIGURE 61. Distribution map for *Ceratodon purpureus* (Hedw.) Brid. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

todon heimii) *& 4911/79*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 15 m, *699/80*; Penguin Ridge, 45 m, *1424/80*; Jasnorzewski Gardens, 4 m, *1455/80, 1465/80 & 1489/80*; Hala, 15 m, *5226/79* (BAE-8); Upłaz, 45 m, *1517/80*; Point Thomas, 5 m, *1735/80*; north-east branch of Panorama Ridge, 1 m, *1726/80*; Skua Cliff, 100 m, *633/80*; Ubocz, 90 m, *2363/80* and 110 m, *5009/79*; Jersak Hills, 140 m, *5066/79*, 145 m, *5057/79* and 180 m, *5145/79*. ***Ezcurra Inlet***: unnamed hills on Wróbel Glacier, 165 m, *146/80* and 190 m, *133/80*; Dutkiewicz Cliff, 10 m, *5083/79* and 15 m, *5081/79*; Krzymiński Point, 30 m, *973/80*; Cytadela, 10 m, *966/80* (BAE-180) *& 940/80*; Pond Hill, 20 m, *1818/80*; Emerald Point, 25 m, *841/80*. ***MacKellar Inlet***: Klekowski Crag, 220 m, *2302/80*. Komandor Peak, 180 m, *1940/80* and 200 m, *1943/80*; Crépin Point, 5 m, *2040/80*. ***Keller Peninsula***: Ore Point, 30 m, *452/80*; Speil Point, 3 m, *530/80* (BAE-158) and 4 m, *530/80*; Round Hill, 60 m, *542/80*; Moraine Point, 40 m, *481/80* and 60 m, *490/80*. ***Martel Inlet***: Stenhouse Bluff, 4 m, *2616/80 & 2617a/80*; Ullman Spur, 2 m, *583/80*; Warkocz, 300 m, *2551/80*; Smok, 4 m, *2087/80*, 5 m, *2096/80* and 10 m, *2052/80 & 2082/80*; Point Hennequin, 10 m, *2225/80*; Basalt Point, 20 m, *2224/80*; Mount Wawel, 25 m, *2113/80* and 40 m, *2133/80, 2146/80 & 2197/80* (BAE-157). ***Viéville Glacier***: Rembiszewski Nunataks, 200 m, *2728/80*; Vauréal Peak, 35 m, *5233/79* and 40 m, *5244/79* (BAE-130); Cape Vauréal, 3 m, *5254/79*. **LEGRU BAY**. Low Head, *BJ-90*. **KING GEORGE BAY**. Turret Point, *BJ-134 & BJ-137*; Penguin Island, *BJ-60*. **SHERRATT BAY**. Three Sisters Point, *BJ-119 & BJ-120*. **DESTRUCTION BAY**. Cape Melville, *BJ-78*; Wrona Buttress, *BJ-176*; Jenny Buttress, 270 m, *BJ-169*. **VENUS BAY**. North Foreland, *BJ-104*. **DRAKE PASSAGE**. False Round, *BJ-76*; Ridley Island, *BJ-27*; Davey Point, *BJ-46*. **FILDES PENINSULA**. Bellingshausen Station, 15 m, *2404/80 & 2422/80*; Nebles Point, *BJ-57 & BJ-58*; Green Point, *BJ-20 & BJ-41*. **MARIAN COVE**. North Spit, *BJ-154*. **BARTON PENINSULA**. Without specific locality, *Li K14* (AAS); Winship Point, *BJ-185*. **POTTER PENINSULA**. Three Brothers Hill, *BJ-163*; Stranger Point, *BJ-108 & BJ-110*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Bonner & Lewis-

Smith, 1985; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Admiralty Bay (Przywara *et al.*, 1984; Furmańczyk & Ochyra, 1982; Kanda, 1986; Ochi & Ochyra, 1986; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Gumińska *et al.*, 1994; Okada & Kanda, 1994).

DISTICHIUM

Distichium Bruch & Schimp. *in* B., S. & G., Bryol. Eur. 2: 153. 1846 [Fasc. 29–30 Mon. 1], *nom. cons.*

A small cosmopolitan genus consisting of about five species which are mainly montane and cool temperate to polar, saxicolous or terrestrial. The distichous habit resulting from the 2-ranked leaves with strongly clasping bases makes it unmistakable in the Antarctic, where two species are known to occur. One of them is present in the study area.

Distichium capillaceum (Hedw.) B., S. & G. Bryol. Eur. 2: 156, *pl. 193*. 1846 [Fasc. 29–30 Mon. 4, *pl. 1*]. FIG. 62

Plants densely caespitose, green to yellow-green, 1–5 cm tall. Stems simple or occasionally branched, densely tomentose. Leaves distichous, 1.5–4.0 mm long, horizontally spreading, imbricate, abruptly narrowed from an erect, oblong, sheathing base to a rough, squarrose, lanceolate subula; margins plane, hyaline-bordered at base; costa mostly occupying almost the entire subula; upper laminal cells small, subquadrate to short-rectangular, coarsely papillose; basal cells linear or oblong-linear, smooth, thin-walled. Autoecious. Setae erect, straight, 8–20 mm long, red to reddish-brown; capsules long exserted, cylindrical or ovoid-cylindrical, erect and symmetric, 1–2 mm long; peristome single, composed of 16 lanceolate teeth, irregularly split or perforate nearly to the base into 2 subequal prongs, minutely papillose or smooth with oblique striations. Spores 16–25 μm in diameter, spherical, finely papillose.

Ecology. — On rock ledges, scree and rock outcrops, in rock fissures, on stony ground, usually in dry and sheltered situations, sometimes in caves and beneath overhangs, more rarely on soil.

Phytogeography. — **Bipolar** – Widely distributed in the Northern Hemisphere from temperate to arctic zones, scattered at altimontane elevations in the tropics and disjunct in the Southern Hemisphere: SE Australia; New Zealand; southern South America; Falkland Is.; South Georgia; Marion I.; Îles Crozet. In Antarctica in the South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Alexander Island.

Distribution on King George Island. — A relatively rare though locally abundant species, occurring mostly at higher elevations in the group of nunataks on the western shore of Admiralty Bay and on the Keller Peninsula. Outside Admiralty Bay it is found only rarely on the Barton and Fildes Peninsulas (Fig. 63).

Specimens examined from King George Island. — ADMIRALTY BAY. Without specific locality, 300 m, *Gain 299* (PC). ***Bransfield Strait***: Blue Dyke, 120 m, *1152/80* (BAE-54) and 135 m,

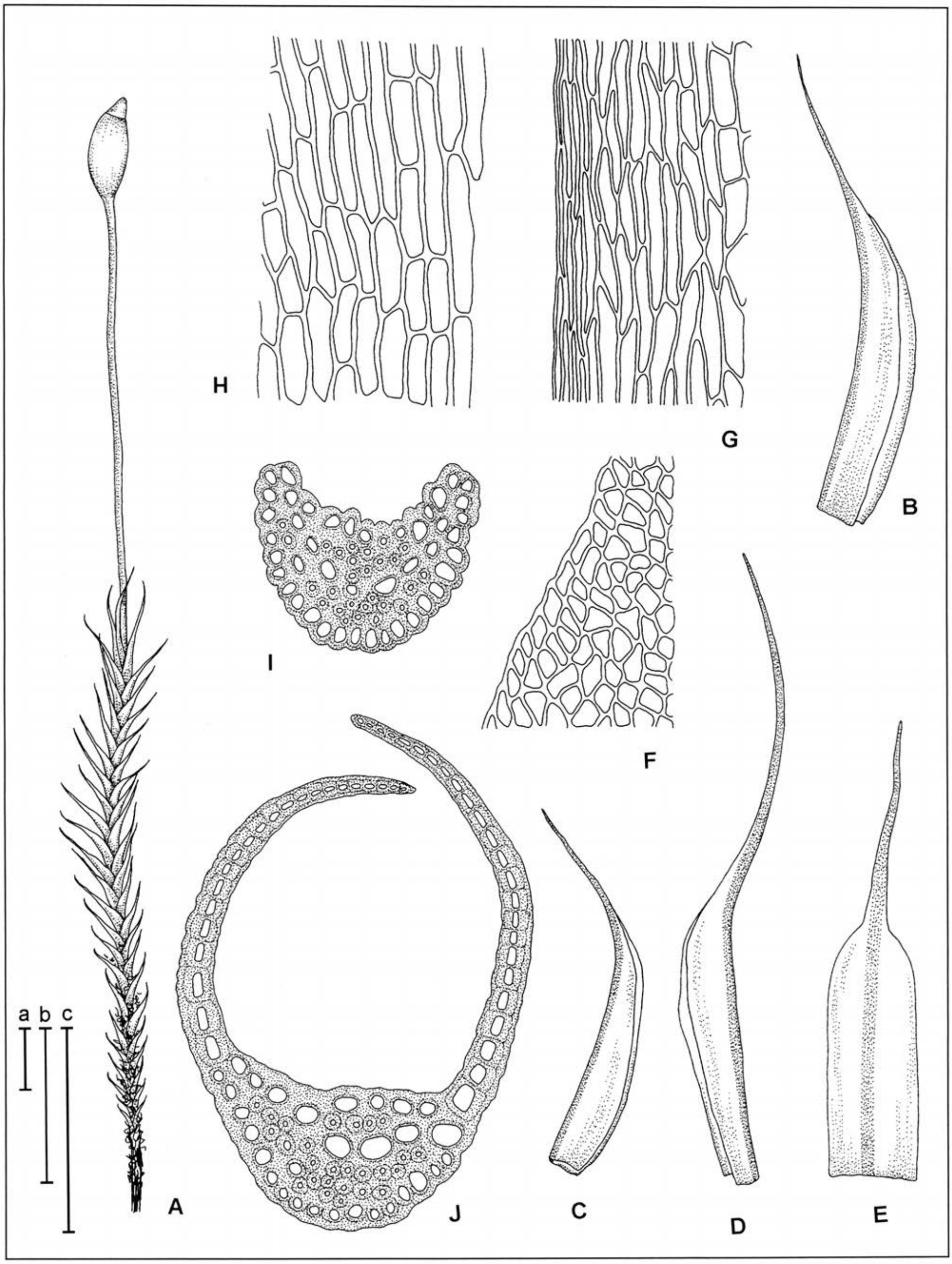


FIGURE 62. *Distichium capillaceum* (Hedw.) B., S. & G. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Laminal cells at shoulder. — **G**. Mid-leaf cells at margin. — **H**. Lower leaf cells. — **I**. Cross-section of subula. — **J**. Cross-section of sheathing base (A–C, F & H from *Ochyra 1775/80*; D from *Komárková 1243*; E from *Komárková 1240*; G from *Ochyra 730/80*; I–J from *Ochyra 810/80*; all in KRAM). Scale bars: a – 1 mm (A); b – 50 μm (F–J); c – 1 mm (B–E).

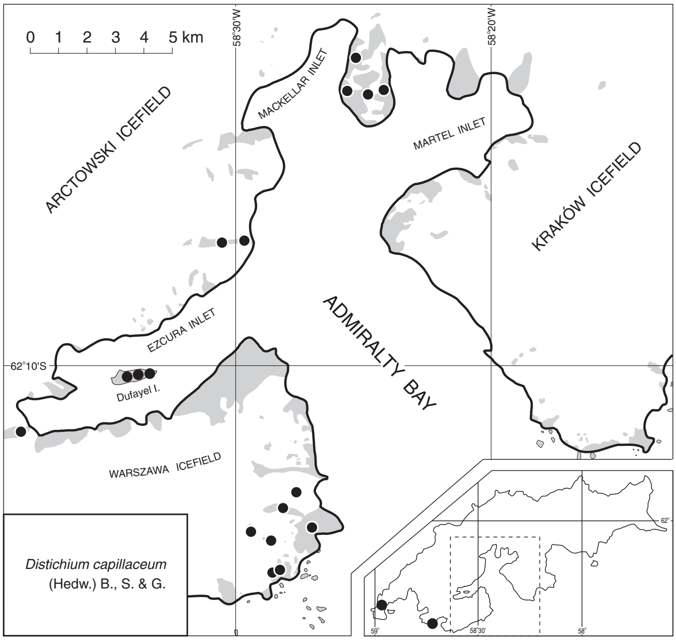


FIGURE 63. Distribution map for *Distichium capillaceum* (Hedw.) B., S. & G. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

1147/80; The Tower, 350 m, *812/80*; Bastion, 240 m, *983/80*; Creeping Slopes, 100 m, *1297/80*; Brama, 260 m, *810/80* (BAE-106). ***Ecology Glacier***: Siodło, 120 m, *750/80*, 125 m, *761/80* and 140 m, *730/80* (BAE-131). ***Ezcurra Inlet***: Belweder, 145 m, *1594/80*. ***Dufayel Island***: Gdynia Point, 80 m, *1760/80* and 85 m, *1772/80*; Sopot Peak 140 m, *1775/80* and 190 m, *1789/80*. ***MacKellar Inlet***: Klekowski Crag, 120 m, *2288/80* and 250 m, *2259/80*. ***Keller Peninsula***: Ore Point, 30 m, *528/80* (BAE-79), 40 m, *519/80* and 50 m, *517/80*; Speil Point, 10 m, *547/80*; Mount Flagstaff, 275 m, *414/80*; Moraine Point, 30 m, *Taylor 272A* (AAS, PC). **FILDES PENINSULA**. Gemmel Peaks, 145 m, *2475B/80*. **MARIAN COVE**. North Spit, *BJ-153*.

Literature records. — Fildes Peninsula (Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Barton Peninsula (Chen *et al.*, 1995); Admiralty Bay (Cardot, 1911a, 1911b, 1913; Steere, 1961; Newton, 1977a; Ochyra, 1984b; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991).

DITRICHUM

Ditrichum Hampe, Flora 50: 181. 1867, *nom. cons.*

A large cosmopolitan genus with approximately 70–80 species. It is well represented in Antarctica with no fewer than five distinct species present, although they are generally uncommon (Ochyra, 1996d). Plants of *Ditrichum* often closely resemble those of other genera of the Ditrichaceae or Dicranaceae, notably *Distichium* and *Anisothecium*, and the confusion is often compounded because of the frequent sterility of the species. The occurrence of leaves in many ranks distinguishes the genus from *Distichium*, while the very broad costa with two strong stereid bands separates it easily from the local species of *Anisothecium*. Very recently *Ditrichum* has been revised taxonomically for Antarctica by Ochyra and Lewis-Smith (1998). Two species are known to occur on King George Island.

KEY TO THE KING GEORGE ISLAND SPECIES OF *DITRICHUM*

1. Costa broad, 100–120 µm wide at the base; leaf subula mostly straight and rigid; capsule exserted on a long seta; peristome present . . . . ***D. hyalinum***
1. Costa narrow, 60–70 µm wide at the base; leaf subula flexuose; capsule immersed in the perichaetial leaves; peristome absent . . . . ***D. lewis-smithii***

Ditrichum hyalinum (Mitt.) Kuntze, Rev. Gen. Pl. 2: 835. 1891. FIG. 64

Leptotrichum hyalinum Mitt.
Pseudodistichium austrogeorgicum Card.
Ditrichum austrogeorgicum (Card.) Seppelt

Plants small, 0.5–1.5 cm tall, dark olive-green or brownish-green. Leaves arranged around the stem, narrowing abruptly from an oblong or oblong-ovate, sheathing base to a channelled subula, erect when dry, erect-spreading when wet, 1.5–3.5 mm long; margins entire; costa single, usually not sharply demarcated from the laminal cells, percurrent to shortly excurrent, flattened, 100–120 µm wide at base, in cross-section consisting of a median row of large guide cells between 2 stereid bands; cells at the shoulders subquadrate, rounded or elliptic to short-rectangular, becoming elongate below; marginal cells thin-walled, usually forming a distinct hyaline border. Autoecious. Setae erect, yellow or pale reddish-brown, about 1 cm long; capsules exserted, erect to somewhat inclined, shortly cylindrical; peristome teeth 16, reddish or yellowish, unequally split longitudinally, papillose, obliquely striolate. Spores 25–30 µm in diameter, brownish, finely papillose.

Remark. — Until recently this species was better known as *Ditrichum austrogeorgicum*, but Ochyra (1999a) has shown that the oldest available name for this species is *D. hyalinum*.

Ecology. — An epigean moss growing on dry mineral soil amongst stones and boulders, on soil over rock outcrops and in rock crevices. It is most frequently associated with various associations of the fruticose lichen and moss cushion subformation typical of sparsely vegetated hillsides.

Phytogeography. — **Amphipacific South-Temperate** – South Sandwich Is.; South Orkney Is.; South Shetland Is.; Campbell I.; South Georgia; South America: Falkland Is.; West Patagonia; Tierra del Fuego (Fig. 36).

Distribution on King George Island. — An infrequent species found at several localities but only rarely growing abundantly. Most localities are concentrated in the Point Thomas area. In addition it is widely distributed but scattered along the south-eastern coast of the island (Fig. 65). It occurs at elevations from 15–295 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red

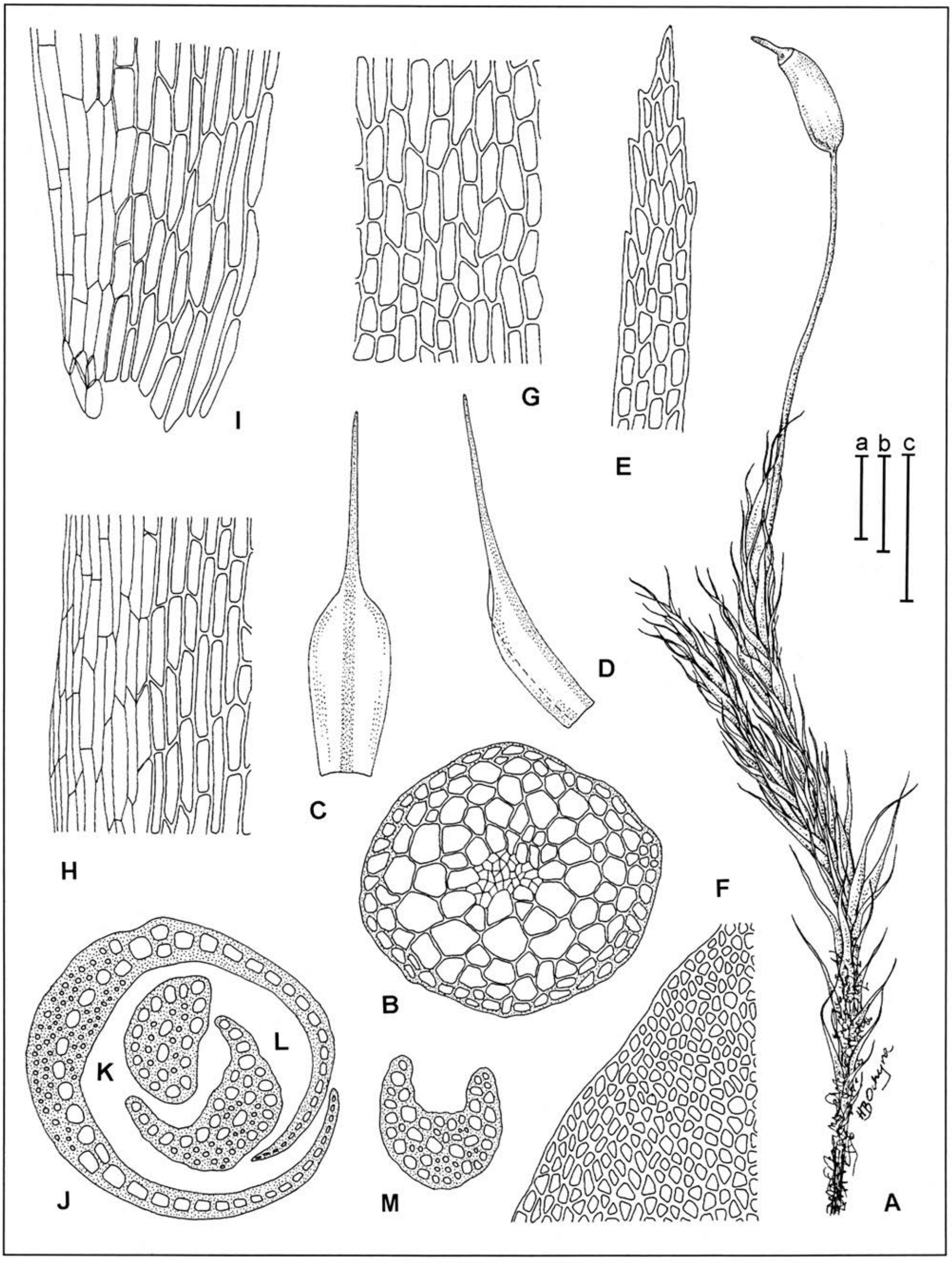


FIGURE 64. *Ditrichum hyalinum* (Mitt.) Kuntze. — **A**. Habit. — **B**. Cross-section of stem. — **C**–**D**. Leaves. — **E**. Leaf apex. — **F**. Laminal cells at leaf shoulder. — **G**. Mid-leaf cells. — **H**. Mid-leaf cells at margin. — **I**. Basal leaf cells. — **J**–**M**. Cross-sections of leaves (all from *Ochyra 590/80*, KRAM). Scale bars: a – 1 mm (A); b – 50 μm (B & E–M); c – 1 mm (C–D).

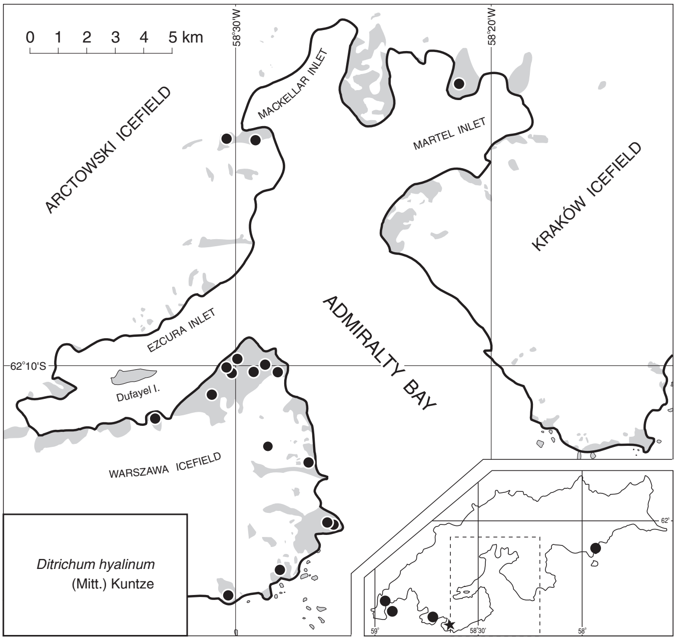


FIGURE 65. Distribution map for *Ditrichum hyalinum* (Mitt.) Kuntze in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Hill, 100 m, *1086/80*, *1097/80 & 1099/80*; Blue Dyke, 90 m, *1182/80*; Demay Point, 40 m, *1369/80* and 50 m, *1388/80*. ***Ecology Glacier***: Sphinx Hill, 100 m, *227/80 & 241/80*; Czajkowski Needle, 245 m, *656/80*, 250 m, *658/80 & 662/80* and 260 m, *663/80*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 25 m, *905/80*; Hala, 25 m, *5218/79*; Ubocz, 125 m, *2367/80*; Jersak Hills, 100 m, *5068/79*, *5070/79*, *5072/79* (BAE-181) & *5073/79*; unnamed hill between Jersak Hills and Krokiew, 170 m, *130/80*. ***Ezcurra Inlet***: Jardine Peak, 285 m, *5190/79*; Italia Valley, 100 m, *106/80 & 107/80*; Breccia Crag, 140 m, *932/80*. ***MacKellar Inlet***: Kapitan Peak, 200 m, *1924/80*; Wegger Peak, 295 m, *2000/80*. ***Martel Inlet***: Ullman Spur, 40 m, *590/80*. **KING GEORGE BAY**. Turret Point, *BJ-129*. **FILDES PENINSULA**. Ardley Island, 25 m, *2492/80* and *Li AW8* (AAS); Bellingshausen Station, 15 m, *2405/80* (BAE-105). **BARTON PENINSULA**. Noel Hill, *BJ-202* and *Li K15* (AAS).

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Barton Peninsula (Chen *et al.*, 1995); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Ochyra, 1984b; Ochyra *et al.*, 1986; Myrcha *et al.*, 1991).

Ditrichum lewis-smithii Ochyra, Ann. Bot. Fennici 33: 304, *f. 1*. 1996. FIG. 66

Plants small, 1.0–1.5 cm tall, forming low turfs, yellowish-brown to olive-green. Leaves 1.5–2.5 mm long, each narrowing rapidly from an oblong-lanceolate, sheathing base into the subula, erect-spreading when dry, sharply spreading when wet; subula shining, 1.5 to 2 times as long as the lamina, narrow, strongly flexuose when dry, smooth on the back; margins entire, inflexed; laminal cells at the shoulder region mostly irregular, subquadrate, rounded or rhombic to short-rectangular, usually bistratose and obscure, becoming rectangular to linear-rectangular in the middle and near the base of the lamina; marginal cells usually forming a distinct hyaline border extending from mid-leaf to the base; costa subpercurrent to percurrent, 60–70 µm wide at

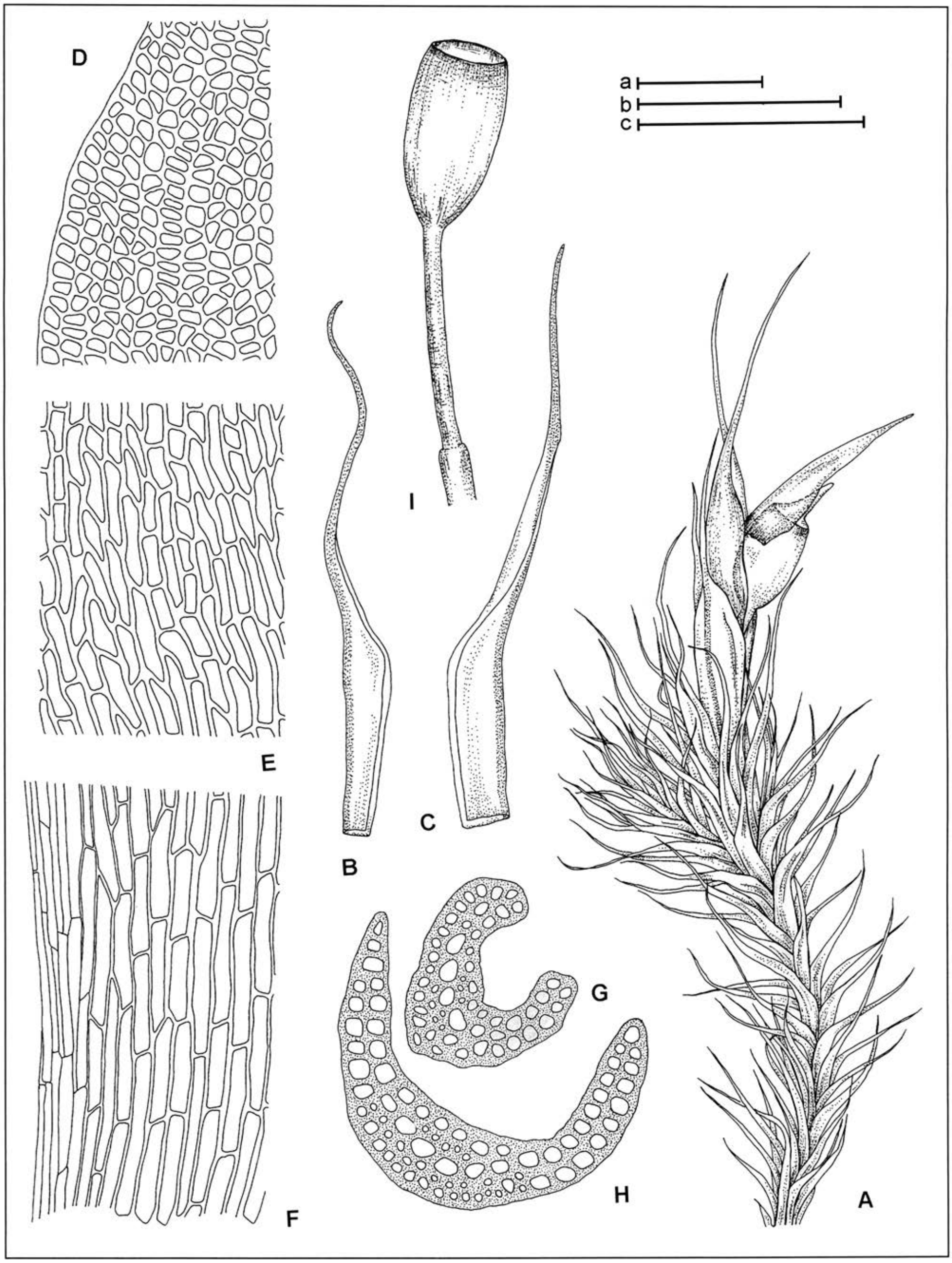


FIGURE 66. *Ditrichum lewis-smithii* Ochyra. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Laminal cells at leaf shoulder. — **E**. Mid-leaf cells. — **F**. Basal leaf cells. — **G**. Cross-section of subula. — **H**. Cross-section of leaf lamina at shoulder. — **I**. Capsule (A from *Ochyra 1994/80*, paratype; B & H from *Smith 689*, paratype; C–G & I from *Ochyra 1829/80*, holotype; all in KRAM). Scale bars: a – 1 mm (I); b – 2 mm (A) and 1 mm (B–C); c – 100 μm (D–H).

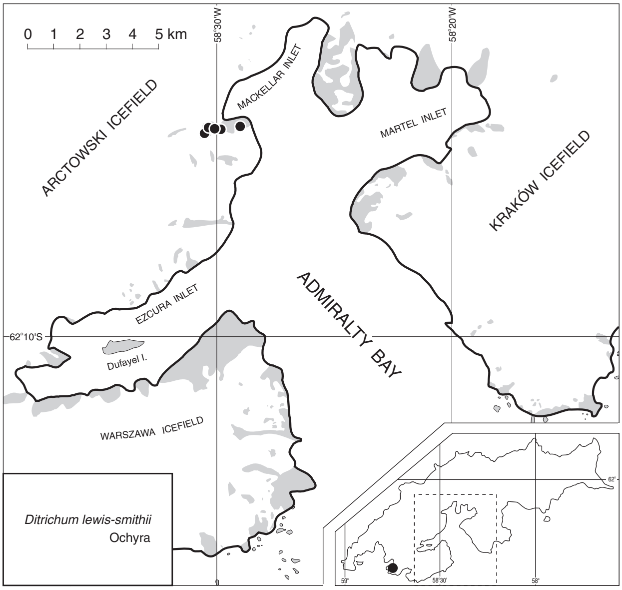


FIGURE 67. Distribution map for *Ditrichum lewis-smithii* Ochyra in the Admiralty Bay area. Inset: distribution of the species on King George Island.

the base, in cross-section consisting of a median row of large guide cells between 2 stereid bands. Autoecious. Innermost perichaetial leaves strongly modified, 6.0–7.5 mm long, gradually narrowed from a broad, convolute, oblong-lanceolate base into a short subula. Setae erect, about 2 mm long; capsules immersed, symmetric or slightly gibbous, shortly cylindrical, 1.3–1.5 mm long; peristome absent. Spores 20–26 μm in diameter, brownish, finely papillose-verrucose.

Ecology. — An epigean moss growing on bare ground and on soil covering rock ledges, in dry or slightly moist, open places.

Phytogeography. — **American Subantarctic** – South Orkney Is.; Joinville I.; South Shetland Is. (King George I., Livingston I.); South Georgia (Fig. 34).

Distribution on King George Island. — An exceedingly rare species known only from the Crépin Point area in MacKellar Inlet and the Barton Peninsula (Fig. 67). Most collections have come from high elevations near the top of the nunatak, but a single specimen was collected quite low down near the beach.

Specimens examined from King George Island. — ADMIRALTY BAY. ***MacKellar Inlet***: Crépin Point, 10 m, *2042/80*; Wegger Peak, 310 m, *1994/80* and 320 m, *2006/80 & 2009/80*. BARTON PENINSULA. Noel Hill, 10 m, *Lindsay 764* (AAS, KRAM).

DITRICHACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Ceratodon kinggeorgicus Kanda

This species was described as new to science by Kanda (1986) from the Potter Peninsula area and Chen *et al.* (1993, 1995) reported it from the Fildes Peninsula. This species is actually *Meesia uliginosa* (Ochyra & Lewis-Smith, 1999).

DICRANACEAE

The Dicranaceae are a large family difficult to circumscribe because of many intergradations with closely similar families as well as great internal variability. The principal characters of this family are narrow, tapered leaves with a single costa and flat peristome teeth that are usually forked and vertically pitted-striolate. The family consists of about 60 genera, but the number of species cannot be given precisely. Although about 1500 species have been described, it is certain that very many of these will be reduced by synonymy. In the Antarctic the Dicranaceae are rather poorly represented and only *Chorisodontium aciphyllum* plays an important role in the terrestrial vegetation in the maritime Antarctic. In total four genera and eight species have been recorded in this biome. Of these three species of *Campylopus* are known exclusively from the volcanic South Sandwich Islands and Deception Island. *Dicranowesia*, a genus traditionally placed in this family, has been transferred to the Seligeriaceae on account of its peristome structure (Ochyra, 1993a).

KEY TO THE KING GEORGE ISLAND GENERA OF THE DICRANACEAE

1. Costa very broad, about 1/3 of the width of the leaf base . . . . ***Chorisodontium***
1. Costa narrow about 1/4 of the width of the leaf base 2
   2. Alar cells well differentiated; leaves generally falcato-secund, non-vaginate; costa in cross-section composed of almost homogeneous cells . . . . ***Kiaeria***
   2. Alar cells not differentiated; leaves straight to squarrose, vaginate; costa in cross-section with a central row of guide cells and small stereid bands . . . . ***Anisothecium***

ANISOTHECIUM

Mitt., J. Linn. Soc. Bot. 12: 39. 1869.

A medium-sized worldwide genus consisting of approximately 50 species. It is not universally distinguished and many bryologists merge it with *Dicranella*, making the latter an unnatural taxon. Its recognition as a separate genus is warranted by the combination of the following character states: annulus present, non-revoluble, composed of several rows of small, thick-walled cells; basal membrane of peristome present, low and smooth; stomata present. Three species of the genus occur rarely in Antarctica. A useful revision of South Georgian species has been published by Newton (1977b).

Anisothecium cardotii (R Br. ter.) Ochyra, *comb. nov.* FIG. 68

Dicranum cardotii R. Br. ter., Trans. New Zealand Inst. 35: 329, *pl. 36, f. 9*. 1903.
Dicranella cardotii (R. Br. ter.) Dix.

Plants slender, erect, densely caespitose, to 2 cm tall, bright green above, brownish below. Leaves distant, 0.6–1.0(–1.5) mm long, abruptly narrowed from an ovate or deltoid sheathing base to a flexuose-spreading, erecto-patent to patent, channelled limb; margins plane, entire;

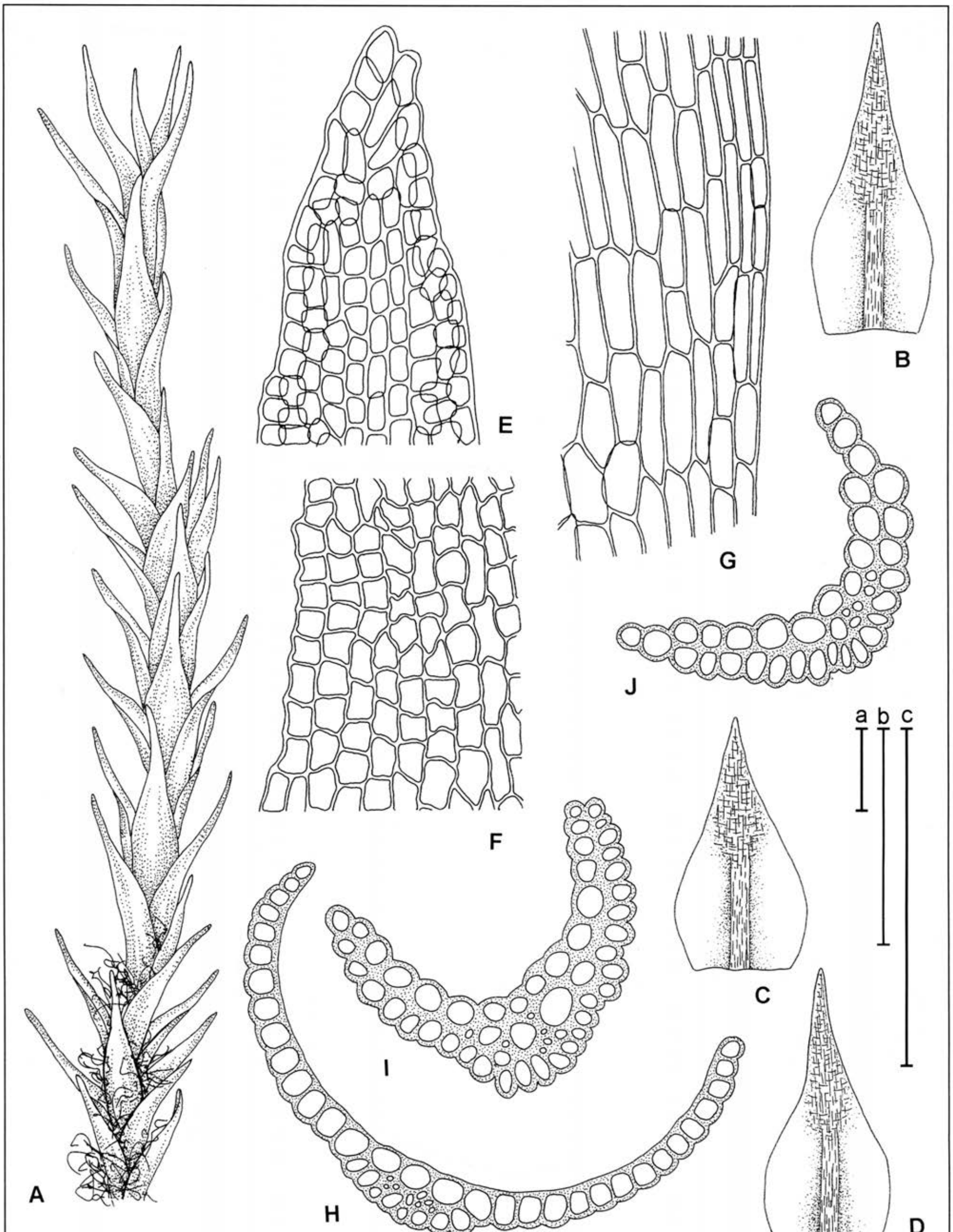


FIGURE 68. *Anisothecium cardotii* (R. Br. ter.) Ochyra. — **A**. Habit. — **B**–**D**. Leaves. **E**. Leaf apex. **F**. Lamina cells at leaf shoulder. — **G**. Mid-leaf cells at margin. — **H**–**J**. Cross-sections of leaves (A–E, G–H & J from *Ochyra 889/80*; F & I from *Bell 1388*; all in KRAM). Scale bars: a – 50 μm (E–J); b – 1 mm (A); c – 1 mm (B–D).

cells of limb bistratose, quadrate to short-rectangular, 6–11 µm wide, 8–16 µm long, mamillose towards the margins; lower cells elongate, rectangular, smooth; cells at leaf shoulders shorter and rounded; costa broad, subpercurrent, gradually merging into the laminal cells in the limb, in transverse section usually with 2 stereid bands and a single row of large guide cells. Sterile.

Remark. — This species, originally described from New Zealand as *Dicranum cardotii* (Brown, 1903), fits perfectly the concept of *Anisothecium* as evidenced by fruiting specimens which are frequently found on South Georgia and in southern South America. Accordingly, the appropriate nomenclatural change is necessary. For further synonymy see Ochyra and Newton (1986).

Ecology. — An epigean moss growing on soil on a steep and wet slope.

Phytogeography. — **Pan-South-Temperate** – New Zealand; SE Australia; Tasmania; Campbell I.; Subantarctica (Macquarie I., Îles Kerguelen, South Georgia); South Africa; Falkland Is.; Tierra del Fuego; South and West Patagonia; Antarctica (South Shetland Is.); Northern Andes (Colombia) (Fig. 38).

Distribution on King George Island. — Very rare, known only from a single locality in the Admiralty Bay area (Fig. 51) at an elevation of 70 m.

Specimen examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***: Pond Hill, 70 m, *889/80*.

Literature records. — Admiralty Bay (Ochyra & Newton, 1986).

CHORISODONTIUM

Chorisodonium (Mitt.) Broth. *in* Engl., Nat. Pflanzenfam. ed. 2, 10: 204. 1924. LECTOTYPE (*nov.*): *Chorisodontium aciphyllum* (Hook. f. & Wils.) Broth. *in* Engl. (*Dicranum aciphyllum* Hook. f. & Wils.).

As delimited by Frahm (1981, 1989), the genus consists of eight species distributed mainly in the Andean region and only *Chorisodontium aciphyllum* has a broader circumsubantarctic range. In general appearance species of *Chorisodontium* resemble large species of *Campylopus* and in many anatomical details species of *Dicranum*. The genus can be distinguished by the long excurrent, awnlike costa completely filling the leaf subula and being somewhat widened at the leaf shoulders. Astonishingly the generic name has not been typified as yet and therefore *Chorisodontium aciphyllum* is here chosen as lectotype of this generic name. A useful taxonomic revision of the southern South American species was presented by Hyvönen (1991) and the South Georgian and Antarctic species have been revised by Bell (1973c) (see also Bell, 1977; Ochyra, 1994a, 1996e). In the Antarctic the genus is represented by a single species.

Chorisodontium aciphyllum (Hook. f. & Wils.) Broth. *in* Engl., Nat. Pflanzenfam. ed. 2, 10: 204, *f. 164D–F*. 1924. FIG. 69

Dicranum aciphyllum Hook. f. & Wils.

D. nordenskjöldii Card.

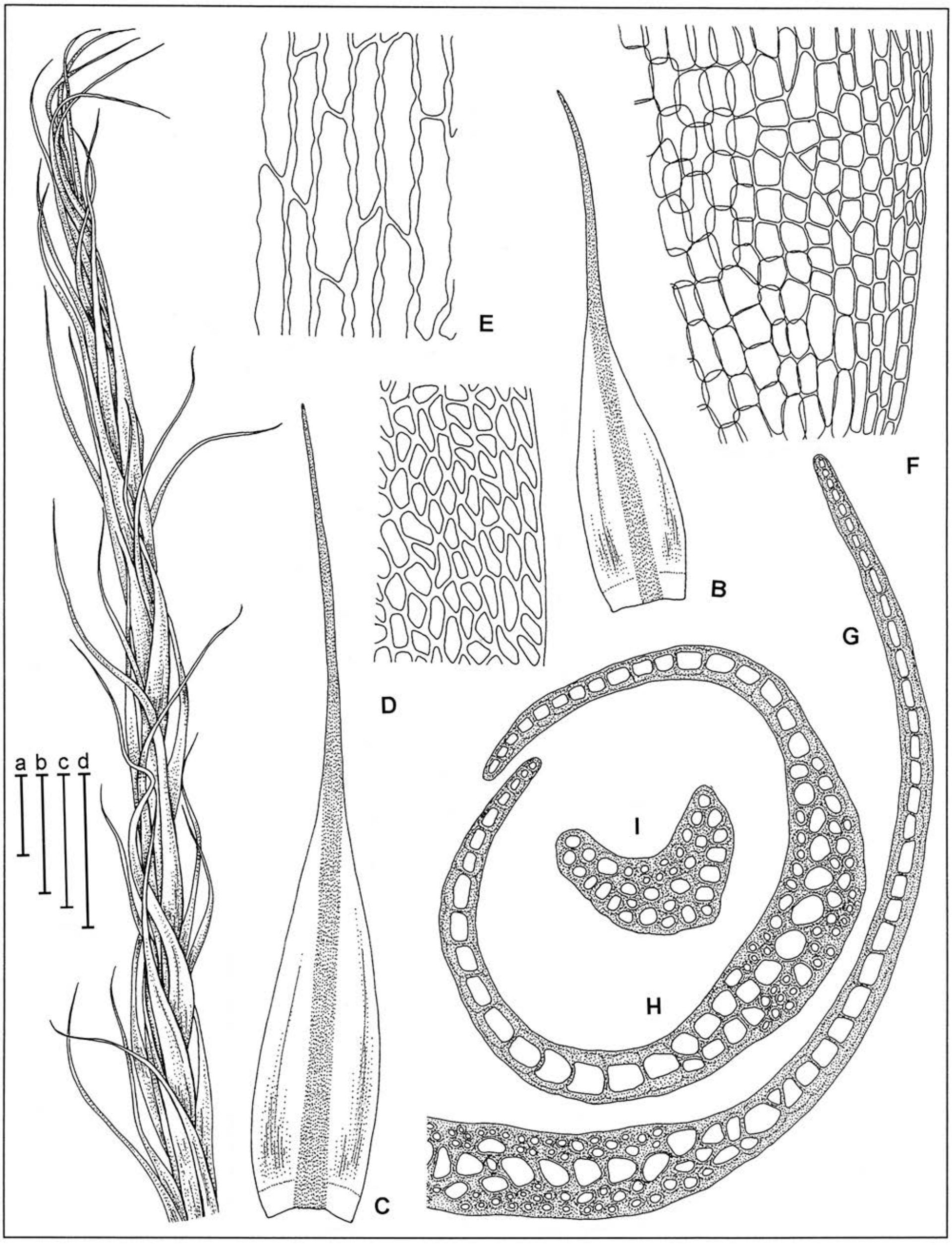


FIGURE 69. *Chorisodontium aciphyllum* (Hook. f. & Wils.) Broth. *in* Engl. — **A**. Habit. — **B–C**. Leaves. — **D**. Lamina cells at leaf shoulder. — **E**. Mid-leaf cells. — **F**. Basal cells. — **G–I**. Cross-sections of leaves (A & E from *Ochyra 1247/80*; B from *Ochyra 2401/80*; C, G & I from *Ochyra 2163/80*; D from *Skottsberg 440*, isotype of *Dicranum nordenskjöldii*, S; F from *Ochyra 594/80*; H from *Skottsberg 442*, isotype of *Blindia skottsbergii* fo. *robusta*, S; all in KRAM unless otherwise stated). Scale bars: a – 1 mm (A–C); b – 50 µm (G–I); c – 50 µm (D–E); d – 100 µm (F).

D. nordenskjöldii Card. fo. *minus* Card.
Blindia skottsbergii Card. fo. *robusta* Card.

Medium-sized to large plants, up to 10 cm tall, growing in loose to compact, yellowish-brown to dark green tufts. Stems erect, usually conspicuously interwoven with the numerous reddish brown tomentum of the rhizoids. Leaves appressed, 5–10 mm long, straight to flexuose, linear-lanceolate from an oblong base, gradually narrowed to a long, channelled subula; margin plane, entire; upper laminal cells quadrate to short-rectangular, becoming elongate towards the base with relatively thick, smooth to porose walls, gradually narrowed towards the margins and forming an indistinct border; alar cells large, brownish, numerous, thin-walled, forming distinct, easily detached, flat auricles; costa very broad, excurrent, usually occupying about one-third of the leaf base, in cross-section with a median row of enlarged guide cells and conspicuous ventral and dorsal stereid bands. Sterile.

Ecology. — In relatively dry and open situations, typically forming peat banks dominated by *Polytrichum strictum* or *Polytrichastrum alpinum*, rarely on mineral soil and humus between boulders.

Phytogeography. — **Pan-South-Temperate** – New Zealand; Amsterdam I.; Falkland Is., Tierra del Fuego; Patagonia north to the Valdivian region; South Georgia; Antarctica: South Orkney Is., South Shetland Is., Antarctic Peninsula south to the Argentine Is. (Fig. 39).

Distribution on King George Island. — An occasional species in the Admiralty Bay area, known only from six localities where it occurs abundantly. Outside Admiralty Bay it is more frequent on the Barton and Fildes Peninsulas, very rare elsewhere (Fig. 70). It occurs at low elevations from sea level to about 60 m.

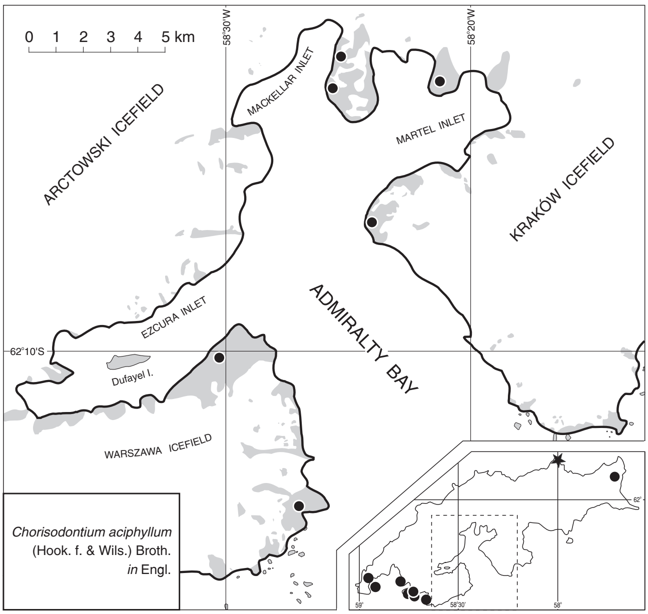


FIGURE 70. Distribution map for *Chorisodontium aciphyllum* (Hook. f. & Wils.) Broth. *in* Engl. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – literature record.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***. Creeping Slopes, 90 m, *1247/80* (BAE-107). ***Point Thomas***: Jersak Hills, 170 m, *5064/79* (BAE-183). ***Keller Peninsula***: Ore Point, 3 m, *521/80* (BAE-132); Speil Point, 50 m, *544/80* (BAE-29). ***Martel Inlet***: Ullman Spur, 60 m, *594/80*; Mount Wawel, 40 m, *2163/80* (BAE-80). DESTRUCTION BAY. Faraway Nunataks, *BJ-17*. FILDES PENINSULA. Ardley Island, 15 m, *2493/80* (BAE-10), *Kühnemann 15, 55, 57, 146 & 276* (AAS, KRAM), *Booth RILS 5299* (AAS, KRAM), *Montiel CM 2238* (BA, KRAM) and *VK-279 & 560*; Bellingshausen Station, 15 m, *2401/80* (BAE-160). MARIAN COVE. North Spit, *BJ-141*. BARTON PENINSULA. Narębski Point, *BJ-179*; Noel Hill, *BJ-195*; Winship Point, *Lindsay 717* (AAS, KRAM) and *BJ-180*. POTTER PENINSULA. Stranger Point, *BJ-107B*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Bonner & Lewis-Smith, 1985; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Zhou *et al.*, 1995; Li *et al.*, 1998; Hu, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Kuta *et al.*, 1982; Czeczuga *et al.*, 1982; Bonner & Lewis-Smith, 1985; Komárková *et al.*, 1985; Ochyra, 1984b; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Hyvönen, 1991; Okada & Kanda, 1994); Corsair Bight (Lindsay, 1971).

KIAERIA

Kiaeria I. Hag., K. Norsk Vid. Selsk. Skrift. 1914(1): 109. 1915.

A small genus of five species primarily distributed in the Northern Hemisphere. Gametophytically, *Kiaeria* very much resembles *Dicranum* and sometimes has been considered congeneric with it, but the lack of internal differentiation of the costa is the essential feature defining the genus. A single species, *Kiaeria pumila*, is known from Antarctica.

Kiaeria pumila (Mitt. *in* Hook. f.) Ochyra, Fragm. Flor. Geobot. 38: 79. 1993.
FIG. 71

Symblepharis pumila Mitt. *in* Hook. f.
Holomitrium pumilum (Mitt. *in* Hook. f.) Jaeg.
Dicranum pumilum Mitt.
Blindia dicranellacea Müll. Hal. *in* Neum.
Holodontium pumilum Broth. *in* Engl.
Dicranum oleodictyon Dix.

Plants in lustrous, green or yellowish, dense tufts, to 5 cm tall. Leaves erect to falcato-secund when moist, flexuose when dry, lanceolate, gradually subulate, smooth; margins plane or incurved, entire; costa somewhat excurrent, in cross-section consisting of nearly homogeneous cells, without stereids; upper laminal cells subquadrate to elongate, becoming long rectangular below, with smooth or porose walls, alar cells well differentiated, often forming conspicuous inflated, brownish or hyaline groups. Sterile.

Remark. — *Kiaeria pumila* has been recorded from the Antarctic as *Dicranum oleodictyon* Dixon from the South Orkney Islands (Lewis-Smith, 1972; Bell, 1973c), a species described from South Georgia (Dixon, 1934). Examination of the

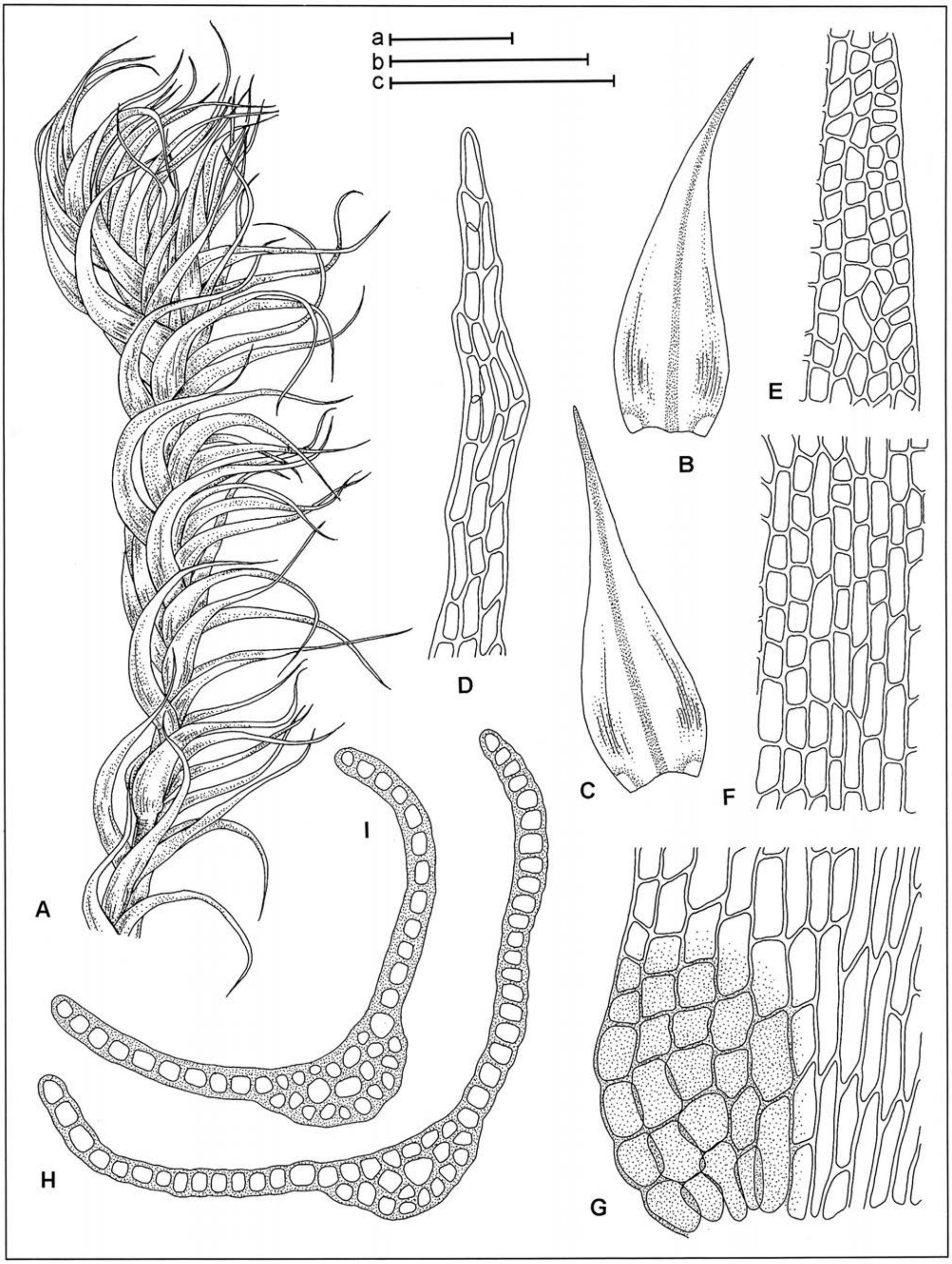


FIGURE 71. *Kiaeria pumila* (Mitt. *in* Hook. f.) Ochyra. — **A**. Habit. — B–C. Leaves. — **D**. Leaf apex. — **E**. Lamina cells in subula. — **F**. Mid-leaf cells. — **G**. Alar cells. — **H**–**I**. Cross-sections of leaves (A & D from *Longton 1055*; B–C, E–F & H–I from *Ochyra 533/80*; G from *Baylis 253*; all in KRAM). Scale bars: a – 1 mm (A); b – 1 mm (B–C); c – 100 μm (D–I).

original collection (see Bell, 1983) [Lectotype (*nov.*): "Albatros", Grytviken. S. Georgia, 300 m alt. 13 March 1933, Tröim 125 – BM-Dix!; syntype: same locality, Tröim 136 – BM-Dix!] as well as many non-type collections of this species revealed that it matches perfectly the New Zealand type collection of *K. pumila*. Kanda (1987b) reported *Blindia dicranellacea* from the Potter Peninsula, but I was refused permission to study the voucher specimen. This species was described from South Georgia by Müller (1890) and I was able to examine a portion of the original collection [Lectotype (*nov.*): "Austro-Georgia, ad rupes am Ausgange des Brockenthales, 23/I 83 Südpolarexpeditionen" – HBG!] which also agrees in all details with the type of *Kiaeria pumila*. Accordingly all species must be considered conspecific, the last mentioned name having priority.

Ecology. — On stony ground and on soil, on rock ledges in rather dry situations.

Phytogeography. — **Pan-South-Temperate** – New Zealand; Amsterdam I.; Tristan da Cunha; Tierra del Fuego, Falkland Is., West Patagonia; Subantarctica (Îles Kerguelen, Marion I., South Georgia); Antarctica (South Orkney Is., South Shetland Is.).

Distribution on King George Island. — Very rare, known only from the Admiralty Bay area and, reportedly, from the Potter Peninsula (Fig. 52).

Specimen examined from King George Island. — ADMIRALTY BAY. ***Keller Peninsula***: Speil Point, 4 m, *533/80.*

Literature records. — Potter Peninsula (Kanda, 1987b).

DICRANACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Anisothecium hookeri (Müll. Hal.) Broth. *in* Engl.

Putzke and Pereira (1990) cited this species for King George Island [as *Dicranella hookeri* (Müll. Hal.) Card.] ascribing this record to Ochyra and Newton (1986). Actually the latter authors recorded *Anisothecium cardotii* from the island [as *Dicranella cardotii* (R. Br. ter.) Dixon], so the information provided by the Brazilian authors is totally misleading. *A. hookeri* is known only from Deception Island, South Shetland Islands (Lewis-Smith, 1988a), although Cardot (1910) reported it from Victoria Land, but the voucher specimens have not been located during the course of the present study (cf. also Newton, 1977a).

SELIGERIACEAE

A relatively small, cosmopolitan family consisting of seven genera. The recognition of the family is based on its unique peristome structure that is single and comprises 16 teeth, which have been interpreted as endostome segments, the exostome being reduced to a low preperistome. On this basis the genera *Dicranoweisia* and *Holodontium* have been transferred to the Seligeriaceae (Ochyra, 1993a). Because these genera differ markedly in their habit from those traditionally placed in the Seligeriaceae, for example *Seligeria, Blindia* and *Brachydontium*, particularly in the structure of the costa, the separate subfamily Dicranoweisioideae has been resurrected to accommodate them (Ochyra, 1994b). In the study area only two genera with five species belonging within the latter subfamily are present.

KEY TO THE KING GEORGE ISLAND GENERA OF THE SELIGERIACEAE

1. Leaves flexuose and crisped when dry, oblong-lanceolate; costa narrow, about 1/4 of the width of the leaf base . . . . *Dicranoweisia*
1. Leaves rigid, erect-flexuose to falcato-secund, long subulate; costa broad, about 1/3 or more of the width of the leaf base . . . . *Holodontium*

DICRANOWEISIA

Dicranoweisia Lindb. *ex* Milde, Bryol. Siles.: 48. 1869.

A small cosmopolitan genus consisting of about ten species occurring in temperate, polar and montane regions of both hemispheres, very rare in the tropics in altimontane stations. Sterile plants of this genus are distinct because of the numerous longitudinal cuticular thickenings densely covering the laminal cells and giving them a papillose appearance in cross-section. In Antarctica there are four species of *Dicranoweisia* which are prominent in the impoverished flora of this continent and play an important role in various plant communities. The genus has not yet been revised taxonomically for the Antarctic and the treatment for Signy Island (Bell, 1976) is very misleading. Three species have been recorded from the study area.

KEY TO THE KING GEORGE ISLAND SPECIES OF *DICRANOWEISIA*

1. Lower laminal cells short and broad, oblong to hexagonal . . . . *D. grimmiacea*
1. Lower laminal cells elongate, narrowly rectangular to linear 2
    2. Setae slender, tall, yellow, 7–10 mm or more long; capsules long-exserted; peristome teeth vertically striate, irregularly and low papillose at the apex; spores 14–18 µm wide . . . . *D. crispula*
    2. Setae usually shorter, stouter and darker, 3–4 mm long; capsules weakly exserted; peristome teeth roughly and prominently papillose throughout; spores (18–)21–27 µm wide . . . . *D. brevipes*

Dicranoweisia brevipes (Müll. Hal.) Card., Bull. Herb. Boissier, Sér. 2, 5(11): 998. 1905. FIG. 72

Blindia brevipes Müll. Hal. *in* Neum.

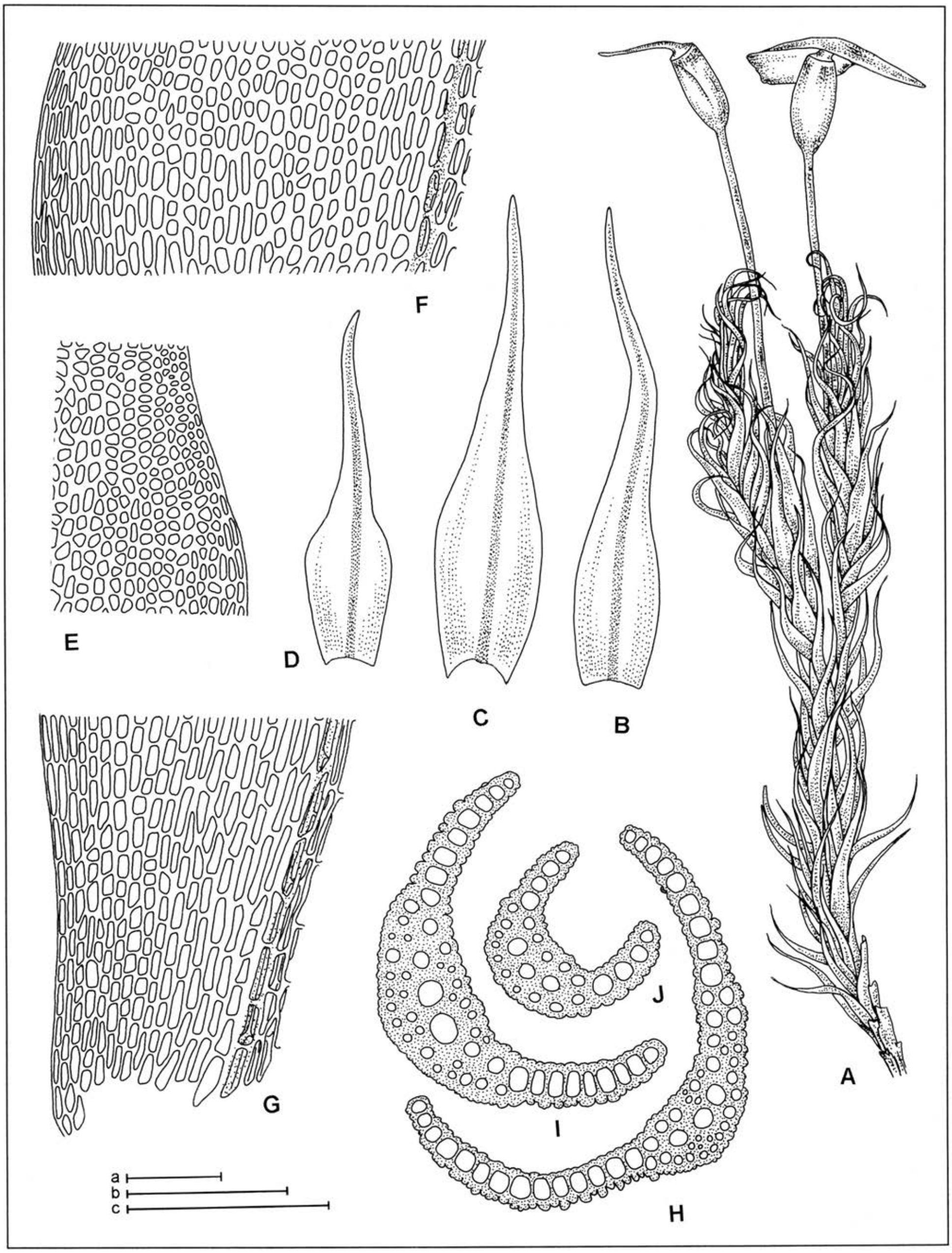


FIGURE 72. *Dicranoweisia brevipes* (Müll. Hal. *in* Neum.) Card. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Laminal cells at leaf shoulders. — **F**. Mid-leaf cells. — **G**. Basal cells. — **H**–**J**. Cross-sections of leaves (A & C from *Ochyra 2177/80*; B from *Jabłoński 165*; D–G & I–J from *Ochyra 689/80*; H from *Webb 93*; all in KRAM). Scale bars: a – 1 mm (A); b – 100 μm (E–J); c – 1 mm (B–D).

Plants medium-sized, up to 1.5 cm tall, green or yellow-green, forming dense short tufts. Leaves flexuose, strongly crisped when dry, gradually narrowed from an ovate or lanceolate base to a short, concave subula; margins entire to crenulate, weakly recurved in mid-leaf; costa narrow, subpercurrent; upper laminal cells quadrate, oval to short-rectangular; lower cells short- to elongate-rectangular, thick-walled; angular cells not differentiated or enlarged, thin-walled, brownish, forming auricles. Autoecious. Perichaetial leaves long, abruptly contracted into a short, acute point. Setae stout, 3–4 mm long, dark yellow to brownish. Capsule erect, ovate-oblong, 1.2–1.5 mm long, scarcely exserted beyond the perichaetial leaves; peristome teeth hyaline, strongly papillose throughout. Spores papillose, 21–27 µm in diameter.

Ecology. — On rock ledges and outcrops, on stony ground, usually in moist and sheltered situations, but sometimes in open and exposed places.

Phytogeography. — **Pan-South-Temperate** – SE Australia; Subantarctica (Marion I., Prince Edward I., South Georgia); Falkland Is.; Tierra del Fuego; West Patagonia; Antarctica (South Sandwich Is., South Orkney Is., South Shetland Is., Antarctic Peninsula).

Distribution on King George Island. — A frequent and locally common species throughout the Admiralty Bay area, rare elsewhere (Fig. 73), usually occurring at higher elevations, over 100 m, and only rarely found at sea level.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1101/80*; Blue Dyke, 120 m, *1183/80*; The Tower, 340 m, *814/80*; Bastion, 290 m, *1023/80*; Demay Point, 30 m, *1390/80*; Creeping Slopes, 100 m, *1249/80* and 135 m, *1273/80 & 1282/80*; Brama, 180 m, *806/80* and 200 m, *796/80*. ***Ecology Glacier***: Zamek, 330 m, *9/80*;

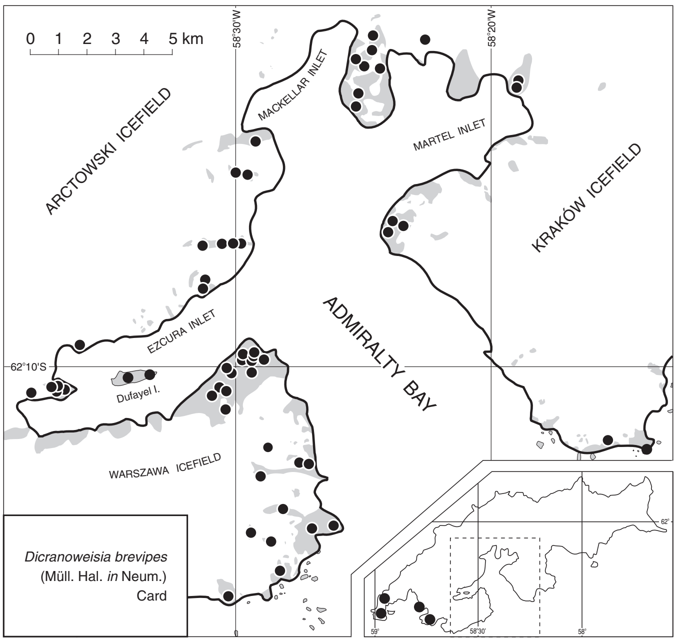


FIGURE 73. Distribution map for *Dicranoweisia brevipes* (Müll. Hal. *in* Neum.) Card. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Sphinx Hill, 100 m, *193/80* and 130 m, *204/80*; Czajkowski Needle, 230 m, *689/80*. ***Point Thomas***: Upłaz, 40 m, *1538/80*; Krzesanica, 90 m, *4977/79* [BAE-55 as *D. antarctica*]; north-east branch of Panorama Ridge, 160 m, *1698/80* [BAE-108 as *D. antarctica*]; Ambona, 85 m, *1604/80*; Skua Cliff, 105 m, *623/80* and 106 m, *604/80*; Ubocz, 110 m, *4942/79* and 180 m, *5126/79* [BAE-159 as *D. antarctica*]; Krokiew, 165 m, *1675/80*; Jersak Hills, 140 m, *5059/79*. ***Ezcurra Inlet***: Jardine Peak, 280 m, *5176/79*; Kasprowy Hill, 220 m, *81/80*; Italia Valley, 40 m, *60/80 & 61a/80* and 100 m, *105/80* [BAE-82 as *D. antarctica*]; unnamed hills on Wróbel Glacier, 180 m, *136/80*; Scalpel Point, 150 m, *1798/80*; Pond Hill, 30 m, *1819/80*, 50 m, *864/80*, 140 m, *863/80* and 145 m, *885/80*; Emerald Point, 45 m, *821/80*; Urbanek Crag, 100 m, *2321/80 & 2348/80* and 130 m, *2314/80* [BAE-9 as *D. grimmiacea*]. ***Dufayel Island***: Gdynia Point, 85 m, *1788/80*; Sopot Peak, 180 m, *1580/80*. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2287/80*, 230 m, *2265/80* and 240 m, *2309/80*; Komandor Peak, 200 m, *1930* [BAE-182 as *D. antarctica*] *& 1976/80* and 250 m, *1932/80*; Kapitan Peak, 210 m, *1925/80*. ***Keller Peninsula***. Ore Point, 90 m, *450/80*; Round Hill, 30 m, *540/80*; Harpoon Point, 15 m, *550/80*; Yellow Point, 40 m, *497/80*; Piasecki Pass, 205 m, *433/80*; Mount Birkenmajer, 200 m, *428/80* and 270 m, *444/80* [BAE-81 as *D. antarctica*]. ***Martel Inlet***: Shark Fin, 150 m, *2644/80 & 2651/80*; Precious Peaks, 100 m, *2662/80* and 140 m, *2665/80*; Point Hennequin, 10 m, *2242/80*; Mount Wawel, 40 m, *2141/80* and 120 m, *2177/80*. ***Viéville Glacier***: Harnasie Hill, 140 m, *1845/80* [BAE-133 as *D. antarctica*]; Martins Head, 210 m, *1869/80*. FILDES PENINSULA: Gemmel Peaks, ca. 100 m, *2476/80*, 120 m, *2477/80* and 15 Feb 1989, *Komárek s.n.* (KRAM); Fossil Hill, 90 m, *Schulz 18* (KRAM). MARIAN COVE. North Spit, *BJ-156*. BARTON PENINSULA. Noel Hill, *BJ-201* and *Lindsay 731* (AAS, KRAM).

Literature records. — The species was first reported from the Antarctic. Many collections from King George Island named in the literature as *Dicranoweisia antarctica* (Müll. Hal.) Kindb. belong within this species (Ochyra, 1984b; Ochyra *et al.*, 1986; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998).

Dicranoweisia crispula (Hedw.) Milde, Bryol. Siles.: 49. 1869. FIG. 74

Blindia subinclinata Müll. Hal. *in* Neum.

Dicranoweisia subinclinata (Müll. Hal. *in* Neum.) Broth. *in* Engl. & Prantl

Plants medium-sized, up to 2 cm tall, in yellow-green, compact cushions. Leaves flexuose, strongly crisped when dry, gradually tapering from an ovate or lanceolate base to a long or short, subtubulose subula; margins entire to crenulate, plane or weakly recurved in mid-leaf; costa narrow, subpercurrent; cells at the leaf shoulders subquadrate to short-rectangular; lower cells elongate-rectangular to linear, thick-walled; angular cells not differentiated to enlarged, thin-walled, brownish forming inflated auricles. Autoecious. Perichaetial leaves long, clasping, abruptly contracted into a short, acute point. Setae slender, up to 1 cm long, yellow-brown. Capsule erect, ovate-oblong, ca 1.8 mm long, long-exserted; peristome teeth minutely papillose above, smooth below. Spores globose, papillose, 14–18 µm in diameter.

Remark. — This species is here recorded for the first time from the Antarctic and the Southern Hemisphere. Dusén (1903, 1905a) showed the close resemblance of the Patagonian populations described as *Dicranoweisia perpulvinata* Dusén to the northern *D. crispula*. A careful comparison of the South Georgian plants described by Müller (1890) as *Blindia subinclinata* [Lectotype (*nov.*): "Felsen am Ausgange des Brockenthales in kleinen Polstern, Süd-Georgien, 23/I 83 Will 7"

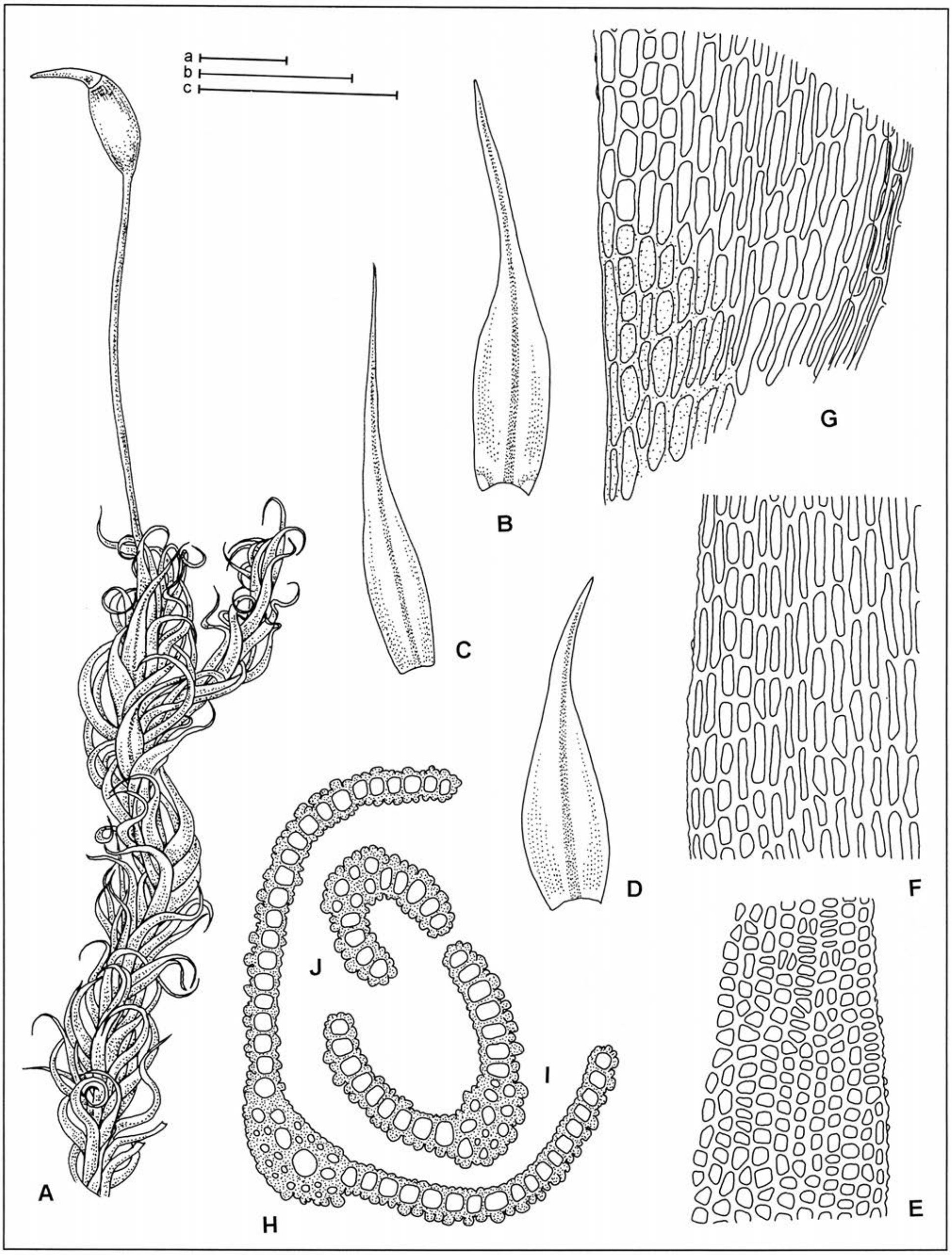


FIGURE 74. *Dicranoweisia crispula* (Hedw.) Milde. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Lamina cells at leaf shoulders. — **F**. Mid-leaf cells at margin. — **G**. Alar cells. — **H**–**J**. Cross-sections of leaves (A–B & G from *Acuña 7044*; C from *Ochyra 599/80*; D–F & H–J from *Ochyra 501/80*a; all in KRAM). Scale bars: a – 1 mm (A); b – 1 mm (B–D); c – 100 µm (E–J).

– HBG!], and other Antarctic specimens so-named, with northern populations of *D. crispula* revealed their perfect correspondence in both gametophyte and sporophyte characters and consequently several austral species' names must be reduced to synonymy with *D. crispula.*

Ecology. — On rock surfaces moistened by trickling water, on damp gravel, rarely in drier situations on rock ledges and outcrops, usually in sheltered sites.

Phytogeography. — **Bipolar** – Arctic-boreal-montane, pan-Holarctic in the Northern Hemisphere; Valdivian region; Magellanian Channels; Falkland Is.; Tierra del Fuego; South Georgia; South Orkney Is.; South Shetland Is.; Antarctic Peninsula (Danco Coast, Graham Coast); Charcot Island.

Distribution on King George Island. — An infrequent species recorded mostly from nunataks in the vicinity of Crépin Point and on the Keller Peninsula, rare in the Point Thomas and Point Hennequin areas of Admiralty Bay, very rare on Barton Peninsula (Fig. 75). The species is restricted to higher elevations and only rarely descends below 100 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Point Thomas***: Skua Cliff, 60 m, *635/80*. ***MacKellar Inlet***: Misty Nunatak, 260 m, *2031/80*; Admiralen Peak, 305 m, *2022/80 & 2029/80*; Kapitan Peak 195 m, *1917/80*; Wegger Peak, 310 m, *2003/80*; Garnuszewski Peak, 300 m, *2016/80*. ***Keller Peninsula***: without specific locality, *Schuster 69-946 pp.* (US); Ore Point, 10 m, *501/80*; Mount Flagstaff, 100 m, *419/80*; Moraine Point, 25 m, *483/80* and 40 m, *479/80*. ***Martel Inlet***: Ullman Spur, 60 m, *578/80* and 80 m, *599/80*; Mount Wawel, 60 m, *2123/80*. FILDES PENINSULA. Ardley Island, *Kühnemann 145* (AAS, KRAM). BARTON PENINSULA. Noel Hill, *Lindsay 765* (AAS, KRAM) and *BJ-200*.

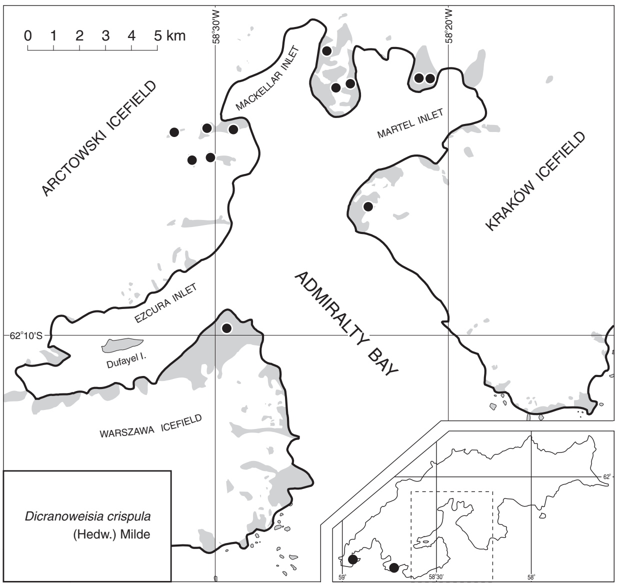


FIGURE 75. Distribution of *Dicranoweisia crispula* (Hedw.) Milde in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Literature records. — Admiralty Bay (Robinson, 1972 as *D. subinclinata*; Przywara *et al.*, 1984 as *D. antarctica*).

Dicranoweisia grimmiacea (Müll. Hal.) Broth. *in* Engl. & Prantl, Nat. Pflanzenfam. 1(3): 318. 1901. FIG. 76

Blindia grimmiacea Müll. Hal. *in* Neum.
Dicranoweisia grimmiacea (Müll. Hal.) Broth. fo. *brevifolia* Card.
D. grimmiacea (Müll. Hal.) Broth. fo. *latifolia* Card.

Plants medium-sized, 1–2 cm tall, forming hemispherical compact, dark green cushions. Leaves less crisped, gradually short-acuminate from an ovate-lanceolate base; subula concave, rather blunt at tip; margins entire to crenulate, plane or weakly recurved; costa narrow, ending below the apex; cells at the leaf shoulders quadrate to short-rectangular, becoming subquadrate to short-rectangular below; angular cells not differentiated or a few enlarged, thin-walled forming somewhat inflated auricles. Autoecious. Setae short, to 6 mm long. Capsule erect, ellipsoidal to short-cylindrical, short-exserted; peristome teeth entire or somewhat bifid at apex, strongly papillose. Spores spherical, papillose, 16–20 μm in diameter.

Ecology. — In rock crevices, in sheltered, rather dry situations.

Phytogeography. — **Amphiatlantic Subantarctic** – South Georgia; Heard I.; Antarctica (Bouvetøya, South Sandwich Is., South Orkney Is., South Shetland Is., Antarctic Peninsula south to Graham Coast).

Distribution on King George Island. — The rarest of all the species of *Dicranoweisia* on the island, scattered on some nunataks at the entrance to Admiralty Bay; outside the bay known only from Penguin Island and North Foreland (Fig. 77). All the collections came from higher elevations above 100 m and only once it has been found lower down.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1111/80*; The Tower, 350 m, *1031/80*; Creeping Slopes, 110 m, *1270/80*. ***Ezcurra Inlet***: Emerald Point, 30 m, *826/80*; Urbanek Crag, 100 m, *2318/80*. KING GEORGE BAY. Penguin Island, *BJ-66 & 69*. VENUS BAY. North Foreland, 20 m, *Lindsay 658* (AAS, KRAM).

Literature records. — Specimens reported from the Keller Peninsula (Robinson, 1972) and from the Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998; Liu & Li, 1998) are actually *Dicranoweisia brevipes*.

HOLODONTIUM

Holodontium (Mitt.) Broth. *in* Engl., Nat. Pflanzenfam. ed. 2, 10: 198. 1924.

A monotypic amphiatlantic subantarctic genus resembling *Chorisodontium* in its very broad and excurrent costa, but the peristome teeth, strongly trabeculate on the dorsal surface, definitely indicate its closer relationship with the Seligeriaceae than the Dicranaceae in which it was originally positioned. The genus has recently been revised by Ochyra (1993a).

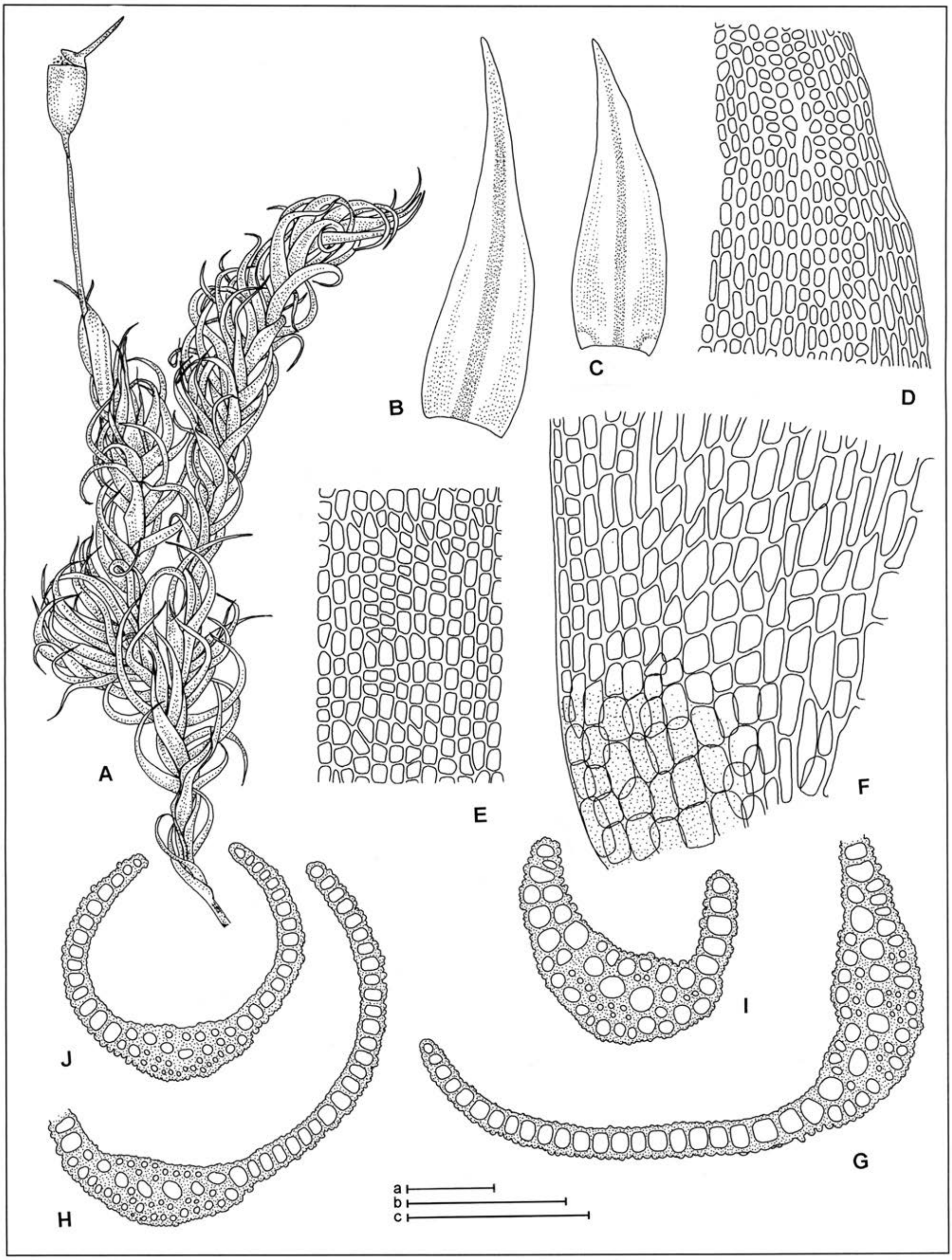


FIGURE 76. *Dicranoweisia grimmiacea* (Müll. Hal. *in* Neum.) Broth. *in* Engl. & Prantl. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Lamina cells at leaf shoulders. — **E**. Mid-leaf cells. — **F**. Basal cells. — **G**–**J**. Cross-sections of leaves (A & D from *Webb 102*; B from *Taylor 360*; C, E, G & I from *Ochyra 826/80*; F from *Webb 4*; H & J from *Will* 7, lectotype of *Blindia grimmiacea*, HBG; all in KRAM unless otherwise stated). Scale bars: a – 1 mm (A); b – 100 µm (E–J); c – 1 mm (B–D).

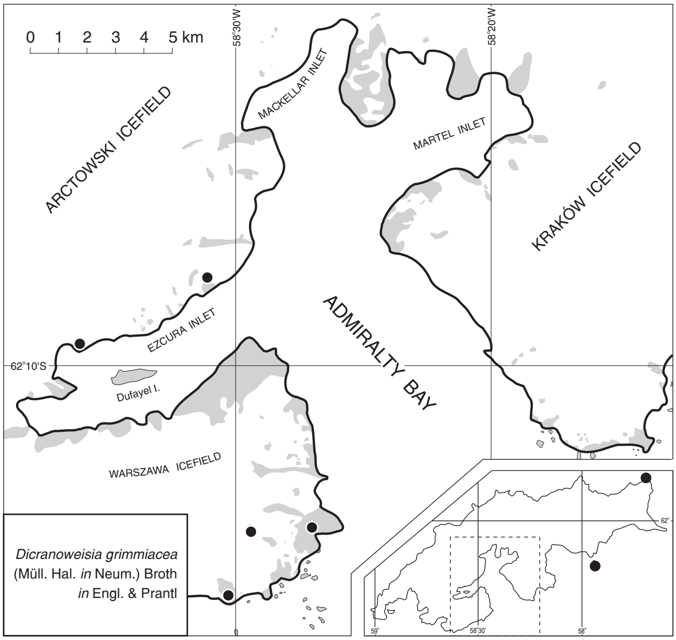


FIGURE 77. Distribution map for *Dicranoweisia grimmiacea* (Müll. Hal. *in* Neum.) Broth. *in* Engl. & Prantl in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Holodontium strictum (Hook. f. & Wils.) Ochyra, Fragm. Flor. Geobot. 38: 84. 1983. FIG. 78

Weissia stricta Hook. f. & Wils.
Blindia stricta (Hook. f. & Wils.) Müll. Hal.

Plants rather large, 1.5–5.5 cm tall, olive-green, in dull, dense tufts. Leaves rigid and stiff, falcato-secund, 3.5–5.0 mm long, gradually long subulate from an ovate-lanceolate or oblong-lanceolate base; subula stout, smooth, 1–2 times the lamina length; costa occupying 1/3 or more of the width of the leaf base, entirely filling the subula, in transverse section consisting of a median row of large guide cells between 2 stereid bands; laminal cells mostly quadrate to short-rectangular above, becoming more elongate below, thin- to moderately thick-walled; alar cells sharply differentiated, forming decurrent auricles. Autoecious. Setae erect, yellowish-brown to brown, 1.0–1.5 mm long; capsules exserted, globose or obloid to shortly cylindrical; peristome teeth 16, coarsely papillose; preperistome well-developed, hyaline. Spores spherical, light brown, papillose, 20–25 µm in diameter.

Ecology. — This typically hydrophilous species was recorded at its only Antarctic station on damp soil by a small stream.

Phytogeography. — **Amphiatlantic Subantarctic** – Antarctica (South Shetland Is.); Îles Kerguelen; Îles Crozet; South Georgia; Tierra del Fuego; Isla de los Estados; West Patagonia to the Valdivian region, occurring above 500 m; above 4000 m in the Northern Andes of Ecuador (Fig. 31).

Distribution on King George Island. — Known only from a single station on the Fildes Peninsula, growing almost at sea level (Fig. 58).

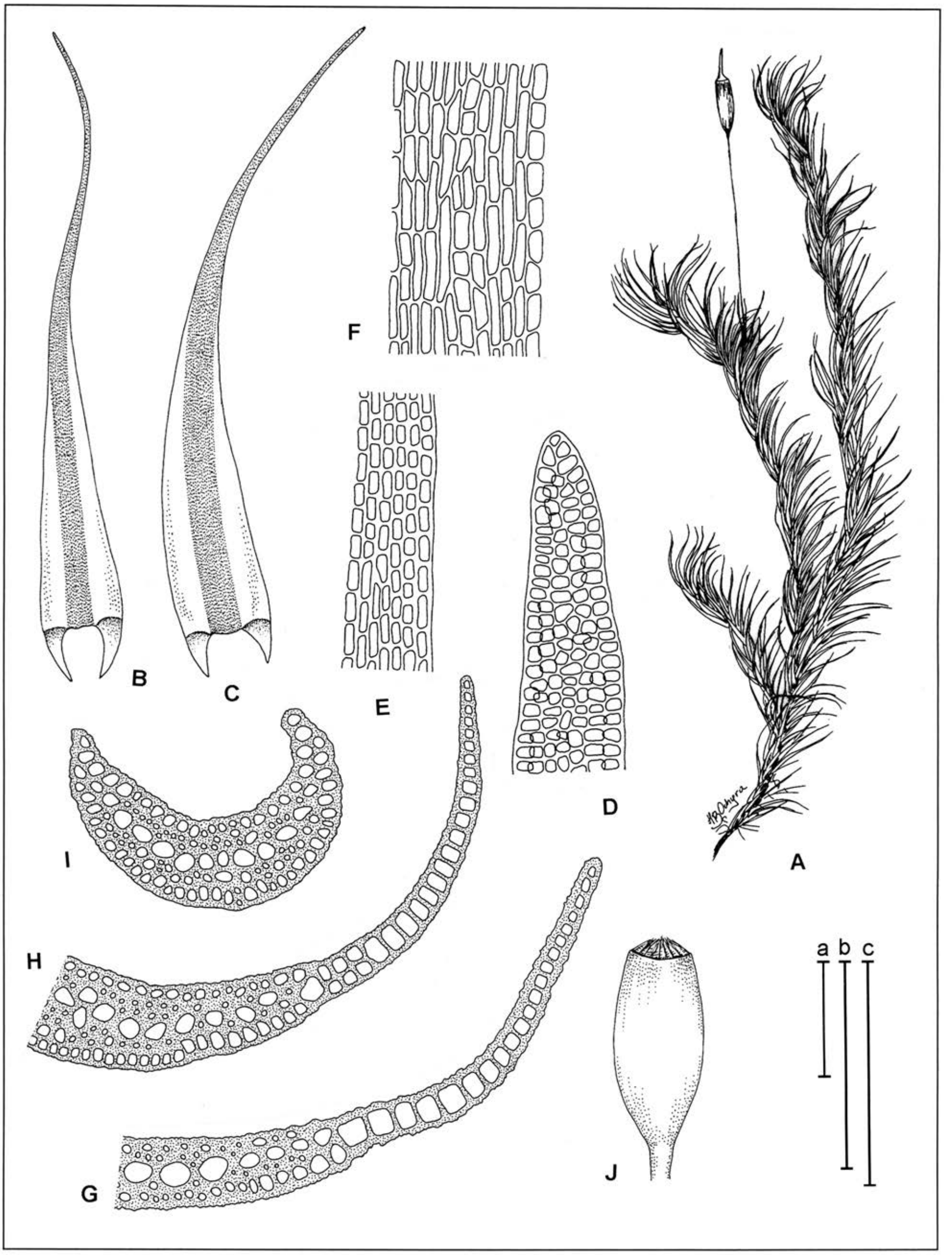
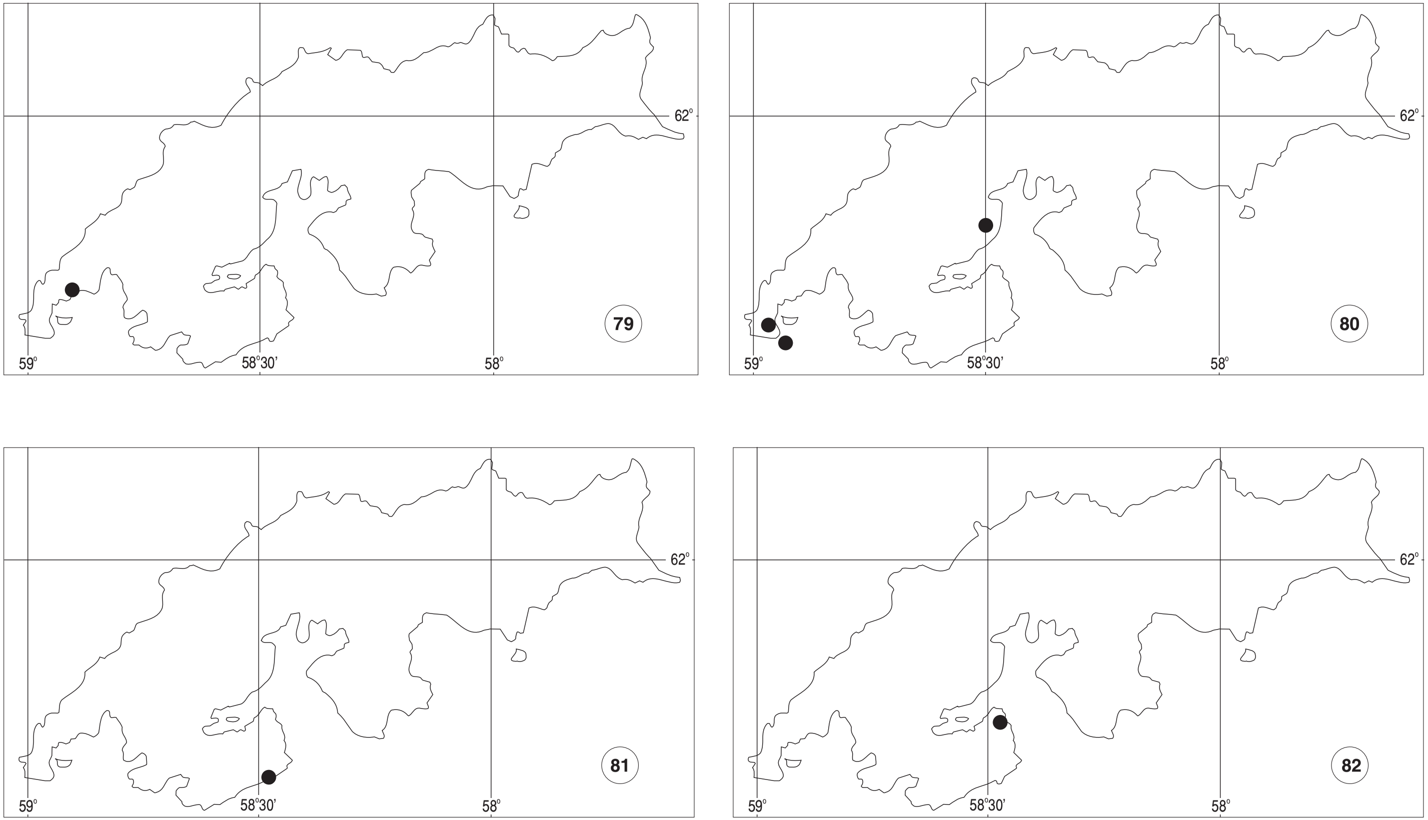


FIGURE 78. *Holodontium strictum* (Hook. f. & Wils.) Ochyra. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Leaf apex. — **E**. Lamina cells at the excurrence of costa. — **F**. Mid-leaf cells. — **G**–**I**. Cross-sections of leaf. — **J**. Capsule, wet (A–C, F–G & I from *Petrov s.n.*, 28.iii.1976, KRAM; D & H from *Hébrard s.n.*, 10.ii.1969, holotype of *Campylopus quezelii*, hb. Hébrard; E from *Jameson 129*, holotype of *Dicranum inerme*, NY; J from *Greene* 2523, KRAM). Scale bars: a – 1 mm (B–C); b – 100 μm (D–I); c – 1 cm (A).



FIGURES 79–82. Distribution maps for *Holodontium strictum* (Hook. f. & Wils.) Ochyra (79), *Didymodon gelidus* Card. (80), *Stegonia latifolia* (Schwägr.) Vent. (81) and *Grimmia reflexidens* Müll. Hal. (82) on King George Island.

Specimen examined from King George Island. — FILDES PENINSULA. Suffield Point (Bukhta Korablev), below a hill by the outflow of a small stream, 28 Mar 1976, *Petrov s.n.* (AAS, F, H, KRAM, LE).

Literature records. — Fildes Peninsula (Ochyra, 1993a).

SELIGERIACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Blindia dicranellacea Müll. Hal.

Kanda (1987b) reported this species from the Potter Peninsula. Unfortunately, the relevant herbarium collection has not been available for study and its true identity remains unknown. As stated above (p. 121), the South Georgian type of *Blindia dicranellacea* is actually *Kiaeria pumila*.

Blindia skottsbergii Card.

Putzke and Pereira (1990) stated that this species had been "cited to King George Island but not found by the authors of this work in the area", but they did not identify the source of this information. Unfortunately I could trace no literature report of this species from King George Island. It has only been recorded from Laurie Island, South Orkney Islands (Cardot, 1908, 1911c) and from Moss Island near the Antarctic Peninsula (Cardot, 1906a, 1908 as fo. *robusta* Card.). Both taxa are identical to *Chorisodontium aciphyllum* (Ochyra, 1993b).

ENCALYPTACEAE

The family consists of two genera, *Encalypta* and *Bryobrittonia*, having in common large, campanulate, rostrate calyptrae, in some taxa variously fringed at the base, and erect, long-cylindric capsules. These taxa resemble some species of *Syntrichia* in vegetative characters, but differ in the peristome structure which in this family may be double, single or lacking.

ENCALYPTA

Encalypta Hedw., Spec. Musc. Frond.: 60. 1801.

A worldwide genus consisting of 24 species which are inhabitants of cold and temperate regions in the Northern Hemisphere. Outside the Holarctic they occur mostly in altimontane stations in the tropics and in temperate regions in the Southern Hemisphere. Two species of *Encalypta* are known to occur in Antarctica and they appear to be uncommon constituents of the flora in this biome. The genus has been reviewed for the region by Newton (1974a) and in the study area only *E. rhaptocarpa* occurs.

Encalypta rhaptocarpa Schwägr., Spec. Musc. Suppl. 1(1): 56, f. 16. 1811.
FIG. 83

Encalypta patagonica Broth. *in* Dusén

Plants 0.5–3.0 cm tall, dull-green or sometimes yellowish or brownish. Leaves 2.2–3.0 mm long, ovate, broadly acuminate, acute and piliferous to obtuse and apiculate; margins plane or recurved near the base; costa ending below the apex or percurrent, often disappearing in the hyaline awn; upper laminal cells quadrate to hexagonal, bulging, coarsely papillose; basal cells narrowly rectangular, hyaline, smooth. Autoecious. Setae 6–10 mm long, brown or red-brown; capsules 2–3 mm long, cylindrical, abruptly narrowed at the base, strongly straight-ribbed; peristome single, the teeth lanceolate, rather coarsely papillose. Spores 35–41 µm in diameter, spherical or subreniform, warty-papillose. Calyptra 4–5 mm long, mitriform, cylindrical, mostly covering the whole capsule.

Remark. — *Encalypta patagonica*, a species originally described from the Brunswick Peninsula in southern South America (Dusén, 1905a, 1905b) and reported by several authors from the Antarctic (e.g. Webb, 1973; Newton, 1974a; Kuta *et al*., 1982; Lewis-Smith, 1985b, c, 1988a; Putzke & Pereira, 1990; Chen *et al*., 1993, 1995), is here considered to be conspecific with *E. rhaptocarpa*. The type material [Lectotype (*nov.*): "Patagonia australis ad Punta Arenas emporium in terra, Dusén 31" – S!; isotype: BM!] agrees in all details with the Holarctic material of the otherwise polymorphous *E. rhaptocarpa* except for its gymnostomous capsules which are diagnostic for *E. vulgaris*. However, the capsules are distinctly ribbed and the leaves hair-pointed, and these features are all typical of *E. rhaptocarpa*. Such intergrading populations occur frequently in North America (Horton, 1983). It should be noted that all Antarctic populations have ochyrostomous capsules with a well-developed peristome and their identity with *E. rhaptocarpa* is unquestionable.

Ecology. — A typical but seldom abundant component of the flora of fairly stable moist to dry soils associated with rock outcrops and ledges.

Phytogeography. — **Bipolar** – In the Northern Hemisphere pan-Holarctic arctic-montane south to California and New Mexico, Central Asia and Japan; in the Southern Hemisphere: South Patagonia; South Georgia; Antarctica (South Orkney Is., South Shetland Is., James Ross I., Alexander I.).

Distribution on King George Island. — An exceedingly rare species known only from three localities in the Admiralty Bay region, occurring at higher elevations above 80 m (Fig. 84).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 125 m, *1161/80* (BAE-30). ***Point Thomas***: Krzesanica, 80 m, *4970/79*. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2286/80*.

Literature records. — Fildes Peninsula (Putzke & Pereira, 1990; Chen *et al*., 1993, 1995; Li *et al*., 1998; Liu & Li, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Kuta *et al*., 1982; Ochyra, 1983, 1984b; Ochyra *et al*., 1986; Myrcha *et al*., 1991; Okada & Kanda, 1994).

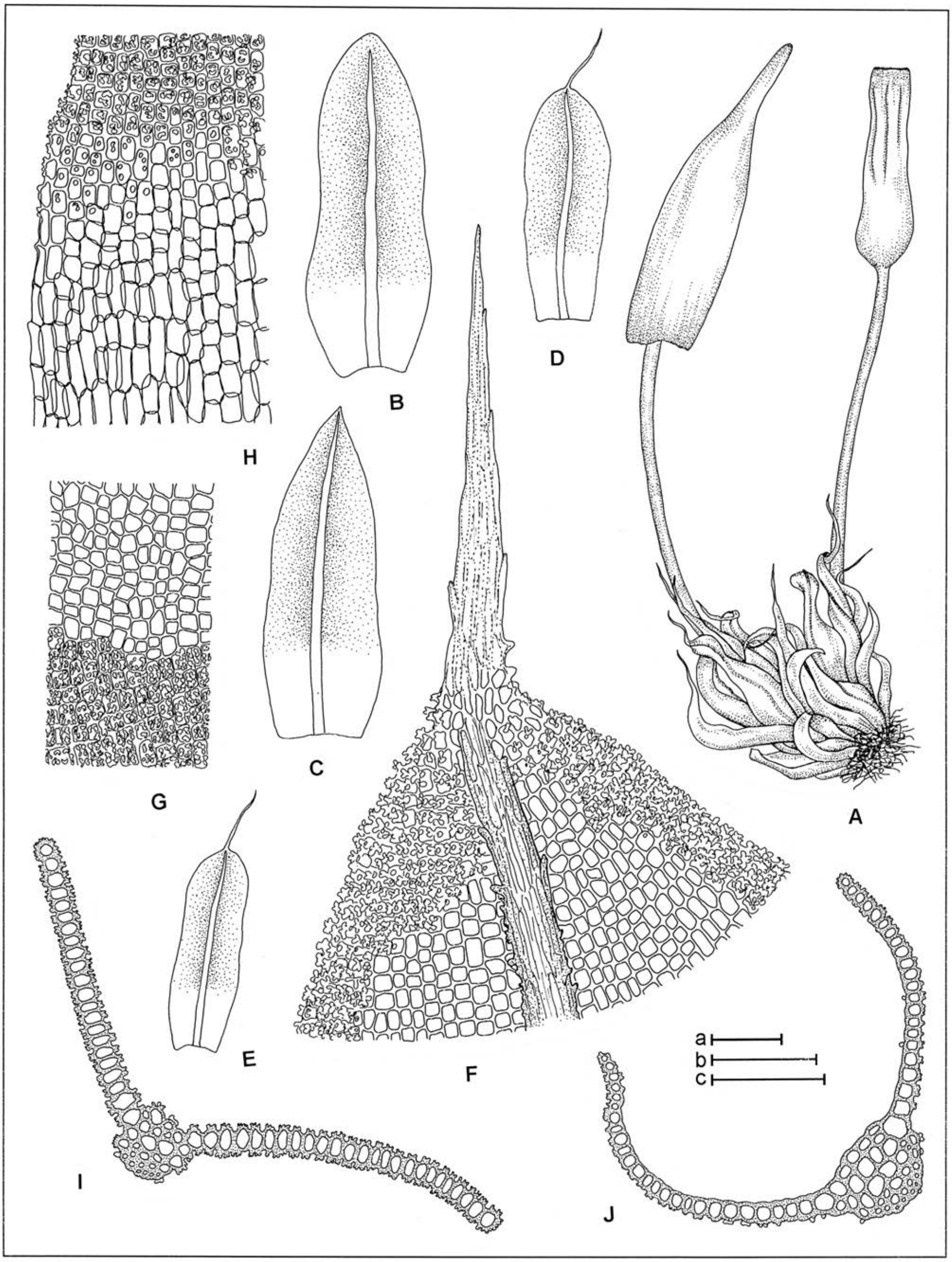


FIGURE 83. *Encalypta rhaptocarpa* Schwägr. — **A**. Habit. — **B–E**. Leaves. — **F**. Leaf apex. — **G**. Mid-leaf cells. — **H**. Lamina cells at leaf base. — **I–J**. Cross-sections of leaf (A, D–H from *Ochyra 2286/80*; B–C, I–J from *Webb 127*; both in KRAM). Scale bars: a – 100 µm (I–J); b – 1 mm (A) and 100 µm (F–H); c – 1 mm (B–E).

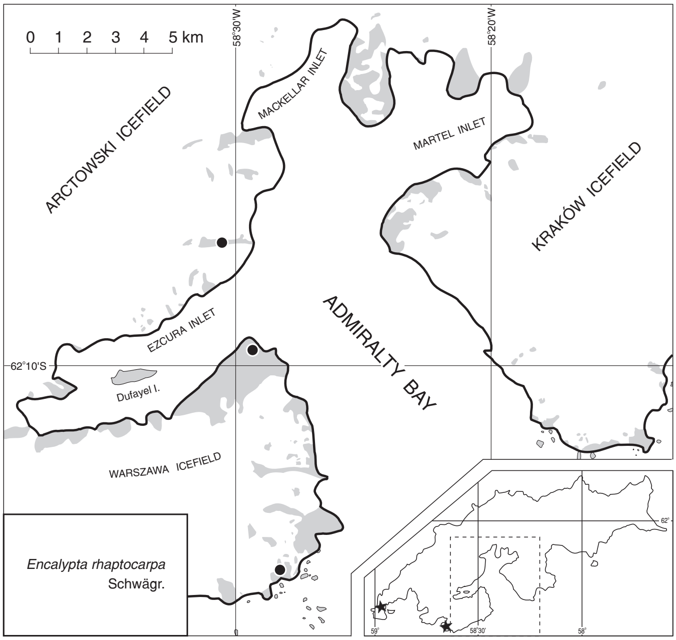


FIGURE 84. Distribution map for *Encalypta rhaptocarpa* Schwägr. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – inexact locality or literature data.

POTTIACEAE

A very large and diverse family whose members are often designated as “harsh environment mosses” because they very often grow on disturbed soil and/or in difficult climatic conditions in polar and montane regions. Zander (1993) recognized 76 genera with about 1500 species which are distributed throughout the globe. The family is well-represented in the impoverished Antarctic moss flora and some of them are important constituents, both in terms of frequency and cover, in some plant communities. In total, ten genera with some 15 species are known in this biome. Of these, four genera and seven species have been recorded from King George Island.

KEY TO THE KING GEORGE ISLAND GENERA OF THE POTTIACEAE

1. Leaves ovate-lanceolate; costa in cross-section with 2 stereid bands .... *Didymodon*
1. Leaves orbicular, lingulate or spathulate to oblong-lanceolate; costa in cross-section with 1 stereid band 2

2. Leaves circular to broadly ovate; plants bud-like .... *Stegonia*
2. Leaves lingulate, spathulate or oblong-lanceolate; plant with elongate stems 3

3. Leaves unbordered .... *Syntrichia*
3. Leaves bordered above or if border indistinct then leaf areolation lax with upper cells more than 15 μm wide and slightly papillose .... *Hennediella*

DIDYMODON

Didymodon Hedw., Spec. Musc. Frond.: 104. 1801.

A very large, cosmopolitan genus consisting of about 125 species. The genus is difficult to characterize and possibly needs further splitting into smaller but better defined genera. The plants are frequently sterile and this contributes much to its misunderstanding. This is true for the only Antarctic member of this genus whose identity still remains uncertain.

Didymodon gelidus Card., Nat. Antarct. Exp. Nat. Hist. 3: 4, *pl. 1 f. 1–11*. 1907.
FIG. 85

Plants small to medium-sized, 5–15 mm tall, in compact, olive-green tufts. Stems simple or sparingly branched, with numerous axillary brood-bodies. Leaves erecto-patent, ovate-lanceolate, gradually short- acuminate, acute to broadly obtuse at the apex, 0.7–1.2 mm long, 0.4–0.7 mm wide; margins entire or crenulate due to protruding papillae, weakly to strongly recurved; costa strong, prominent dorsally, subpercurrent; upper laminal cells obscure, rounded-quadrate, small, 6–9 µm wide, strongly papillose; basal cells short and firm-walled, pellucid, rectangular and elongate towards the costa. Sterile.

Ecology. — On rock ledges and outcrops in dry, sheltered situations.

Phytogeography. — **Antarctic Endemic** – Victoria Land; South Orkney Is.; South Shetland Is.; Trinity Peninsula.

Distribution on King George Island. — Known only from the Admiralty Bay area and the Fildes Peninsula (Fig. 80).

Specimens examined from King George Island. — ADMIRALTY BAY. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2286A/80*. FILDES PENINSULA. Two Summit Island, 14 Feb 1989, *Li S16* (AAS); Great Wall Station, 25 m, *Schulz 3* (KRAM).

HENNEDIELLA

Hennediella Par., Ind. Bryol.: 557. 1896.

Hennediela has been only recently accepted as a genus distinct from *Pottia* (Blockeel, 1990; Zander, 1993). The most important generic characters of *Hennediella* are the broadly lanceolate leaves bordered by a band of usually elongate thick-walled cells, with usually dentate to serrulate and almost always plane upper margins, very large upper medial laminal cells, flat and superficially strongly hollow-papillose cells, and a red reaction with KOH. Of about 20 accepted species two are known to occur in the Antarctic. They have been revised for this region by Matteri (1977a, 1977b) and Kanda (1981).

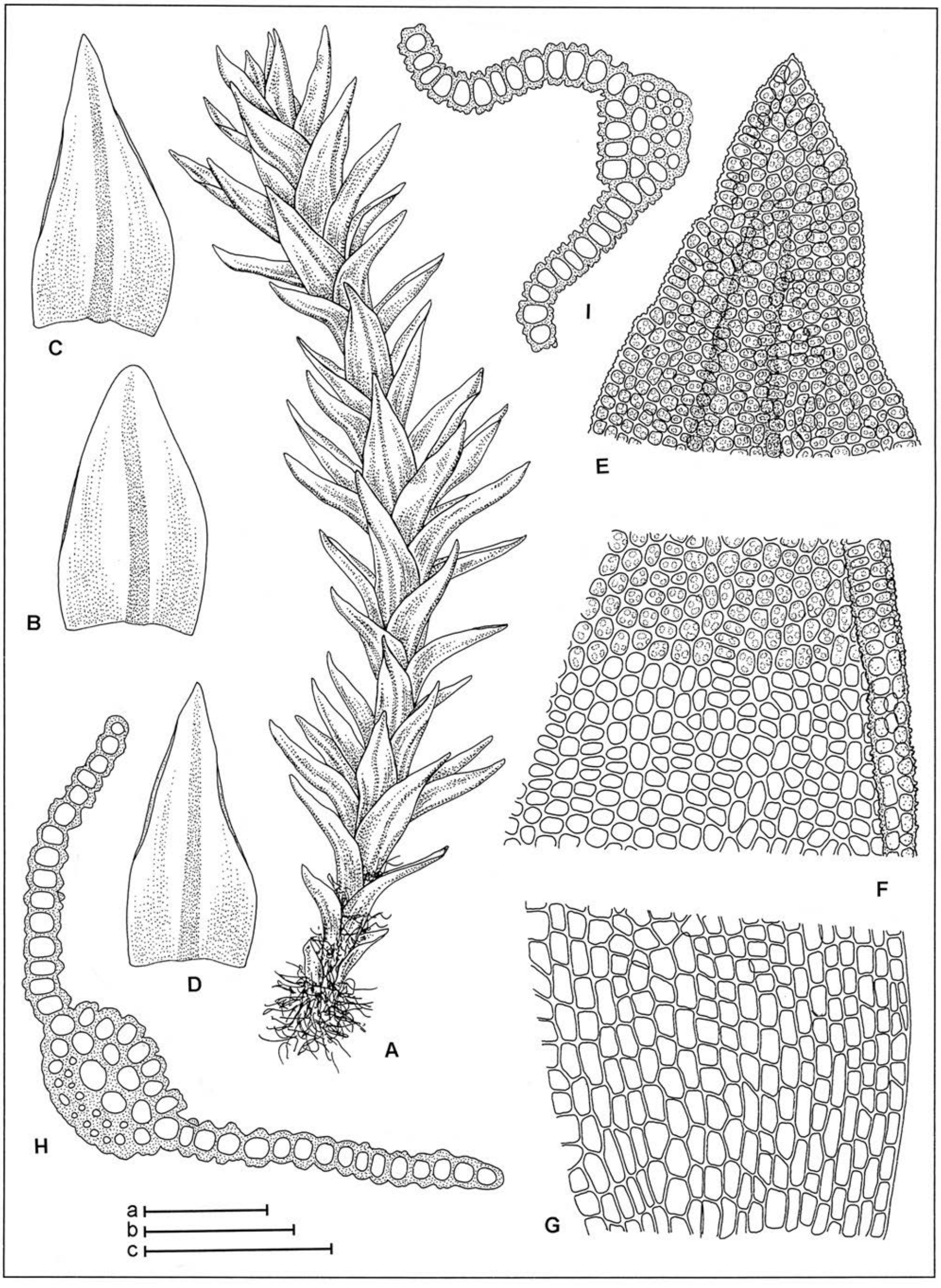


FIGURE 85. *Didymodon gelidus* Card. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells. — **G**. Basal leaf cells. — **H**–**I**. Cross-sections of leaf (all from *Ochyra 2286a/*80, KRAM). Scale bars: a – 100 μm (E–I); b – 1 mm (B–D); c – 1 mm (A).

KEY TO THE KING GEORGE ISLAND SPECIES OF *HENNEDIELLA*

1. Areolation lax, cells more than 15 µm wide; plants light green to yellow; leaves without a prominent border . . . . *H. heimii*
1. Areolation not lax, cells less than 15 µm wide; plants dark green to brown; leaves with a prominent border above . . . . *H. antarctica*

Hennediella antarctica (Ångstr.) Ochyra & Matteri, Fragm. Flor. Geobot. 41(2): 1006. 1996. FIG. 86

Gymnostomum antarcticum Ångstr.
Pottia antarctica (Ångstr.) Müll. Hal.
P. austrogeorgica Card.
Desmatodon austrogeorgicus (Card.) Ochyra *in* Ochyra, Vitt & D. G. Horton

Plants small, 0.5–0.7 cm tall, forming compact, dense cushions. Leaves ovate-lanceolate to shortly oblong-lanceolate, shortly acuminate, with a prominent border from apex to about mid-leaf formed by 2–3 rows of thick-walled, yellowish cells, rhombic to elongate towards the apex, quadrate towards mid-leaf; margin plane, dentate or denticulate above, crenulate for some distance below; costa strong, percurrent or slightly excurrent; upper cells 11.0–14.5(–23.0) µm long, 8.5–14.5(–21.0) µm wide, rounded-quadrate to rounded-hexagonal, obscured by dense, C-shaped papillae; basal cells elongate, rectangular, smooth, lax and hyaline. Autoecious. Setae 2–5(–8) mm long, stout. Capsule 1.0–1.4 mm long, shortly cylindrical to ovoid, wide-mouthed; peristome lacking. Spores (27–)29–39(–42) µm in diameter, red-brown to brown with prominent verrucae. Calyptra cucullate, covering the entire capsule.

Remark. — This species was described from England as *Tortula brevis* (Whitehouse & Newton, 1988). It was subsequently reduced by Blockeel (1990) to synonymy with *Hennediella macrophylla* (R. Br. ter.) Par., an amphipacific temperate species from the Southern Hemisphere. However, this species does not seem to be specifically distinct from *H. antarctica* and I consider these as conspecific taxa. For typification of the latter name see Ochyra and Matteri (1996).

Ecology. — On pockets of soil on rocks by the shore and dry sea cliffs, in moist or occasionally dry places, usually disturbed and enriched by birds or elephant seals.

Phytogeography. — **Bipolar** — In the Northern Hemisphere probably introduced in southern England. In the Southern Hemisphere pan-temperate: New Zealand; Tierra del Fuego; the Brunswick Peninsula; South Georgia; Îles Kerguelen; South Sandwich Is.; South Orkney Is.; South Shetland Is.; Enderby Land; Victoria Land.

Distribution on King George Island. — The species is quite widespread and locally abundant, commonly forming sporophytes in the Admiralty Bay area. In other parts of the island it seems to be rare and localized (Fig. 87). It is associated with rather lower elevations, growing most frequently from sea level to about 120 m, and only rarely is found on higher nunataks at 275 m.

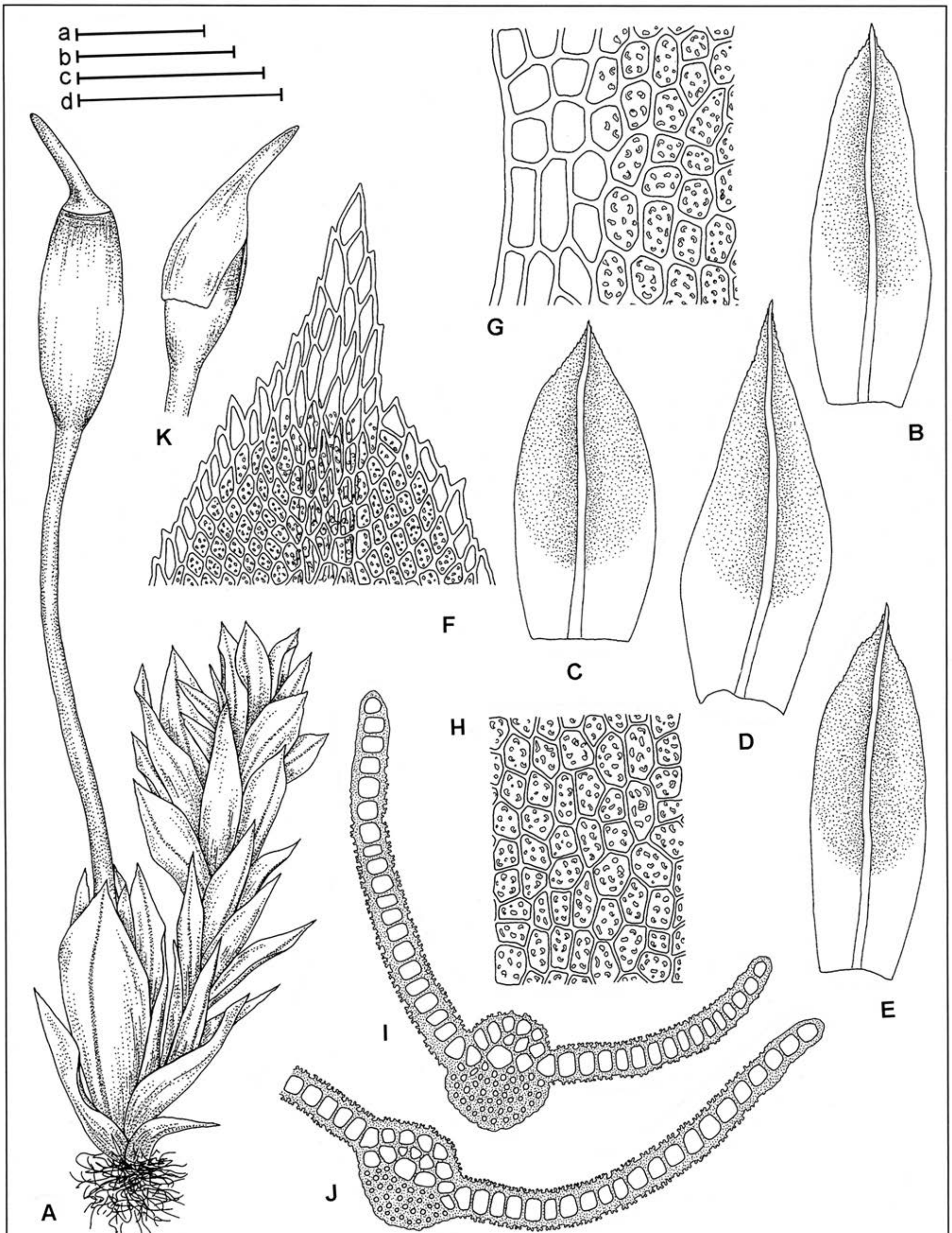


FIGURE 86. *Hennediella antarctica* (Ångstr.) Ochyra & Matteri. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Leaf apex. — **G**. Mid-leaf cells at margin. — **H**. Mid-leaf cells. — **I**–**J**. Cross-sections of leaf. — **K**. Capsule and calyptra, wet (A, C & E from *Ochyra 2351/80*; B from *Skottsberg 29*, UPS; D from *Skottsberg 290*, UPS; F–I from *Ochyra 1284/80*; J–K from *Ochyra 41/80*; all in KRAM unless otherwise stated. Scale bars: a – 1 mm (A, K); b – 50 µm (G–H); c – 100 µm (F, I–J); d – 100 µm (B–E).

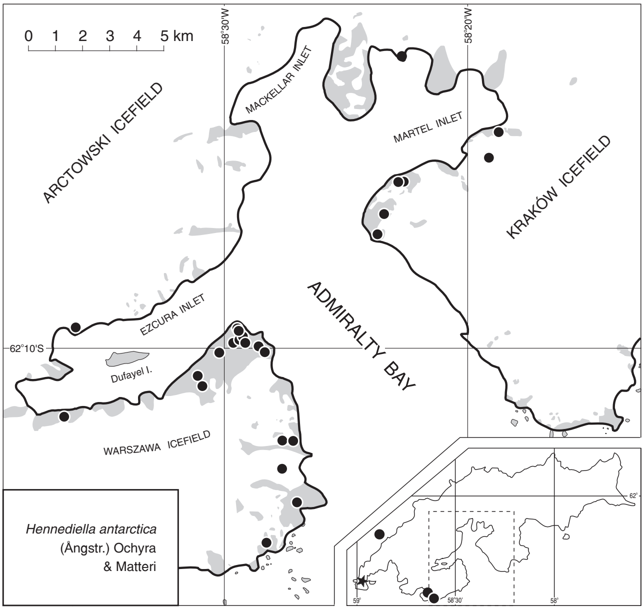


FIGURE 87. Distribution map for *Hennediella antarctica* (Ångstr.) Ochyra & Matteri in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – literature data and oral communication.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 135 m, *1154/80*; Creeping Slopes, 120 m, *1284/80*. ***Ecology Glacier***: Siodło, 90 m, *729/80*; Sphinx Hill, 100 m, *277/80* and 130 m, *211/80*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 20 m, *906/80*; Penguin Ridge, 40 m, *1401/80*; Point Thomas, 15 m, *Kanda 790619-017* (KRAM); Krzesanica, 130 m, *2351/80* and 135 m, *1660/80*; Ambona, 70 m, *1643/80* and 80 m, *1634/80*; Petrified Forest Creek, 45 m, *4836/79*; Skua Cliff, 105 m, *640/80*; Jersak Hills, 175 m, *5139/79* (BAE-109). ***Ezcurra Inlet***: Italia Valley, 60 m, *41/80* and 65 m, *51/80*; Cytadela, 5–20 m, *942/80* (BAE-57); Emerald Point, 20 m, *834/80*. ***Martel Inlet***: Stenhouse Bluff, 4 m, *2611/80*; Ullman Spur, 60 m, *576/80*; Szafer Ridge, 230 m, *2577/80*; Tern Nunatak, 265 m, *2522/80*; Smok, 10 m, *2057/80 & 2082a/80* and 15 m, *2053/80*; Basalt Point, 15 m, *2231/80*; Mount Wawel, 20 m, *2194/80*. DRAKE PASSAGE. Atherton Island, *BJ-113*. POTTER PENINSULA. Three Brothers Hill, 100 m, *Kanda 790609-074* (KRAM) and 120 m, *Kanda 790609-081 & 790690-101* (KRAM); Stranger Point, 10 m, *Kanda 790609-086* (KRAM).

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1981, 1987b); Admiralty Bay (Kanda, 1981, 1987b; Ochyra, 1983, 1984b; Ochyra *et al.*, 1986; Putzke & Pereira, 1990).

Hennediella heimii (Hedw.) Zand., Bull. Buffalo Soc. Nat. Sci. 32: 248. 1993.

FIG. 88

Gymnostomum heimii Hedw.
Desmatodon heimii (Hedw.) Mitt.
Pottia heimii (Hedw.) Hampe
Bryum antarcticum Hook. f. & Wils.
Pottia charcotii Card.
P. heimii (Hedw.) Hampe var. *brevirostris* L. I. Savicz & Smirnova

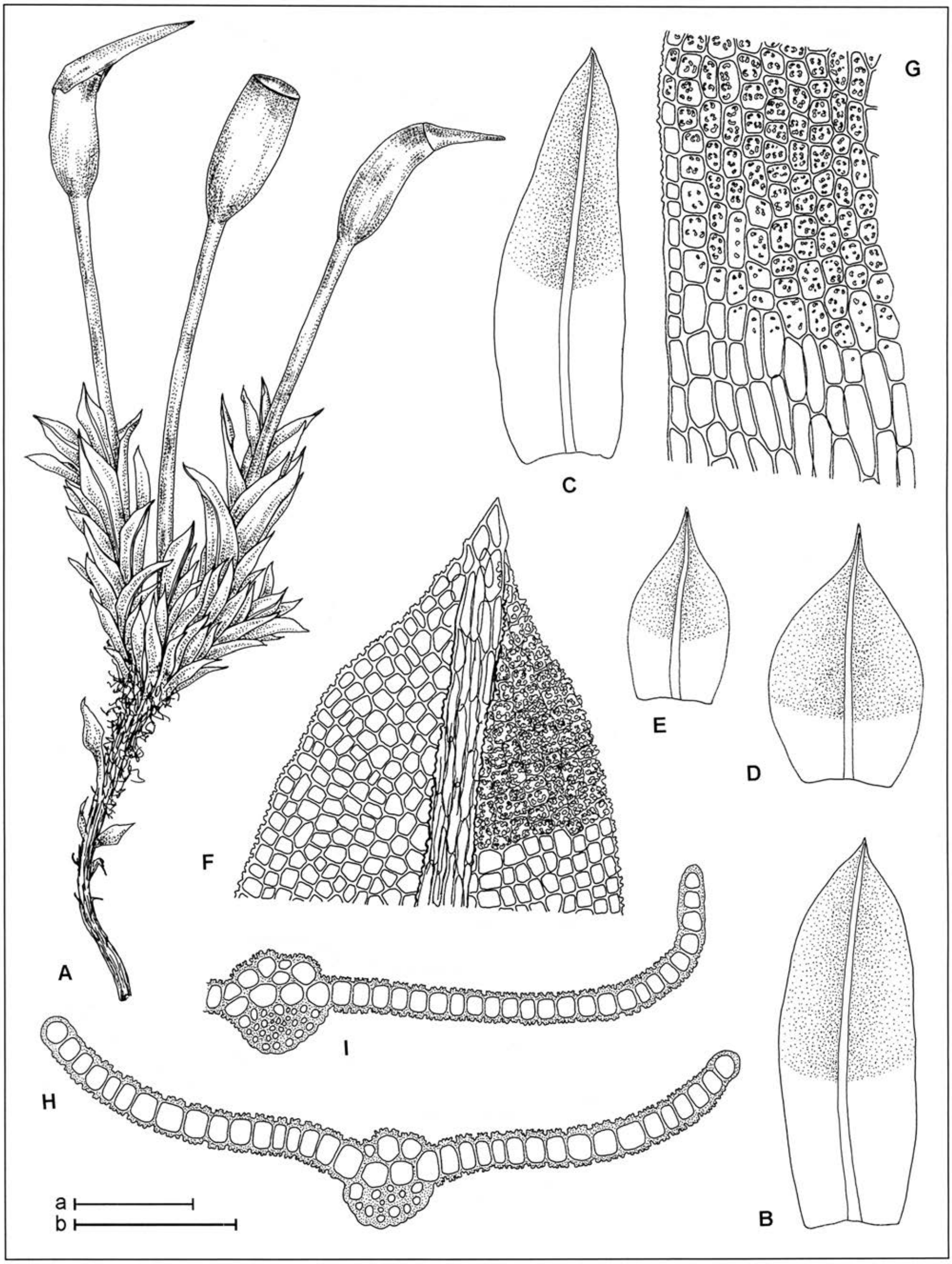


FIGURE 88. *Hennediella heimii* (Hedw.) Zand. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Leaf apex. — **G**. Mid-leaf cells. — **H**–**I**. Cross-sections of leaf (A–C & F–H from *Ochyra 928/80*, KRAM; D from *Gain 272b*, type of *Pottia charcotii*, PC; E from *Hooker 6*, type of *Bryum antarcticum*, BM; I from *Ochyra 1164/*80, KRAM). Scale bars: a – 0.5 mm (B–E) and 1 mm (A); b – 100 µm (G–I).

Plants medium-sized, 1–3 cm tall, green to yellowish-green, growing in compact tufts. Leaves obovate or ovate-lanceolate, about 1 mm long, 0.6 mm wide, short- to long-acuminate, weakly bordered with short, rhombic cells; margin usually very minutely or weakly crenulate above; costa strong, excurrent as a short apiculus; upper laminal cells elongate-hexagonal, rectangular or oblong-rhomboidal, 15–29 µm wide, papillose with C-shaped papillae to nearly smooth; basal cells much larger, lax, thin-walled. Dioecious. Setae 0.8–2.5 cm long; peristome lacking. Spores yellowish- to reddish-brown, minutely papillose, 20–40 µm in diameter.

Ecology. — In dry, sometimes wet, exposed or sheltered rock faces, on ledges and outcrops, also on rock detritus, sometimes in the vicinity of nesting birds.

Phytogeography. — **Bipolar** – Widely distributed in temperate and polar regions in the Northern Hemisphere. In the Southern Hemisphere infrequent and widely scattered: New Zealand; Campbell I.; Îles Kerguelen; Falkland Is.; Tierra del Fuego; Magellanian Channels; Valdivian region; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula (from the Danco to Loubet Coasts); East Antarctic Peninsula (Cockburn I.); Enderby Land; Queen Mary Land; Victoria Land.

Distribution on King George Island. — Rare and widely scattered in the Admiralty Bay area and on the Potter Peninsula and reported also from the Fildes Peninsula, extending from sea level to about 230 m (Fig. 89).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 130 m, *1164/80*. ***Ecology Glacier***: Sphinx Hill, 100 m, *254/80*. ***Ezcurra Inlet***: Kasprowy Hill, 230 m, *74/80*; Breccia Crag, 140 m, *928/80*. ***Viéville Glacier***: Rembiszewski Nunataks,

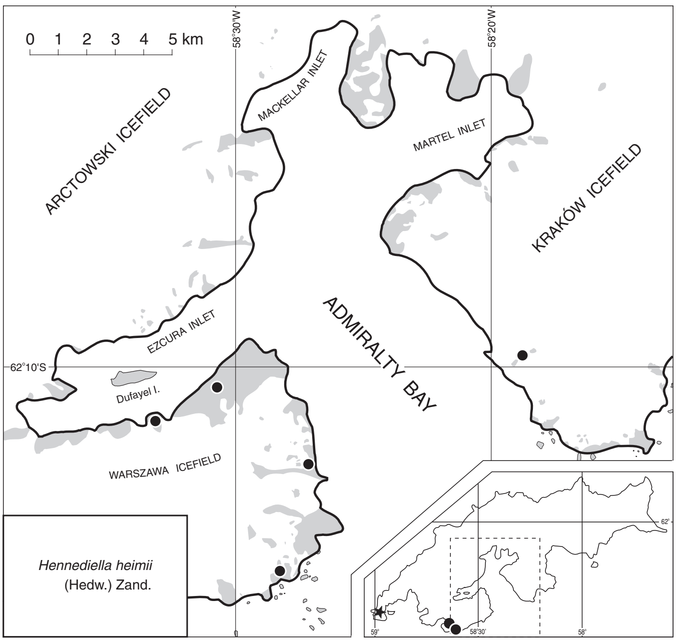


FIGURE 89. Distribution map for *Hennediella heimii* (Hedw.) Zand. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – literature data and oral communication.

190 m, *2761/80* (BAE-134). **POTTER PENINSULA**. Stranger Point, 1 m, *Kanda 092* (KRAM), 2 m, *Kanda 077, 080 & 085* (KRAM) and 5 m, *Kanda 037* (KRAM).

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1981, 1987b); Admiralty Bay (Przywara *et al.*, 1984; Putzke & Pereira, 1990; Gumińska *et al.*, 1994).

STEGONIA

Stegonia Vent., Rev. Bryol. 10: 96. 1883.

A small genus of three species known so far from the Northern Hemisphere and easily recognized by its broadly ovate to almost orbicular leaves. It has been recorded only once from the Southern Hemisphere, in Antarctica (Ochyra & Lewis-Smith, 1996).

Stegonia latifolia (Schwägr. *in* Schult.) Vent. *in* Broth., Laubm. Fennosk.: 145. 1923. FIG. 90

Weissia latifolia Schwägr. *in* Schult.

Plants very small, bud-like, gregarious or in loose to dense, pale green to silvery tufts up to 2.5 mm high. Leaves closely imbricate, very concave, obovate, very broadly ovate to nearly circular, 1.5–2.0 mm long, rounded to broadly acute at the apex; margin plane, entire or faintly to distinctly serrulate above; upper laminal cells smooth, narrowly rectangular to rhomboidal, usually smaller and thicker-walled towards the margin and apex, frequently hyaline in the upper 1/4–1/3 of the leaf and giving the plants a silvery appearance; lower cells narrowly rectangular to oblong-hexagonal, thin-walled, hyaline; costa weak, ending below the apex. Autoecious. Mature sporophytes unknown on King Georgian material.

Ecology. — On bare ground in a slightly moist but sheltered situation.

Phytogeography. — **Bipolar** – Widely distributed, but scattered, arctic-alpine in the Northern Hemisphere. Very rare in the Southern Hemisphere; in Antarctica on South Orkney Is. (Signy I.); South Shetland Is. (King George I.).

Distribution on King George Island. — An exceedingly rare species known only from a single locality at the entrance to Admiralty Bay (Fig. 81).

Specimen examined from King George Island. — **ADMIRALTY BAY**. ***Bransfield Strait***: Blue Dyke, 125 m, *161/80.*

Literature records. — Admiralty Bay (Myrcha *et al.*, 1991; Ochyra & Lewis-Smith, 1996).

SYNTRICHIA

Syntrichia Brid., J. Bot. (Schrader) 1800(1[2]): 299. 1801.

Syntrichia is segregated from the all-encompassing *Tortula* by the combination of red KOH reaction of the upper laminal cells, the lack of narrowly elongate upper

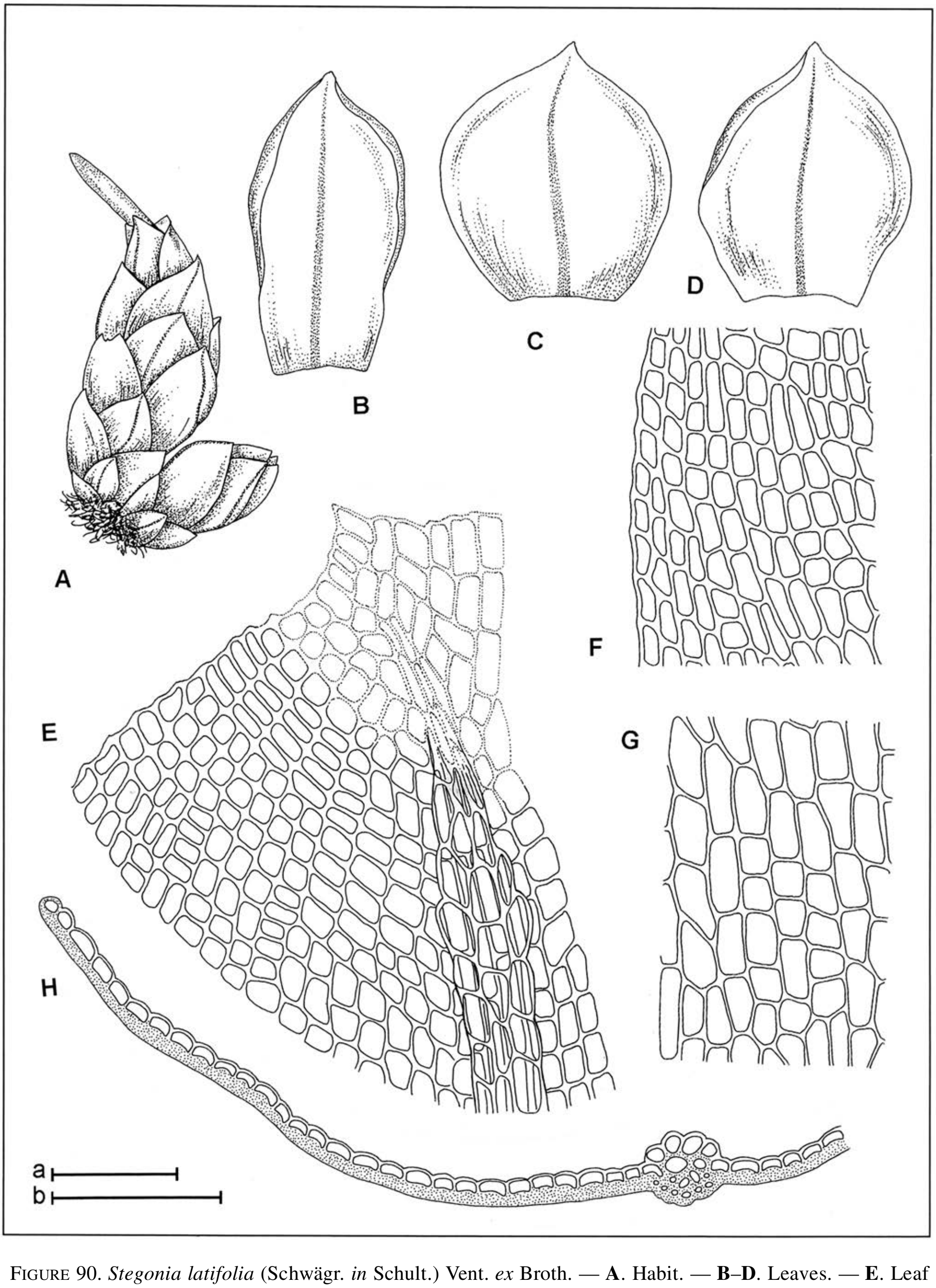


FIGURE 90. *Stegonia latifolia* (Schwägr. *in* Schult.) Vent. *ex* Broth. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells at margin. — **G**. Mid-leaf cells. — **H**. Cross-section of leaf (all from *Ochyra 1161/80*, KRAM). Scale bars: a – 1 mm (A) and 0.5 mm (B–D); b – 100 µm (E–H).

marginal cells, the crescent-shaped transverse section of the stereid band and the absence of a differentiated dorsal costal epidermis. It is a cosmopolitan genus containing about 100 species, which is well represented in temperate and cold regions in the southern Hemisphere. In the Antarctic, species of this genus are common only in the northern maritime Antarctic, particularly in the South Orkney and South Shetland Islands, where they form a prominent part of the terrestrial vegetation. The genus has been thoroughly revised for South Georgia and Antarctica by Lightowlers (1985, 1986a) and a useful discussion of the austral species of *Syntrichia* has been provided by Kramer (1988).

KEY TO THE KING GEORGE ISLAND SPECIES OF *SYNTRICHIA*

1. Costa excurrent in a hyaline or rarely reddish hair-point, sometimes reduced to an apiculus in some leaves on small plants; leaves oblong to ovate-lingulate, rounded at the apex ..... *S. princeps*
1. Costa percurrent or if excurrent producing a short cusp, up to 0.3 mm; leaves lanceolate or lingulate to broadly oblong in shape, acute to acuminate 2
   2. Leaf apex acuminate; margins entire throughout ..... *S. saxicola*
   2. Leaf apex acute; margins dentate or denticulate near apex ..... *S. filaris*

Syntrichia filaris (Müll. Hal.) Zand., Bull. Buffalo Soc. Nat. Sci. 32: 269. 1993.
FIG. 91

Tortula filaris (Müll. Hal. *in* Neum.) Broth. *in* Engl. & Prantl
Barbula filaris Müll. Hal. *in* Neum.
Tortula excelsa Card.

Plants medium-sized to large, in dense, brown-green to reddish-brown tufts, 1–7 cm tall, fastigiately branched. Leaves erect, curled and twisted around the stem when dry, spreading when moist, 2.0–4.4 mm long, 0.7–1.0 mm wide, lanceolate or oblong-lanceolate to sublingulate, gradually narrowed to a short acuminate or acute apex, margin plane to weakly recurved in mid-leaf, dentate or obscurely denticulate at the apex; costa percurrent, strongly convex on the dorsal surface; upper laminal cells rounded-quadrate to hexagonal, moderately papillose, becoming slightly smaller and sparsely papillose in the marginal row; basal cells rectangular to linear, smooth, hyaline. Sterile.

Ecology. — A frequent species found in several habitats including moist rock crevices, rock ledges, often below breeding seabird colonies, stream sides, along melt-water runnels and in swampy places traversed by rills. It is the most frequent associate of some communities of the moss hummock subformation, especially those dominated by *Sanionia georgico-uncinata* and *Bryum pseudotriquetrum*, as well as various sociations within the community dominated by *Deschampsia antarctica* and *Colobanthus quitensis*. Occasionally, it occurs also in some sociations of the moss carpet subformation.

Phytogeography. — **Amphiatlantic Subantarctic** – South Georgia; Îles Kerguelen; Heard I. (Lightowlers, 1986b); Bouvetøya; South Orkney Is.; South Shet-

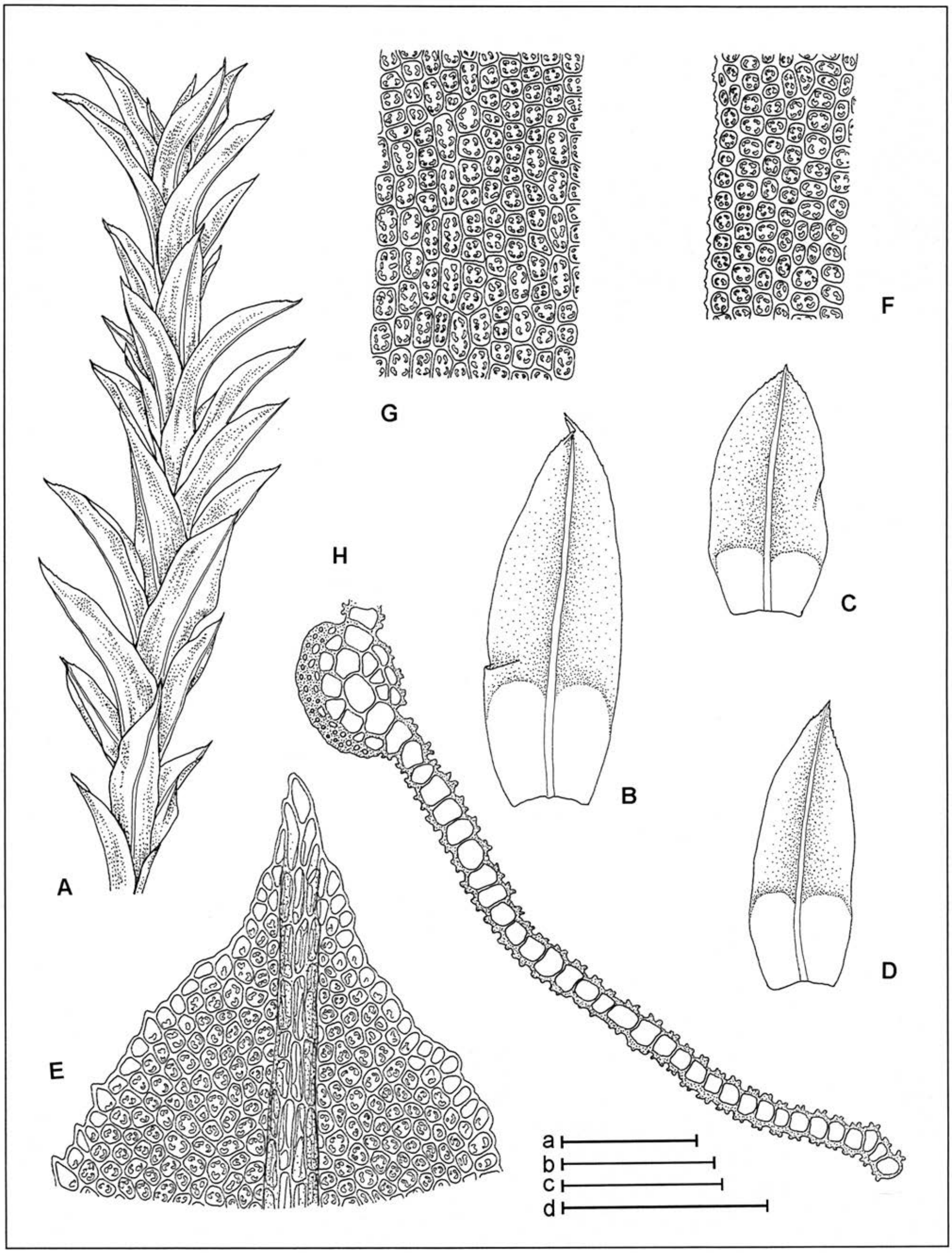


FIGURE 91. *Syntrichia filaris* (Müll. Hal. *in* Neum.) Zand. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Upper laminal cells at margin. — **G**. Mid-leaf cells. — **H**. Cross-section of leaf (A–B & E–H from *Ochyra 5251/79*, KRAM; C from *Ochyra 600/80*, KRAM; D from *Skottsberg 447*, type of *Tortula excelsa*, PC). Scale bars: a – 100 μm (H); b – 2 mm (A); c – 100 μm (E–G); d – 2 mm (B–D).

land Is.; East Antarctic Peninsula (Vega I.); Falkland Is.; Tierra del Fuego; Magellanian Channels.

Distribution on King George Island. — A frequent species, especially widely distributed along the western shore of Admiralty Bay and on the south-western coast along Bransfield Strait (Fig. 92). Most localities are at lower elevations, from sea level to 100 m, and only occasionally is it also found on the highest nunataks, up to 300 m.

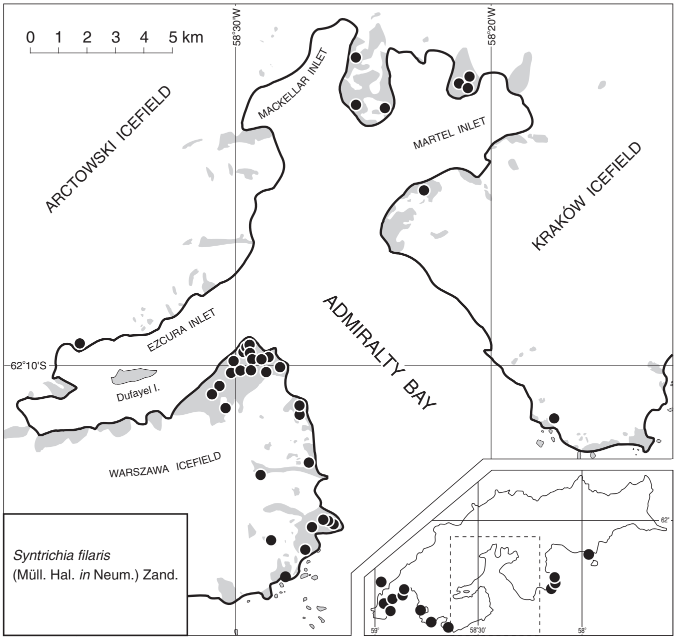


FIGURE 92. Distribution map for *Syntrichia filaris* (Müll. Hal. *in* Neum.) Zand. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 4 m, *1212/80 & 1214/80* and 8 m, *1199/80*; Bastion, 240 m, *896/80 & 1007/80*; Uchatka Point, 20 m, *1052/80* (BAE-185); Demay Point, 15 m, *1383/80* (BAE-136), 25 m, *1343/80* and 50 m, *1330/80* and without elevation *VK-384, 428, 440 & 446*; Creeping Slopes, 100 m, *1252/80*. ***Ecology Glacier***: Zamek, 300 m, *28a/80*; Sphinx Hill, 4 m, *410/80* (BAE-186); Rescuers Hills, 4 m, *4860/79* and 60 m, *4875/79* (BAE-137). ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 25 m, *901/80*; Rakusa Point, 5 m, *322/80*; Penguin Ridge, 30 m, *1396/80*; Jasnorzewski Gardens, 5 m, *1475/80*; Hala, 35 m, *5222/79* (BAE-11) and 40 m, *2388/80*; Upłaz, 45 m, *1522/80*; Point Thomas, 5 m, *1749/80* and 6 m, *1753/80*; north-east branch of Panorama Ridge, 4 m, *1720/80* (BAE-161); Geographers Creek, 95 m, *1601/80*; Ubocz, 94 m, *4953/79* and 110 m, *4939/79*; upper part of Ornithologists Creek, 120 m, *643/80* (BAE-84); Jersak Hills, 135 m, *5062/79*. ***Ezcurra Inlet***: Kasprowy Hill, 190 m, *69/80*; Italia Valley, 5 m, *5076/79* and 65 m, *57/80*; unnamed hills on Wróbel Glacier, 120 m, *643/80*; Emerald Point, 25 m, *827/80 & 857/80*. ***Keller Peninsula***: without specific locality, *VK-687* and *Schuster 69-940* (US); Ore Point, 10 m, *525/80*; Harpoon Point, 60 m, *552/80*; British Point, 3 m, *458/80*. ***Martel Inlet***: Ullman Spur, 2 m, *600/80* (BAE-34), 40 m *569/80* and 90 m, *560/80*;

Smok, 10 m, *2051/80* (BAE-83) *& 2095/80*. ***Viéville Glacier***: Vauréal Peak, 36 m, *5251/79* (BAE-110). **LEGRU BAY**. Low Head, *BJ-85*; Chopin Ridge, 10 m, *BJ-88*; Lions Rump, *BJ-93*. **KING GEORGE BAY**. Without specific locality, Jan 1986, *Lucchiarini s.n.* (KRAM); Turret Point, *BJ-133*. **DRAKE PASSAGE**. Atherton Island, *BJ-114*. **FILDES PENINSULA**. Ardley Island, *Kühnemann 44, 92B, 141 & 143* (AAS, KRAM) and *Booth RILS 5295B & 5296B* (AAS, KRAM); Lake Kitezh, 15 m, *2455/80*; Durant Point, *VK-582*; Nebles Point, *BJ-24 & 55*; Green Point, *BJ-40*. **MARIAN COVE**. North Spit, *BJ-143*. **BARTON PENINSULA**. Winship Point, *BJ-186*. **POTTER PENINSULA**. Three Brothers Hill, *BJ-164*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Bonner & Lewis-Smith, 1985; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1981, 1986, 1987b); Admiralty Bay (Robinson, 1972; Przywara *et al.*, 1984; Ochyra, 1984b; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Lightowlers, 1986a; Kanda, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Okada & Kanda, 1994).

Syntrichia princeps (De Not.) Mitt., J. Linn. Soc. Bot. Suppl.1: 39. 1859. FIG. 93

Tortula princeps De Not.
T. grossiretis Card.
T. heteroneura Card.
T. conferta Bartr.
T. princeps De Not. var. *conferta* (Bartr.) Light.
Syntrichia conferta (Bartr.) Zand.

Plants medium-sized to large, 0.5–5.0 cm tall, forming hoary, brownish-green to reddish-brown or blackish cushions or turfs. Leaves twisted around the stem when dry, wide-spreading to squarrose-recurved when wet, 0.5–3.5 mm long (excluding hair-point), 0.3–1.3 mm wide, broadly oblong to lingulate or ovate-lingulate, obtuse or rounded to emarginate, ending abruptly in a long, 0.2–1.6 mm, hyaline or reddish, spinulose awn, sometimes reduced to a short, smooth to crenate apiculus, occasionally absent; leaf margins entire, plane, recurved or revolute in the lower two thirds or more; costa reaching leaf apex or becoming obscure or disappearing in the upper leaf; upper cells irregularly hexagonal, green and often opaque, densely papillose on both surfaces with C-shaped papillae; basal cells rectangular to linear, hyaline. Synoecious, autoecious or dioecious. Setae 10–15 mm long, red; capsules 1.8–3.2 mm long, erect, cylindrical; peristome teeth 32, orange to salmon-pink, arising from a high, pale basal membrane forming a tube, twisted into a dextrorse helix. Spores 10–15 μm in diameter.

Ecology. — A common species found in a range of habitats on soil and rocks, on peaty soil and humus on rock ledges, outcrops and moraines, on gravel and stones by streams, often near seabird colonies, generally distributed in open and sheltered, dry and moist habitats. It is a frequent but not abundant associate of communities dominated by the two native species of vascular plant.

Phytogeography. — **Bipolar** – In the Northern Hemisphere warm temperate, widespread in western and southern Europe and in Macaronesia; Near East east to the Himalayas; N Africa (Kramer, 1980); SW North America; Mexico. In the Southern Hemisphere widely distributed in temperate regions – Southern Africa; New Zealand; Australia; Central Andes (Peru, Bolivia); Patagonia; Falkland Is.; South Georgia; Îles Kerguelen (Lightowlers, 1986b); Bouvetøya; South Sandwich

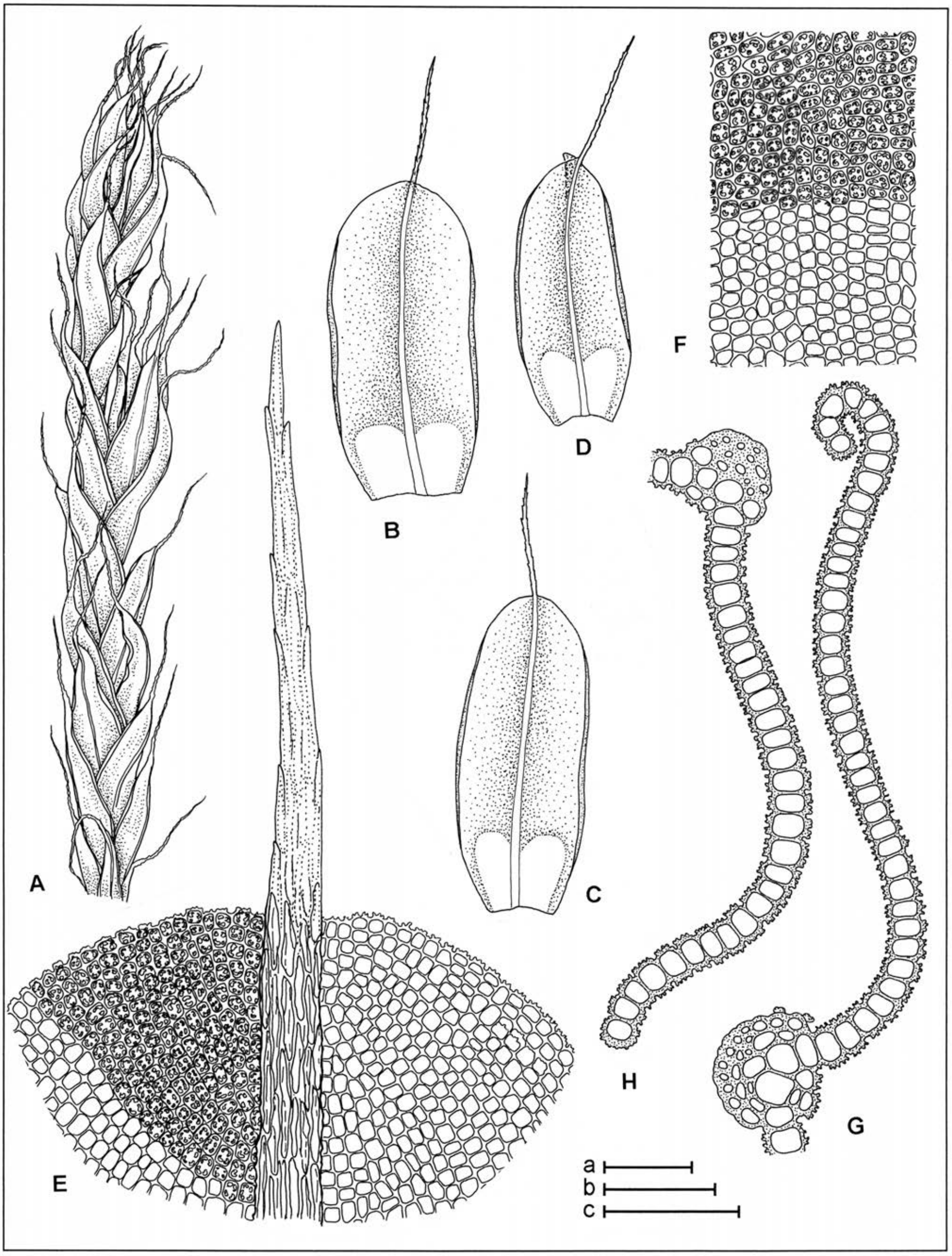


FIGURE 93. *Syntrichia princeps* (De Not.) Mitt. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells. — **G**–**H**. Cross-section of leaf (A from *Ochyra 963/80*; B & G–H from *Ochyra 1831/80*; C from *Ochyra 2690/80*; D–F from *Ochyra 5227/79*; all in KRAM). Scale bars: a – 1 mm (A); b – 100 µm (E–F); c – 1 mm (B–D) and 100 µm (G–H).

Is.; South Orkney Is.; South Shetland Is.; Antarctic Peninsula (from Trinity Peninsula to Alexander I.); Victoria Land (Greene, 1967).

Distribution on King George Island. — One of the commonest and most widespread species, occurring in most ice-free areas on the island (Fig. 94). Its elevational range extends from sea level to the summits of the highest nunataks.

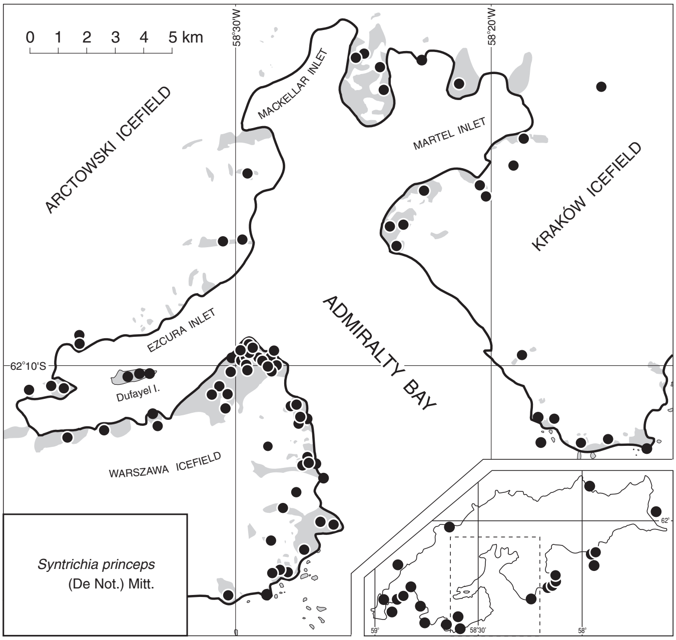


FIGURE 94. Distribution map for *Syntrichia princeps* (De Not.) Mitt. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1092/80* (BAE-162); Patelnia, 10 m, *1135/80* and 12 m, *1136/80*; Blue Dyke, 8 m, *1197/80*, 130 m, *1166/80 & 1179/80* and 135 m, *1141/80*; Bastion, 240 m, *1005/80*; Uchatka Point, 12 m, *1067/80*; Demay Point, 10 m, *1335/80* and 40 m, *1332/80*; Brama, 200 m, *785/80 & 786/80*. ***Ecology Glacier***: Siodło, 140 m, *768/80*; Agat Point, 15 m, *377/80* and 20 m, *360/80*; Sphinx Hill, 6 m, *408/80*, 95 m, *236/80*, 110 m, *248/80* (BAE-188) and 125 m, *195/80*; Czajkowski Needle, 230 m, *682/80*; Rescuers Hills, 3 m, *4904/79*, 10 m, *4885/79* and 110 m, *167/80*; Llano Point, 10 m, *4879/80*, 20 m, *4886/79* (BAE-184), 15 m, *4847/79* and 25 m, *4884/79* (BAE-187). ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 10 m, *705/80*; Rakusa Point, 8 m, *301/80* (BAE-135) and 10 m, *304/80 & 290/80*; Penguin Ridge, 40 m, *1412/80*; Jasnorzewski Gardens, 5 m, *1467/80 & 1480/80*; Shag Point and Latarnia Rocks, 4 m, *1554/80 & 1556/80*; Hala, 20 m, *5227/79* (BAE-112); Upłaz, 45 m, *1510/80 & 1528/80*; Point Thomas, 5 m, *1764/80* and 6 m, *1752/80* and 20 m, *Lindsay 691* (AAS, KRAM); Krzesanica, 50 m, *4984/79*; north-east branch of Panorama Ridge, 3 m, *4839/79* and 160 m, *1705/80*; Observatory Creek, 50 m, *4984/79* (BAE-87); Ambona, 85 m, *1628/80*; Skua Cliff, 100 m, *613/80* and 105 m, *609/80*; Ubocz, 97 m, *2369/80*, *2382/80 & 2382a/80*, 100 m, *5006/79* and 110 m, *4990/79 & 5008/79*; Krokiew, 165 m, *1680/80*; Jersak Hills, 200 m, *5098/79 & 5099/79*. ***Ezcur-***

ra Inlet: Kasprowy Hill, 160 m, *163/80*, 250 m, *162/80*; Italia Valley, 5 m, *5075/79*; unnamed hills on Wróbel Glacier, 160 m, *153/80*; Breccia Crag, 1 m, *921/80*, 2 m, *930/80* and 50 m, *918/80*; Cytadela, 10 m, *963/80* and 20 m, *965/80*; Scalpel Point, 20 m, *1799/80*; Pond Hill, 40 m, *1831/80* (BAE-36) and 130 m, 19 Jan 1980, *Ochyra s.n.*; Emerald Point, 15 m, *846/80* and 20 m, *830/80*. ***Dufayel Island***: Gdynia Point, 8 m, *1778/80*; Sopot Peak, 10 m, *1836/80* and 190 m, *1574/80 & 1576/80*. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2280/80* and 250 m, *2255/80*. Komandor Peak, 230 m, *1931/80*. ***Keller Peninsula***: without specific locality, *VK-939, 947 & 948* and *Schuster 69-939 & 69-955* (US); west side of the peninsula, 10 m, *Lindsay 833* (AAS, KRAM); Ore Point, 10 m, *508/80* and 90 m, *451/80*; Moraine Point, 50 m, *467/80*; Yellow Point, 40 m, *500/80*. ***Martel Inlet***: Stenhouse Bluff, 4 m, *2615/80* and 30 m, *2590/80*; Ullman Spur, 15 m, *567/80*; Ternyck Needle, 430 m, *1835/80*; Szafer Ridge, 230 m, *2566/80 & 2574/80*; Tern Nunatak, 255 m, *2513/80*, 260 m, *2511/80 & 2516/80* and 265 m, *2521/80*; Warkocz, 200 m, *2526/80 & 2548/80* and 250 m, *2547/80*; Smok, 45 m, *2070/80*, 50 m, *2069/80* and 80 m, *2690/80* (BAE-60); Basalt Point, 10 m, *2200/80* and 15 m, *2206/80*; Mount Wawel, 25 m, *2128/80* and 40 m, *2122/80 & 2125/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 150 m, *2750/80* and 200 m, *2740/80*. Vauréal Peak, 80 m, *5238/79*; Cape Vauréal, 20 m, *5227/79*; Chabrier Rock, 6 m, *1873/80*; Cape Syrezol, 10 m, *1851/80*; Harnasie Hill, 180 m, *1839/80*; Martins Head, 20 m, *1866/80*. LEGRU BAY. Malczewski Point, *BJ-13*; Cinder Spur, 30 m, *BJ-2*; Low Head, *BJ-87*; Chopin Ridge, *BJ-90*. KING GEORGE BAY. Lions Rump, *BJ-96 & BJ-99*; Turret Point, *BJ-131 & BJ-135*; Penguin Island, *Lindsay 809* (AAS, KRAM) and *BJ-65 & BJ-70*. SHERRATT BAY. Three Sisters Point, *BJ-121 & BJ-124*. DESTRUCTION BAY. Trowbridge Island, *BJ-9*. DRAKE PASSAGE. Gam Point, *BJ-10*; Cieślak Point, *BJ-16*; Bell Island, 15 m, *BJ-4*. FILDES PENINSULA. Bellingshausen Station, 10 m, *2410/80* (BAE-58) *& 2433/80* and 15 m, *2414/80 & 2416*; Ardley Island, *Kühnemann 278A* (AAS, KRAM); Suffield Point, 50 m, *2446/80*; Nebles Point, *BJ-25, BJ-51 & BJ-56*; Green Point, *BJ-21*, *BJ-22 & BJ-42*. MARIAN COVE. North Spit, *BJ-155*. BARTON PENINSULA. Narębski Point, 6 m, *Lindsay 721* (AAS, KRAM). POTTER PENINSULA. Stranger Point, *BJ-109*; Three Brothers Hill, *BJ-162*; Florence Nunatak, 340 m, *1312/80*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Bonner & Lewis-Smith, 1985; Wu & Hu, 1990 as *Tortula ruralis*; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Robinson, 1972; Przywara *et al.*, 1984; Ochyra, 1984b; Ochyra *et al.*, 1986; Lightowlers, 1986a; Kanda, 1986, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Gumińska *et al.*, 1994; Okada & Kanda, 1994).

Syntrichia saxicola (Card.) Zand., Bull. Buffalo Soc. Nat. Sci. 32: 270. 1993.
FIG. 95

Tortula saxicola Card.
T. fuscoviridis Card.

Plants medium-sized, densely caespitose, 1–4 cm tall, blackish-brown. Leaves oblong-lanceolate or oblong, gradually tapering to a long acumen, carinate, erect and slightly twisted when dry, erecto-patent to patent when moist, 1.6–2.3 mm long; margins entire, weakly recurved to revolute in most or all of the lower two thirds; costa percurrent, or excurrent as a short, hyaline or reddish to yellowish-brown cusp, 0.1–0.3 mm long, strongly convex and papillose dorsally; upper cells subquadrate to hexagonal, densely papillose with C-shaped papillae on both faces; basal cells rectangular to linear, sometimes lax and inflated. Sterile.

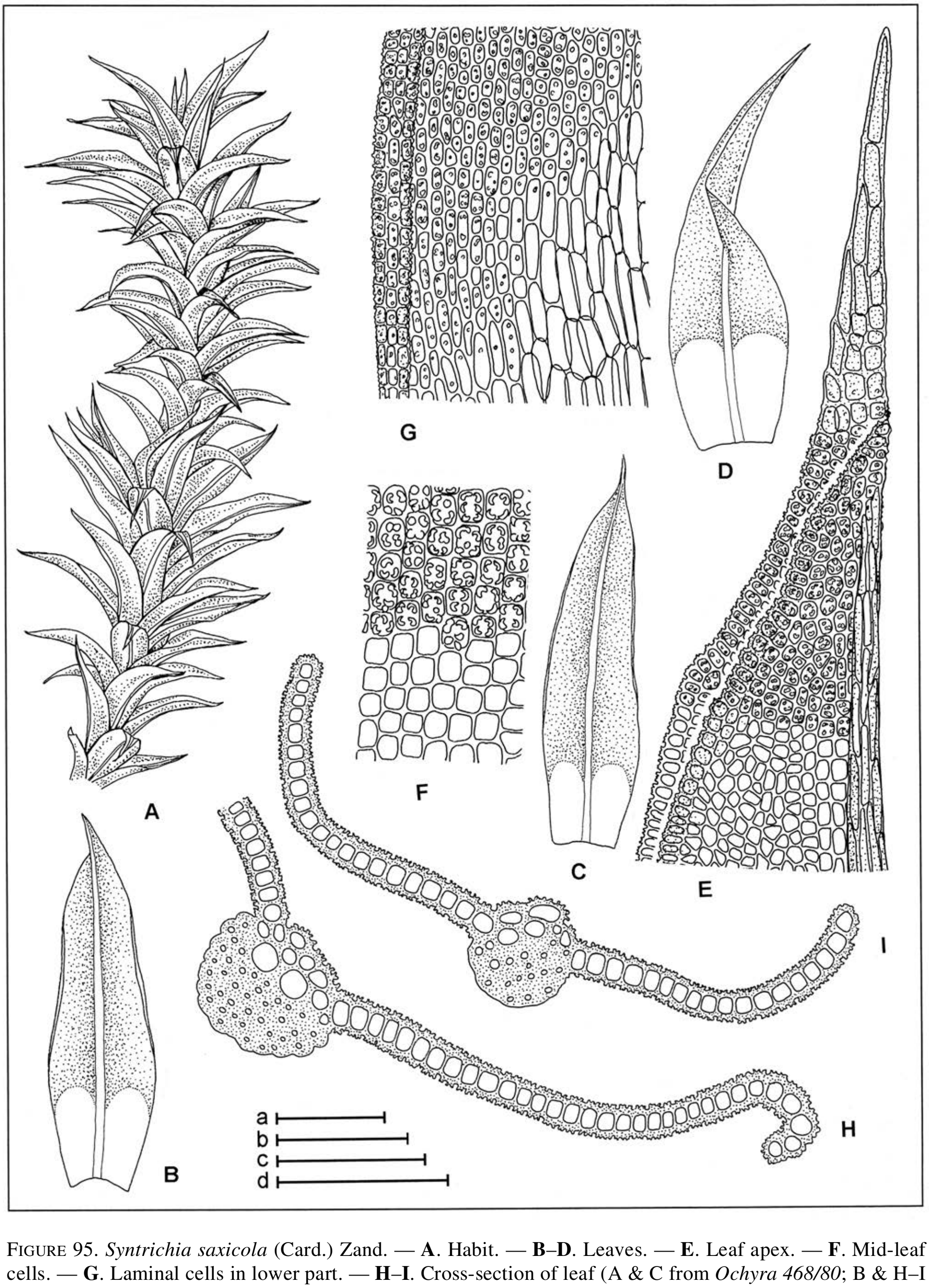


FIGURE 95. *Syntrichia saxicola* (Card.) Zand. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells. — **G**. Laminal cells in lower part. — **H**–**I**. Cross-section of leaf (A & C from *Ochyra 468/80*; B & H–I from *Ochyra 957/80*; D from *Ochyra 121/80*; E from *Skottsberg 298*, type of *Tortula fuscoviridis*, S; F from *Ochyra 411/80*; G from *Skottsberg 62*, type of *Tortula saxicola*, S; all in KRAM unless otherwise stated). Scale bars: a – 50 µm (A); b – 100 µm (F); c – 1 mm (B–D) and 100 µm (E); d – 2 mm (A).

Ecology. — Restricted to rock faces, crevices, rock ledges and outcrops, usually in dry, sheltered situations.

Phytogeography. — **Amphiatlantic Subantarctic** – South Georgia; Îles Kerguelen; South Orkney Is.; South Shetland Is.; Tierra del Fuego; Magellanian Channels (Lightowlers, 1986a, 1986b; Ochyra, 1997b).

Distribution on King George Island. — A common and locally abundant species widespread throughout the Admiralty Bay area and along the Bransfield Strait coast (Fig. 96). It does not seem to have elevational preferences and occurs from sea level to the summits of the highest nunataks.

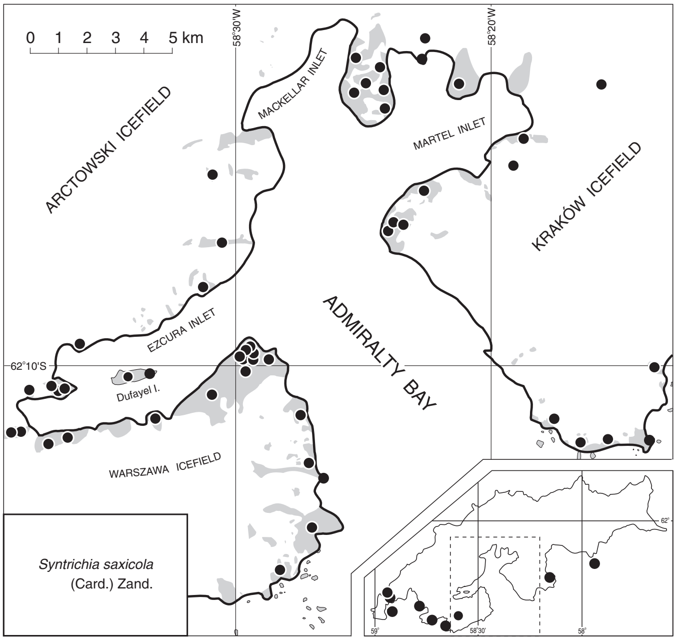


FIGURE 96. Distribution map for *Syntrichia saxicola* (Card.) Zand. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 130 m, *1165/80* (BAE-86); Creeping Slopes, 60 m, *1230/80*. ***Ecology Glacier***: Agat Point, 6 m, *413/80*; Sphinx Hill, 6 m, *411/80* (BAE-59) and 125 m, *213/80*; Rescuers Hills, 100 m, *172/80*. ***Point Thomas***: Hala, 35 m, *2394/80*; Krzesanica, 65 m, *4978/79* and 100 m, *1655/80*; Ambona, 70 m, *1727/80* and 85 m, *1632/80*; Skua Cliff, 105 m, *634/80*; Ubocz, 180 m, *5123/79*; Krokiew, 165 m, *1692/80*; south-western branch of Panorama Ridge, 160 m, *1706/80*. ***Ezcurra Inlet***: Italia Valley, 90 m, *121/80* (BAE-85); Breccia Crag, 145 m, *925/80*; Cytadela, 10 m, *962/80* and 100 m, *957/80* (BAE-35); Belweder, 90 m, *1588/80* and 150 m, *1587/80*; Scalpel Point, 160 m, *1804/80*; Barrel Point, 3 m, *893/80*; Pond Hill, 40 m, *861/80 & 1828/80* and 130 m, *868/80*; Emerald Point, 10 m, *831/80*; Urbanek Crag, 4 m, *1769/80*. ***Dufayel Island***: Gdynia Point, 10 m, *1836a/80* and 15 m, *1782/80* and 95 m, *1765/80*; Sopot Peak, 4 m, *1578/80*. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2276/80*; Misty Nunatak, 220 m, *2307/80*. ***Keller Penin-***

sula: Ore Point, 8 m, *523/80* and 90 m, *447/80*; Round Hill, 20 m, *548/80*; British Point, 5 m, *455/80 & 461/80*; Moraine Point, 40 m, *468/80* (BAE-138) and 50 m, *474/80*; Yellow Point, 30 m, *493/80* and 40 m, *498/80*; Tyrrell Ridge, 200 m, *436/80*. ***Martel Inlet***: Shark Fin, 145 m, *2714/80*; Stenhouse Bluff, 30 m, *2594/80*; Ullman Spur, 12 m, *562/80* (BAE-111); Ternyck Needle, 430 m, *1836/80*; Szafer Ridge, 230 m, *2576/80*; Tern Nunatak, 260 m, *2502/80*; Smok, 50 m, *2099/80*; Point Hennequin, 10 m, *2247/80*; Mount Wawel, 120 m, *2147/80 & 2195/80* and 140 m, *2184/80*. ***Viéville Glacier***: Vauréal Peak, 80 m, *5239/79*; Cape Syrezol, 15 m, *1864/80 & 1865/80*; Harnasie Hill, 190 m, *1838/80*; Martins Head, 210 m, *1870/80*; Stańczyk Hill, 140 m, *1847/80*. **KING GEORGE BAY**. Lions Rump, *BJ-94*; Penguin Island, *BJ-73*. **FILDES PENINSULA**. Gemmel Peaks, *2474/80*; Flat Top Peninsula, *Li FW3*(AAS); Geologist Island, *Li DEN7* (AAS); Ardley Island, *Kühnemann 17, 21, 59B & 148* (AAS, KRAM); Suffield Point, 50 m, *2445/80*. **MARIAN COVE**. North Spit, *BJ-149*. **BARTON PENINSULA**. Winship Point, *BJ-189*. **POTTER PENINSULA**. Three Brothers Hill, *BJ-166*; Florence Nunatak, 340 m, *1313/80*.

Literature records. — Fildes Peninsula (Putzke & Pereira, 1990; Wu & Hu, 1990 as *Barbula unguiculata*; Chen *et al.*, 1993, 1995; Li *et al.*, 1998; Hu, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Przywara *et al.*, 1984; Ochyra, 1984b; Ochyra *et al.*, 1986; Lightowlers, 1986a; Kanda, 1987b; Myrcha *et al.*, 1991; Okada & Kanda, 1994).

POTTIACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Barbula unguiculata Hedw.

This species was reported by Wu and Hu (1990) from the Fildes Peninsula, its first record from the Antarctic. Unfortunately, the original material (King George Island, along the coast of the Bay of the Fildes Peninsula, *Wei 8412*, KRAM) is a typical expression of *Syntrichia saxicola*. Accordingly, *Barbula unguiculata* must be withdrawn from the Antarctic moss flora. This species is essentially pan-Holarctic in distribution, having some localities in South America in Uruguay (Greene, 1986).

Sarconeurum glaciale (Müll. Hal.) Card. & Bryhn *in* Card.

Chen *et al*. (1993, 1995) reported this species from Two Summit Island near the Fildes Peninsula. This report is based upon a misdetermination and the voucher collection actually represents *Didymodon gelidus*. *S. glaciale* had long been considered to represent the only endemic Antarctic moss genus until Greene (1975) extended its range to Tierra del Fuego. The species has a circumantarctic distribution along the peripheries of the continent and its only localities in the South Shetland Islands are on Deception Island (Greene *et al*., 1970).

Syntrichia geheebiopsis (Müll. Hal.) Zand.

This species was reported from two localities on the Fildes Peninsula (Chen *et al*., 1993, 1995), its first and only report from within the Antarctic. Actually the voucher collections represent *Syntrichia saxicola*, so the species must be withdrawn from the flora of the Island and the Antarctic. *S. geheebiopsis* is a rare subantarctic species, known from Îles Kerguelen, South Georgia and Isla de los Estados (Lightowlers, 1986b).

Syntrichia ruralis (Hedw.) Web. & Mohr

Wu and Hu (1990) reported this species from King George Island as *Tortula ruralis* (Hedw.) C. F. Gaertn., B. Mey. & Scherb., another first Antarctic record. It was, however, based on a misdetermination and examination of the voucher collection (north coast of the Fildes Peninsula, *Wei 8086A*, KRAM) revealed it to be a typical expression of *Syntrichia princeps*. *S. ruralis* is essentially a Northern Hemisphere species, found rarely in Southern Africa (Magill, 1981) and South America (Greene, 1986). It has leaves narrowed near the middle, and larger upper (about 14 μm wide) and basal (about 25 μm) laminal cells; in *S. princeps* the leaves are widest about one third of the way up from the base and then taper to the apex, with upper and basal cells about 10 and 15 μm wide, respectively. *S. princeps* is sometimes defined by its being synoecious and in possessing a central strand in the stem, but austral populations from South Georgia (and Antarctica) are often autoecious, paroecious or dioecious (Lightowlers, 1985), and the central strand is often absent or very indistinct in Antarctic plants. Therefore in the case of Antarctic material one must rely on gametophyte features to separate *S. princeps* from *S. ruralis*.

GRIMMIACEAE

The Grimmiaceae are a large and very widely distributed family of acrocarpous mosses whose members are mostly primary colonizers of bare rock faces and exposed ground. This has resulted in the adaptation of many of them to xeric habitats, although a fair number are aquatic or hygrophytic. They are particularly common at higher elevations in mountains and/or in cold and polar regions of both hemispheres. The family is too diversified to be characterized except in generalities. The grimmiaceous mosses typically have lanceolate leaves very often terminated by a hyaline hair-point, small and thick-walled laminal cells, mostly undifferentiated alar cells and a haplolepidous peristome which is extremely variable in structure. Although they are basically acrocarpous mosses, many species show a tendency toward pleurocarpy, producing sporophytes at the tips of branches. The family comprises about 350–400 species in twelve genera, some of which are very large and taxonomically difficult. In the Antarctic the Grimmiaceae are the richest family of mosses, comprising 18 species in three genera. Some are very widespread and abundant in a variety of habitats and play an important role in the terrestrial vegetation.

KEY TO THE KING GEORGE ISLAND GENERA OF THE GRIMMIACEAE

1. Plants decumbent, branching; laminal cells in mid-leaf elongate with strongly thickened, nodose-sinuate cell walls; peristome teeth split nearly to the base into 2–3 filiform branches; central strand of stem lacking .... *Racomitrium*
1. Plants erect, tufted; laminal cells in mid-leaf mostly short and straight-walled, if with nodulose-sinuate walls then capsule immersed; peristome teeth entire or cleft only above the middle or perforate; central strand of stem present or absent 2
   2. Capsules sessile and immersed, symmetric; seta straight; columella attached to operculum after dehiscence .... *Schistidium*
   2. Capsule exserted or if immersed then ventricose on a cygneous seta; columella remaining in urn after dehiscence .... *Grimmia*

GRIMMIA

Grimmia Hedw., Spec. Musc. Frond.: 75. 1801.

A cosmopolitan genus comprising species which are primary colonists predominantly found on bare rocks and therefore markedly xerophytic in structure. The distinctive features include the presence of an annulus, the calyptra covering the operculum and part of the urn, and the columella remaining in the urn after dehiscence. The genus is one of the most difficult taxonomically and the frequently sterile condition of the plants is responsible for many misidentifications. In the Antarctic *Grimmia* is not well represented, in terms of frequency, cover and number of species. Four species are currently known to occur in this biome (Ochyra, 1993c), one of which is very rare in the study area.

Grimmia reflexidens Müll. Hal., Syn. Musc. Frond. 1: 795. 1849. FIG. 97

Grimmia grisea Card.
G. donniana auct. antarct. *non* Sm.
G. donniana Sm. fo. *antarctica* Kuc

Small, erect plants, 0.5–1.5 cm tall, forming compact, olive-green tufts, mostly hoary owing to the long hyaline hair-points. Leaves imbricate, erecto-patent to patent when wet, keeled, 0.9–1.8 mm long (excluding hair-point), ovate to oblong-lanceolate, with short or long, hyaline, terete hair-point; margins entire, plane or recurved in the lower half on one side, bi- or tristratose above; costa ceasing below the apex, dorsally convex; upper laminal cells irregularly quadrate with incrassate walls, 8–12 µm wide, bistratose, becoming elongate downwards; basal cells rectangular, 2–5 times as long as wide, with thick, straight walls. Autoecious. Setae straight, 1.3–2.5 mm long; capsule exserted, erect, ovoid to obloid, 0.8–1.2 mm long, straw-coloured, with 4–8 stomata at base; operculum conical or shortly rostrate; peristome teeth 16, orange-brown to light brown, papillose, lanceolate. Spores small, 11–13 µm in diameter, minutely papillose.

Remark. — This species has long been known in the Northern Hemisphere as *Grimmia sessitana* De Not., but Muñoz (1998) has shown that it is conspecific with the neglected South American *G. reflexidens*, the latter name having priority. All Antarctic records of *G. donniana* Sm. (e.g. Cardot, 1901, 1908, 1913; Kuc,

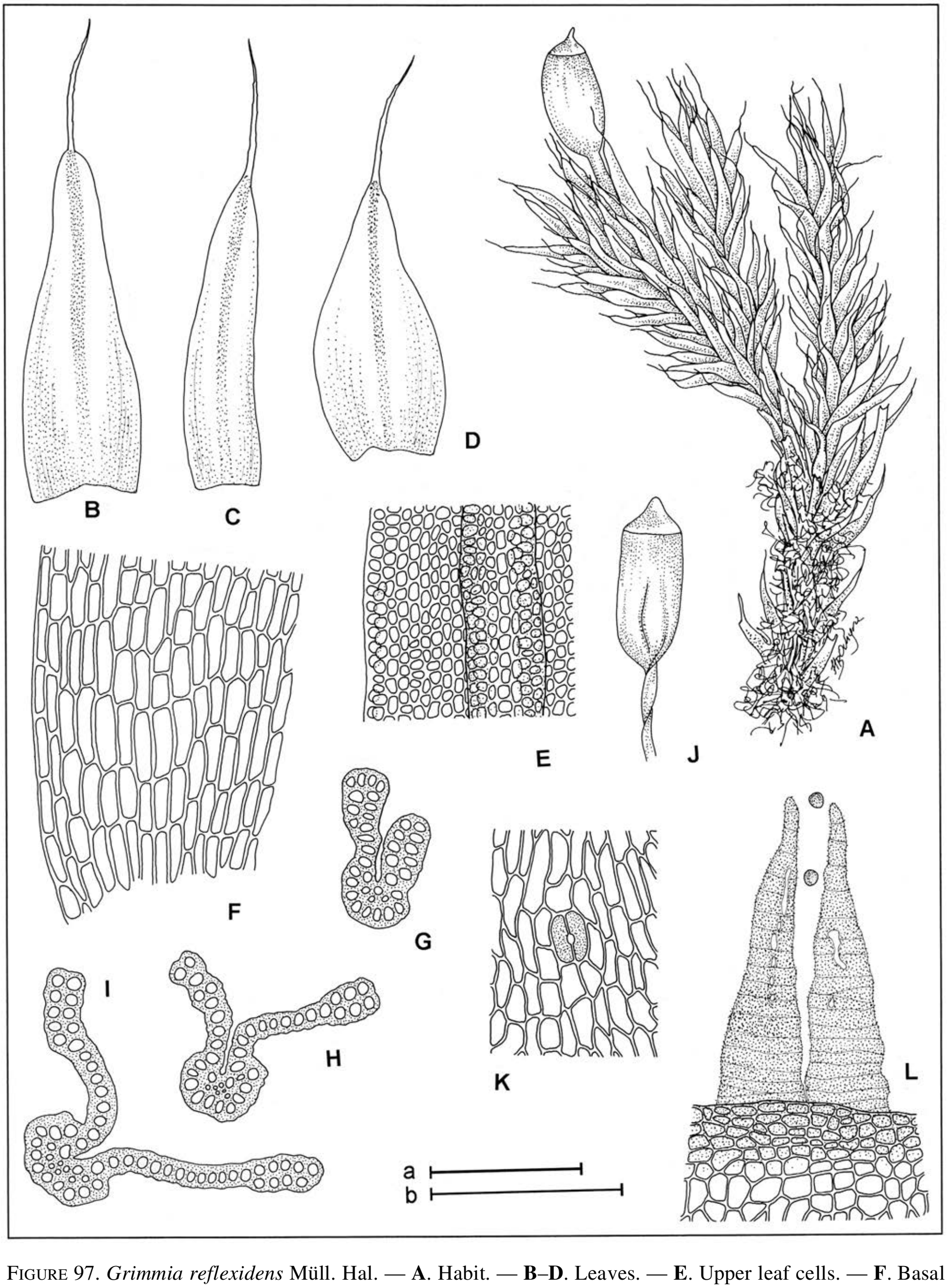


FIGURE 97. *Grimmia reflexidens* Müll. Hal. — **A**. Habit. — **B–D**. Leaves. — **E**. Upper leaf cells. — **F**. Basal cells. — **G–I**. Cross-sections of leaf. — **J**. Capsule, dry. — **K.** Lower exothecial cells and stoma. — **L**. Portion of peristome (A, C from *Fukuchi 81*, NIPR; B, E–F, J from *Ochyra 627/80*, KRAM; D from *Gain 231c*, PC; G–I from *Fukuchi 34*, NIPR; K–L from *Lewis-Smith As-1*, KRAM). Scale bars: a – 1 mm (J) and 100 µm (E–I & K–L) ; b – 1 mm (B–D) and 2 mm (A).

1969; Savicz-Lyubitskaya & Smirnova, 1970; Robinson, 1972) should actually be referred to this species.

Ecology. — On a dry and exposed acidic andesite rock face.

Phytogeography. — **Bipolar** – In the Northern Hemisphere *Grimmia reflexidens* has a wide but disjunct, arctic-alpine range, being particularly frequent in Europe and very rare in eastern North America. In the Southern Hemisphere it is commonest in the Antarctic (Queen Mary Land; Enderby Land; Victoria Land; South Orkney Is.; South Shetland Is.; West and East Antarctic Peninsula; Charcot I.; Alexander I.); South America (Valdivian region); East Africa (Uganda).

Distribution on King George Island. — An exceedingly rare species known only from a single station in the Admiralty Bay area (Fig. 82).

Specimen examined from King George Island. — ADMIRALTY BAY. ***Point Thomas***: Skua Cliff, 45 m, *627/80*.

Literature records. — Admiralty Bay (Myrcha *et al.*, 1991 as *G. grisea*).

RACOMITRIUM

Racomitrium Brid., Mant. Musc.: 78. 1819.

The genus has a cosmopolitan distribution but is confined to cool climatic regimes, so is restricted to mountain summits within the tropics. It comprises about 65 species (Bednarek-Ochyra, 1995), but additional species are expected as progress is made in revisionary studies of exotic taxa. The strongly nodose lateral walls of the basal laminal cells, and usually also of the upper leaf cells, are a significant feature of the genus, although there is a suggestion of the same type of thickening in some species of *Grimmia* and *Schistidium.* The lack of a central strand in the stem, the pleurocarpous manner of growth and the deeply split peristome teeth are also of generic importance. In the Antarctic four species of the genus have been found, mostly on the volcanic islands of the South Sandwich Islands archipelago and on Deception Island in the South Shetland Islands group, but in general they are not a prominent element in the flora. *Racomitrium* has been revised taxonomically for Tierra del Fuego (Roivainen, 1955) and South Georgia (Bell, 1974) and some species occurring in Antarctica have been dealt with by Deguchi (1984) and Frisvoll (1986). Nonetheless, some groups within *Racomitrium*, especially the *R. crispulum* complex, need reassessment in the Southern Hemisphere.

Racomitrium sudeticum (Funck) Bruch & Schimp. *in* B., S. & G., Bryol. Eur. 3: 141, *pl. 264*. 1845 [Fasc. 25–28 Mon. 7, *pl. 1*]. FIG. 98

Trichostomum sudeticum Funck

Racomitrium austrogeorgicum Par.

R. substenocladum Card.

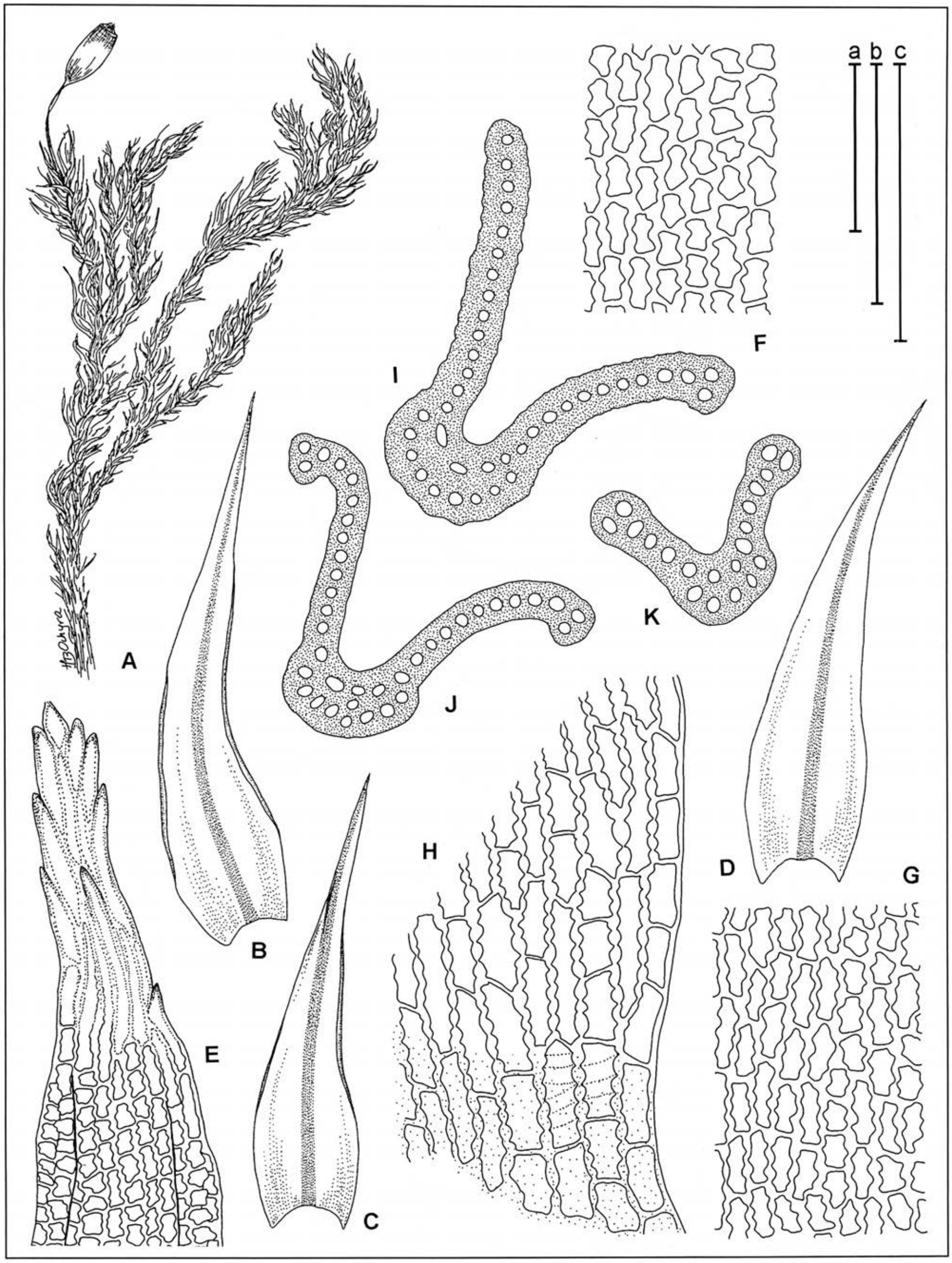


FIGURE 98. *Racomitrium sudeticum* (Funck) Bruch & Schimp. *in* B., S. & G. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Upper laminal cells. — **G**. Mid-leaf cells. — **H**. Alar cells. — **I**–**K**. Cross-sections of leaf (A from *Bell 169*; B & I from *Ochyra 599/80*; C from *Corner 465*; D–E & G from *Ochyra 506/80*; F & K from *Ochyra 535/80*; H & J from *Will 53*, lectotype of *Grimmia austropatens*, HBG; all in KRAM unless otherwise stated). Scale bars: a – 100 µm (F–H); b – 100 µm (I–K) and 1 mm (B–D); c – 0.5 cm (A).

Plants forming loose or dense cushions, green above, brown to blackish-brown below. Stems 0.5–4.5 cm high, dichotomously branched. Leaves imbricate when dry, erecto-patent and often recurved when wet, 1.5–2.3 mm long, narrowly lanceolate, with a short, 0.1–0.2 mm long, hyaline, bluntly denticulate hyaline hair-point, sometimes muticous; margins irregularly revolute on one or both sides for varying distances above the base, bistratose above; costa subpercurrent, strongly convex dorsally, bistratose above, tristratose in the middle and at base; upper laminal cells shortly rectangular or rounded-quadrate, weakly sinuose, becoming elongate in the middle, with strongly sinuose-nodose lateral walls; basal cells somewhat broader, porose; basal marginal cells weakly differentiated, of 2–3 yellowish, slightly sinuose and pellucid cells. Sterile.

Remark. — The species has long been known in Antarctica under local names, *Racomitrium austrogeorgicum* and *R. substenocladum*, but Frisvoll (1986) showed their identity with the Holarctic *R. sudeticum*, making the latter a bipolar species.

Ecology. — On rock ledges and outcrops, on stony ground among boulders and pebbles, usually in dry, sheltered situations, sometimes in moist places.

Phytogeography. — **Bipolar** – In the Northern Hemisphere the species has a strongly discontinuous, pan-Holarctic, boreal-montane range (Bednarek *et al.*, 1990; Bednarek-Ochyra, 1995). In the Southern Hemisphere it is rare and widely disjunct: SE Australia; Valdivian region; Tierra del Fuego; Magellanian Channels; Falkland Is.; South Georgia; South Orkney Is.; South Shetland Is.; West and East Antarctic Peninsula south to Cape Tuxen (Bell, 1973a).

Distribution on King George Island. — An infrequent species known only from the Admiralty Bay area and the Fildes Peninsula, occurring at lower elevations from sea level to about 80 m (Fig. 99).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Point Thomas***: Skua Cliff, 105 m, *621/80*. ***Ezcurra Inlet***: Pond Hill, 30 m, *862/80* and 40 m, *871/80*. ***Keller Peninsula***: Ore Point, 4 m, *504/80 & 506/80* (BAE-61); Speil Point, 2.5 m, *535/80* (BAE-38) and 3 m, *507/80*; Round Hill, 50 m, *541/80*. ***Martel Inlet***: Ullman Spur, 80 m, *599/80* (BAE-13). FILDES PENINSULA. Great Wall Station, 40 m, *Schulz 22* (KRAM) and *Li GWS28* (AAS).

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998 as *Racomitrium striatipilum*); Admiralty Bay (Bell, 1973a; Ochyra, 1984b; Ochyra *et al.*, 1986; Frisvoll, 1986; Putzke & Pereira, 1990; Myrcha *et al.*, 1991).

SCHISTIDIUM

Schistidium Bruch & Schimp. *in* B., S. & G., Bryol. Eur. **3**: 93. 1845 [Fasc. 25–28] Mon. 1], *nom. cons.*

This genus is not universally recognized by bryologists and is often merged with *Grimmia.* It differs, however, in its short, centrally attached setae, resulting in the deep immersion of the symmetric capsules in the perichaetial leaves, as well as in its systylious capsules. The number of species is now difficult to estimate, mostly because of the considerable taxonomic difficulties caused by some complexes, for example *S. apocarpum.* In a recent revision of this complex in Scandinavia

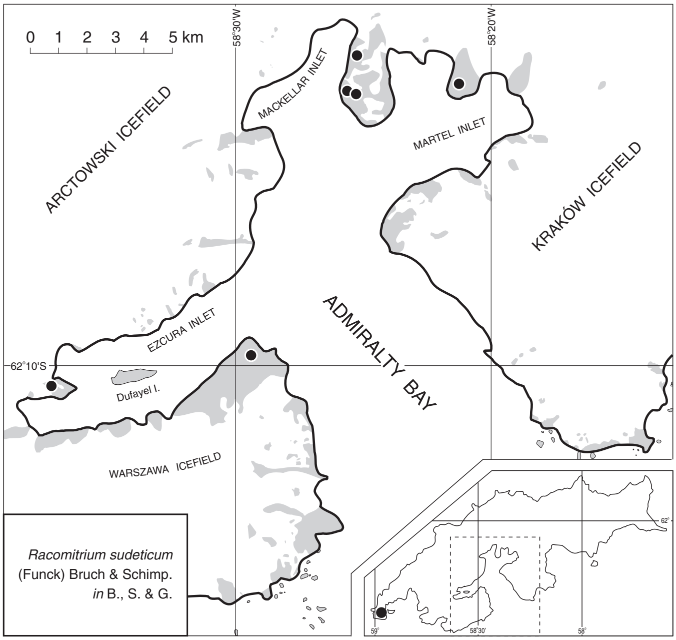


FIGURE 99. Distribution map for *Racomitrium sudeticum* (Funck) Bruch & Schimp. *in* B., S. & G. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Blom (1996) recognized no fewer than 31 species. This contradicts completely a former revision of the genus by Bremer (1980a, 1980b, 1981) who combined almost all exotic species with *S. apocarpum*, a totally unacceptable treatment. A revision of the antipodal taxa has revealed that *S. apocarpum* does not occur in this region at all. It is likely that *Schistidium* consists of about 100 species worldwide which are common in cool temperate to polar regions of both hemispheres but confined to altimontane elevations in the tropics. In the Antarctic *Schistidium* is the largest moss genus and some species are prominent constituents of the flora.

KEY TO THE KING GEORGE ISLAND SPECIES OF *SCHISTIDIUM*

1. Costa excurrent as a stout cuspidate point . . . . *S. falcatum*
1. Costa percurrent 2

 2. Peristome teeth rudimentary or completely lacking 3
 2. Perstome teeth well-developed 4

3. Leaf margins revolute throughout on both sides; leaves not ranked; peristome teeth vestigial or lacking . . . . *S. steerei*
3. Leaf margins narrowly recurved; leaves usually in distinct spiral ranks; peristome teeth variably reduced and rudimentary . . . . *S. antarctici*

 4. Plants of very moist to wet habitats; costa strong, 4–5-stratose in cross-section; spores 17–24 μm in diameter; leaves broadly ovate to broadly ovate-lanceolate, subobtuse, always lacking hair-point . . . . *S. rivulare*

4. Plants of dry habitats; costa weaker, 2–3-stratose in cross-section; spores 7–13 μm in diameter; leaves narrowly lanceolate to ovate-lanceolate, often piliferous 5

5. Plants hoary; leaves with spinulose-denticulate hair-point longer than 0.3 mm 6
5. Plants not hoary; leaves with smooth or denticulate hair-point shorter than 0.3 mm or muticous 7

6. Exothecial cells with strongly incrassate walls; upper laminal cells rectangular, strongly nodulose; central strand absent . . . . *S. urnulaceum*
6. Exothecial cells thin-walled; upper laminal cells isodiametric to oblong, straight-walled; central strand present . . . . *S. halinae*

7. Basal juxtacostal cells long rectangular to linear, slightly porose . . . . *S. cupulare*
7. Basal juxtacostal cells short-rectangular, non-porose 8

8. Laminal cells rectangular, strongly nodulose; leaves narrowly lanceolate; costa bistratose in cross-section; leaf margin unistratose; central strand absent . . *S. amblyophyllum*
8. Laminal cells isodiametric, rounded; leaves ovate-lanceolate; costa tristratose in cross-section; leaf margin bistratose above in 1–2 rows; central strand present . . *S. occultum*

Schistidium amblyophyllum (Müll. Hal.) Ochyra & Hertel, Polish Bot. Stud. 1: 26. 1991. FIG. 100

Grimmia amblyophylla Müll. Hal.
G. angustifolia Mitt.
Schistidium angustifolium (Mitt.) B. Bremer
Grimmia hyalinocuspidata Müll. Hal. *in* Neum.
Schistidium hyalinocuspidatum (Müll. Hal. *in* Neum.) B. G. Bell

Plants in short, compact cushions, yellow-green above, blackish-brown below. Stems 0.5–2.0 cm long, in cross-section without central strand. Leaves imbricate, straight, erect when dry, erect-spreading to erect when moist, 1.0–2.5 mm long, narrowly oblong-lanceolate to ovate-lanceolate, gradually acuminate, acute, non-piliferous or with a short hair-point; margins entire, plane or recurved on one or both sides for varying lengths, unistratose; costa convex on the dorsal side, channelled above, smooth on the back, in transverse section bistratose throughout; upper and median laminal cells rectangular to shortly oblong, with strongly incrassate and nodulose-sinuose walls; basal juxtacostal cells short-rectangular, thick-walled, with straight to slightly sinuose walls; basal marginal cells short-rectangular to quadrate, sinuose almost to the extreme base. Autoecious. Setae short, 0.2–0.4 mm long; capsules deeply immersed in the perichaetial leaves, light brown or yellowish-brown, 0.6–1.1 mm long, ovoid or obloid; operculum rostrate; peristome teeth lanceolate, finely papillose on both surfaces. Spores spherical, smooth, 8–10 μm in diameter.

Ecology. — On bare soil, in crevices of andesite rocks and on rock ledges, generally in dry and exposed situations in various communities of the fruticose lichen and moss cushion subformation.

Phytogeography. — **Amphiatlantic Subantarctic** – Îles Kerguelen; Marion I.; South Georgia; South Shetland Is.; Tierra del Fuego; Magellanian Channels; Valdivian region; Bolivia; Ecuador.

Distribution on King George Island. — An infrequent and widely scattered

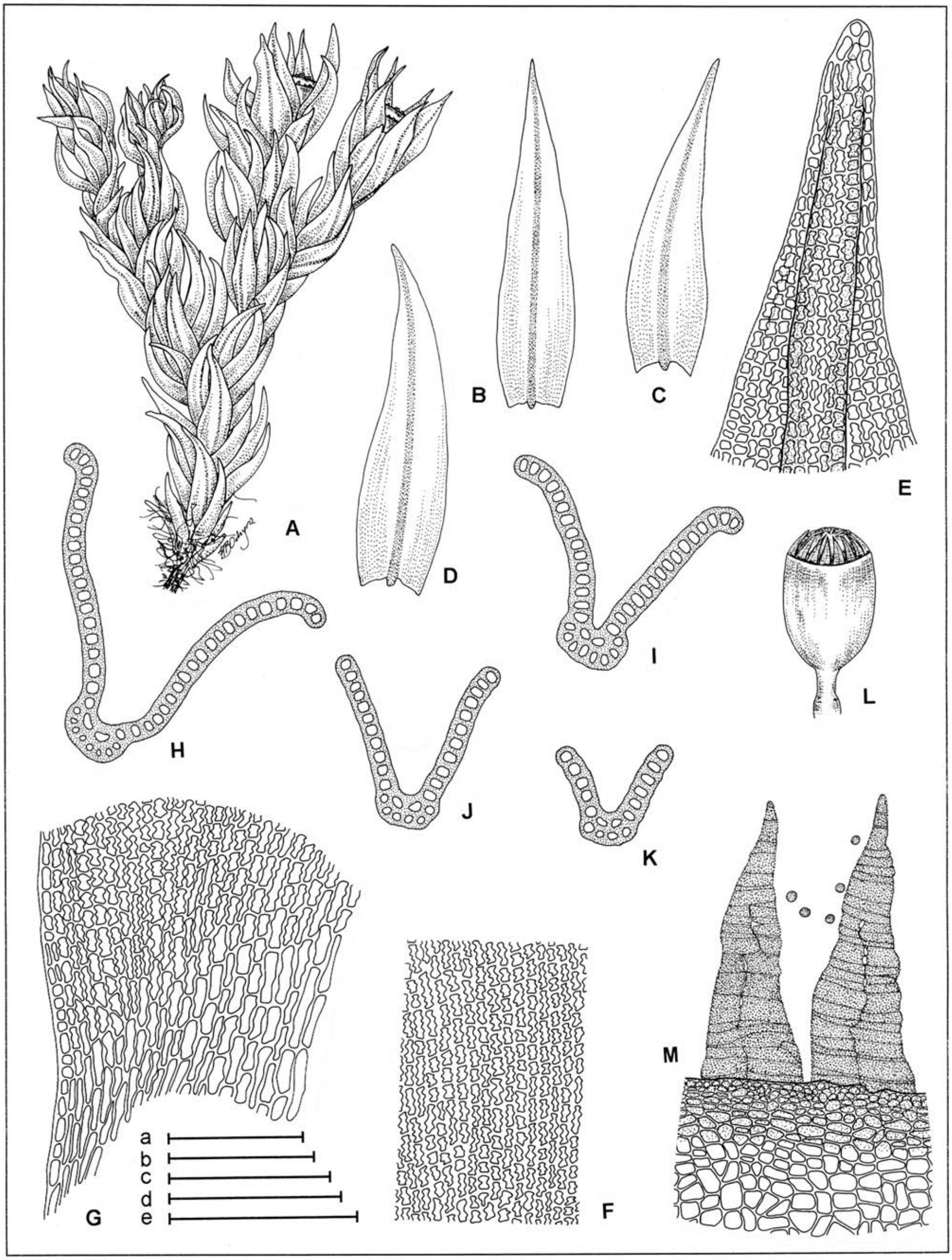


FIGURE 100. *Schistidium amblyophyllum* (Müll. Hal.) Ochyra & Hertel. — **A**. Habit. — **B–D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells. — **G**. Basal cells. — **H–K**. Cross-sections of leaves. — **L**. Operculate capsule, wet. — **M**. Portion of peristome and spores (A, F from *Lewis-Smith 5597A*; B, D–E, G–K from *Ochyra 913/80*; C from *Lewis-Smith 5674*; L from *Lewis-Smith 6917*; M from *Lewis-Smith 5669*; all in KRAM). Scale bars: a – 100 µm (E–G, L); b – 100 µm (H–K); c – 200 µm (M); d – 2 mm (A); e – 1 mm (B–D).

species, known exclusively from the Admiralty Bay area (Fig. 101), occurring at higher elevations from 80–360 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***. The Tower, 360 m, *1026/80*. ***Ezcurra Inlet***: Italia Valley, 80 m, *87/80*; Breccia Crag, 100 m, *913/80*; Urbanek Crag, 100 m, *2323/80*. ***Martel Inlet***: Shark Fin, 210 m, *2634/80*; Precious Peaks, 120 m, *2660/80*.

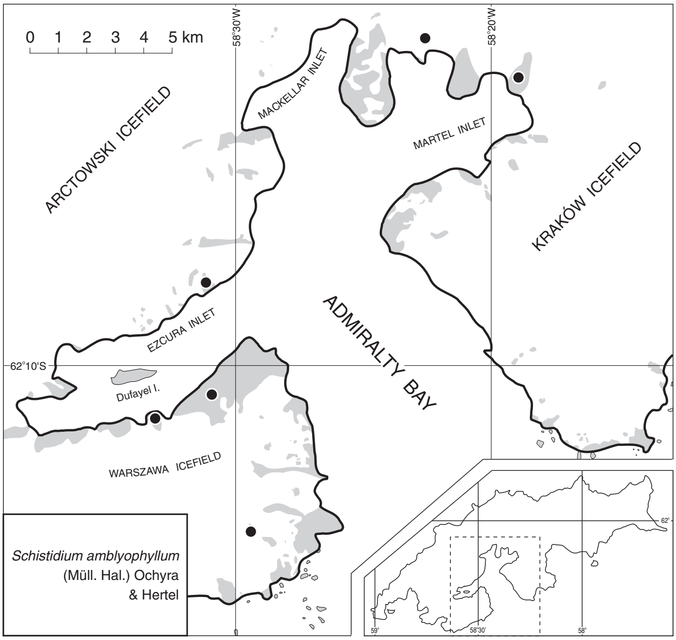


FIGURE 101. Distribution map for *Schistidium amblyophyllum* (Müll. Hal.) Ochyra & Hertel in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Literature records. — Chen *et al.* (1995) reported this species (as *Schistidium hyalinocuspidatum*) from many localities on the Fildes Peninsula. Examination of one voucher collection (*Li BA14*, AAS) showed it to be a typical plant of *S. antarctici*. Interestingly, these authors did not report *S. antarctici* at all from the Fildes Peninsula and probably all records cited by them refer to it as it is common in the area. Putzke and Pereira (1990) also cited this species (as *S. hyalinocuspidatum*) from King George Island, but without giving a specific locality. Unfortunately, this material has not been available for study.

Schistidium antarctici (Card.) L. I. Savicz & Smirnova, Nov. Sist. Nizsh. Rast. 1965: 252. 1965. FIG. 102

Grimmia antarctici Card.

G. antarctici var. *pilifera* Bartr.

G. antarctici var. *percompacta* Bartr.

Plants medium-sized, 1–2 cm tall, forming short, dense cushions, brown, reddish-brown or blackish-green to blackish. Leaves closely imbricate, straight, arranged in 3–4 distinct, spiral rows, erect when dry, erecto-patent when moist, 0.9–2.0(–2.5) mm long, 0.3–0.6 mm wide, narrowly ovate-lanceolate to oblong-lanceolate, gradually acuminate, terminating in a rather short (ca 0.5 mm) hyaline, nearly smooth hair-point or non-piliferous; margins recurved on both sides for varying lengths, unistratose to variously bistratose above in 1 row; costa percurrent, in cross-section bistratose above, 3(–4)-stratose in the middle and below; upper laminal cells quadrate to rounded-quadrate, becoming shortly rectangular in the middle, and rectangular to long rectangular below, with incrassate and weakly to strongly sinuose walls; basal juxtacostal cells short-rectangular; basal marginal cells hyaline, pellucid, quadrate to short-rectangular, with thickened cross-walls. Autoecious. Capsules deeply immersed in the perichaetial leaves, 0.9–1.1 mm long, ovoid or obloid; peristome teeth irregularly truncate, reduced, orange-red, finely granulose. Spores spherical, smooth, 8–10 μm in diameter.

Remark. — *Schistidium antarctici* is here reinstated as a species in its own right. It was considered to be conspecific with the Kerguelenian *S. chrysoneurum* (Ochyra *et al.*, 1986) but detailed taxonomic studies have shown that they are definitely distinct species. It is one of the most widespread moss species in the Antarctic, known from both the Peninsula region and the continent. Gametophytically, it is very variable, but its peristome with variously reduced teeth separate it immediately from all other congeners in this biome. Two varieties described by Bartram (1938) from Marie Byrd Land, *Grimmia antarctici* var. *pilifera* Bartr. (Type: Marie Byrd Land, Edsel Ford Range, Mt. Rea-Cooper, P. Siple, F. A. Wade, S. Corey & O. D. Standcliff 27 – Holotype: FH-Bartr!) and *G. antarctici* var. *percompacta* Bartr. (Type: King Edward VII Land: Rockefeller Mts., Mt. Helen Washington, P. Siple, F. A. Wade, S. Corey & O. D. Standcliff 68a – Holotype: FH-Bartr!), appear to be nothing other than habitat modifications characterized by the stunted habit of the plants because of the extremely severe climatic conditions. Consequently they do not seem to merit taxonomic recognition and both names are here reduced to synonymy with *S. antarctici*.

Ecology. — A rupicolous species growing on rock faces, ledges and outcrops, in rock fissures as well as on gravelly ground and scree, in both dry, exposed and moist, sheltered habitats. It is a common consituent of various associations within the fruticose lichen and moss cushion subformation.

Phytogeography. — **Antarctic Endemic** – Bouvetøya; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula (from Danco Coast to Adelaide I.); Charcot I.; East Antarctic Peninsula; Queen Maud Land; Princess Elizabeth Land; Wilhelm II Land; Queen Mary Land; Victoria Land; Queen Maud Mts; Marie Byrd Land (Fig. 28).

Distribution on King George Island. — One of the commonest of all moss species in the study area, occurring in most ice-free areas along the southern and south-western coasts, but, and surprisingly, absent (?undercollected) from the Drake Passage coast (Fig. 103) from near sea level to the summits of the highest nunataks (433 m).

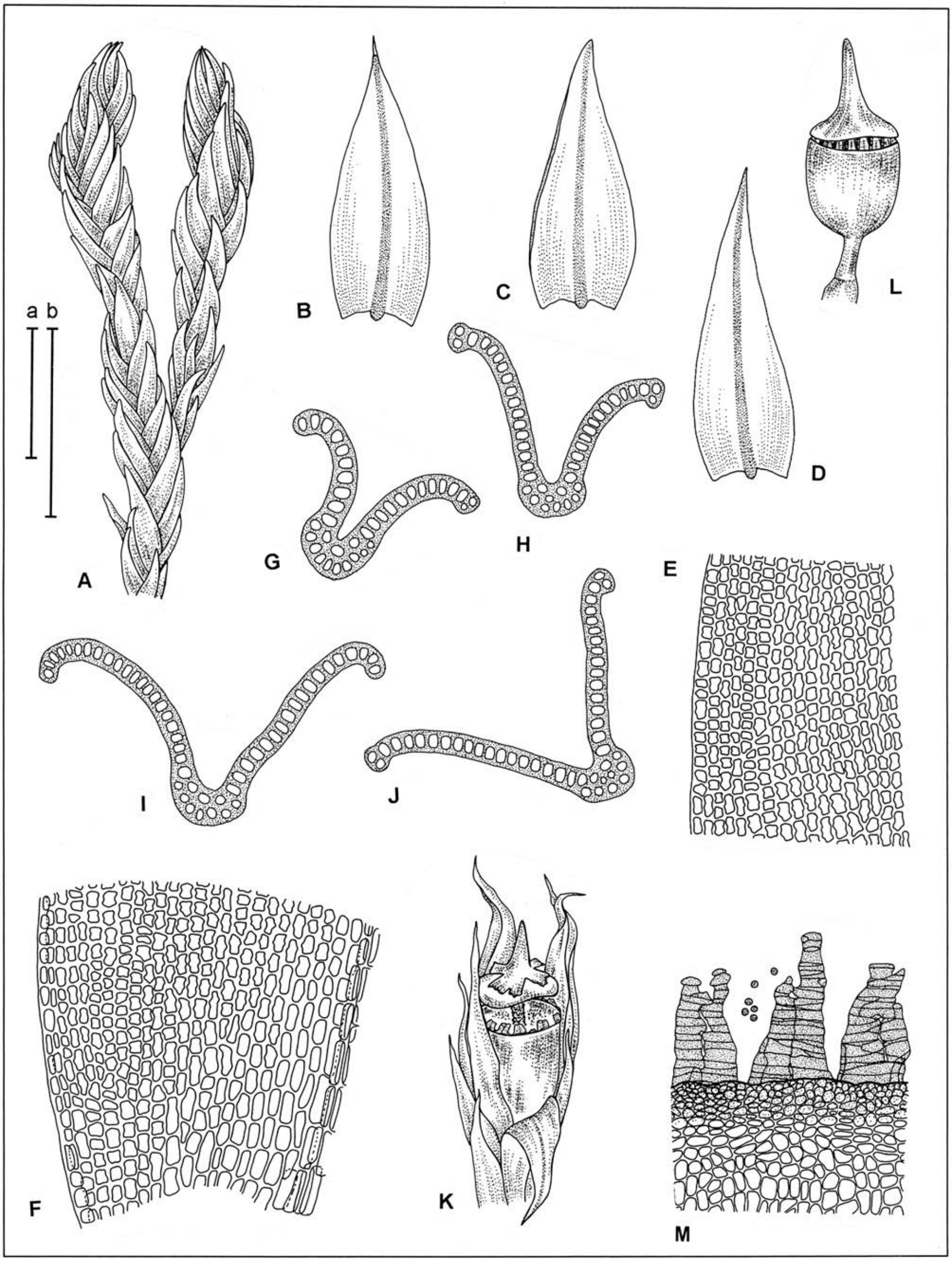


FIGURE 102. *Schistidium antarctici* (Card.) L. I. Savicz & Smirnova. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Mid-leaf cells at margin. — **F**. Basal cells. — **G–J**. Cross-sections of leaf. — **K**. Perichaetium. — **L**. Operculate capsule, wet. — **M**. Portion of peristome and spores (A, C from *Ochyra 441a/80*; B, E, L from *Ochyra 5055/79*; D, H, K, M from *Ochyra 952/80*; F, G, I from *Ochyra 2452/80*; J from *Ochyra 498*; all in KRAM). Scale bars: a – 1 mm (B–D, K–L), 100 µm (E–J) and 200 µm (M); b – 1 mm (A).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1124/80* and 110 m, *1117/80*; Blue Dyke, Blue Dyke, 4 m, *1209/80 & 1211/80*, 120 m, *1143/80*, 125 m, *1142/80* and 135 m, *1145/80*; The Tower, 310 m, *1041/80* (BAE-88) and 340 m, *813/80*; Bastion, 230 m, *1002/80* and 240 m, *978/80*; Demay Point, 50 m, *1387/80*; Creeping Slopes, 60 m, *1380/80*; Brama, 210 m, *798/80*. ***Ecology Glacier***: Siodło, 125 m, *728/80*, 135 m, *742/80* and 140 m, *749/80*; Sphinx Hill, 120 m, *648/80* and 125 m, *201/80*; Czajkowski Needle, 250 m, *673/80*, 265 m, *669/80 & 680/80* and 290 m, *666/80*; Rescuers Hills, 90 m, *169/80* and 100 m, *178/80*; Llano Point, 4 m, *4963/79* and 16 m, *4891/79*. ***Point Thomas***: Penguin Ridge, 60 m, *2396/80*; Upłaz, 45 m, *1529/80*; Krzesanica, 100 m, *4982/79* (BAE-37) and 175 m, *1667/80*; Ambona, 80 m, *1633/80*; Skua Cliff, 85 m, *642/80* (BAE-12), 90 m, *612/80*, 105 m, *606/80* and 106 m, *632/80*; Ubocz, 90 m, *4960/79 & 5014/79* (BAE-189)

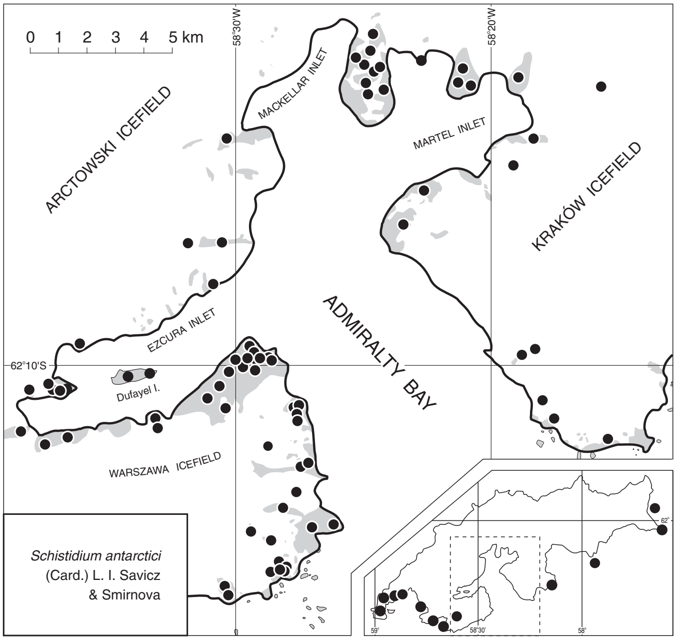


FIGURE 103. Distribution map for *Schistidium antarctici* (Card.) L. I. Savicz & Smirnova in the Admiralty Bay area. Inset: distribution of the species on King George Island.

and 125 m, *2370/80*; Krokiew, 130 m, *1684/80*, 165 m, *1674/80* and 168 m, *1690/80*; Jersak Hills, 160 m, *5055/79* and 180 m, *5140/79*; south-western branch of Panorama Ridge, 160 m, *1696/80*. ***Ezcurra Inlet***: Kasprowy Hill, 265 m, *78/80*; Italia Valley, 60 m, *54/80*; unnamed hills on Wróbel Glacier, 210 m, *138/80*; Breccia Crag, 40 m, *919/80* and 150 m, *915/80*; Cytadela, 80 m, *952/80* and 160 m, *970/80*; Belweder, 150 m, *1590/80*; Scalpel Point, 160 m, *1807/80*; Barrel Point, 60 m, *892/80*; Pond Hill, 50 m, *876/80*, 60 m, *881/80* and 125 m, *878/80*; Emerald Point, 12 m, *829/80*, 30 m, *823/80* and 50 m, *820/80*. ***Dufayel Island***: Gdynia Point, 8 m, *1780/80* and 190 m, *1581/80*. ***MacKellar Inlet***: Klekowski Crag, 130 m, *2299/80* and 250 m, *2271/80*; Wegger Peak, 310 m, *1995/80*. ***Keller Peninsula***: without specific locality, *Schuster 69-948, 69-949 pp. & 69-962* (US); Ore Point, 8 m, *527/80* and 70 m, *449/80*; Moraine Point, 30 m, *489/80*, 35 m, *477/80* (BAE-163) and 40 m, *480/80 & 488/80*; Yellow Point, 40 m, *499/80*; Mount Flagstaff, 110 m, *421/80*; Tyrrell Ridge, 220 m, *429/80*; Piasecki Pass, 205 m, *434/80* and 210 m, *435/80*; Mount Birkenmajer, 300 m, *441a/80*. ***Martel Inlet***: Stenhouse Bluff, 30 m, *2593/80*; Ullman Spur, 7 m, *565/80*, 30 m, *568/80 & 581/80*, 70 m, *566/80* and 100 m, *582A/80*; Precious Peaks, 120 m, *449/80*; Ternyck Needle, 430 m, *1837/80*; Szafer Ridge, 250 m, *2573/80*; Tern Nunatak, 255 m, *2514/80* (BAE-62) and 266 m, *2517/80*; Warkocz, 280 m, *2534/80 & 2660/80*; Smok, 10 m, *2068/80*; Mount Wawel, 80 m, *2172/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 150 m, *2731/80 & 2720/80* and 200 m, *2734/80*; Puchalski Peak, 150 m, *2699/80* and *2712/80*; Vauréal Peak, 40 m, *5236/79* and 45 m, *5248/79*; Harnasie Hill, 240 m, *1844/80*. KING GEORGE BAY. Low Head, *BJ-89*; Penguin Island, *BJ-72*. DESTRUCTION BAY. Cape Melville, *BJ-80*; Trowbridge Island, *BJ-8*. FILDES PENINSULA. Horatio Stump, *Li GWS3* (AAS); Bellingshausen Station, 10 m, *2415/80* and 15 m, *2407/80*; Ardley Island, *Kühnemann 53 & 278* (AAS, KRAM); Suffield Point, 50 m, *2444/80* and 60 m, *2442/80 & 2452/80* (BAE-89); Nebles Point, *BJ-162*. MARIAN COVE. North Spit, *BJ-151*. BARTON PENINSULA. Winship Point, *BJ-183*. POTTER PENINSULA. Three Brothers Hill, *BJ-158*; Florence Nunatak, 340 m, *1314/80*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977 as *Schistidium apocarpum*; Bonner & Lewis-Smith, 1985; Putzke & Pereira, 1990 as *S. apocarpum*); Admiralty Bay (Robinson, 1972; Przywara *et* al., 1984; Ochyra, 1984b; Ochyra *et al.*, 1986 as *S. chrysoneurum*; Kanda, 1987b; Putzke & Pereira, 1990 as *Schistidium apocarpum*; Myrcha *et al.*, 1991 as *S. chrysoneurum*; Okada & Kanda, 1994).

Schistidium cupulare (Müll. Hal.) Ochyra, Fragm. Flor. Geobot. 43(2): 105. 1998.
FIG. 104

Grimmia cupularis Müll. Hal.

Plants medium-sized, 0.5–1.0 cm tall, forming dense, yellow-green cushions. Leaves narrowly lanceolate, straight to somewhat falcate, erect when dry, erecto-patent when moist, 1.8–2.4 mm long, 0.3–0.5 mm wide, gradually acuminate, non-piliferous or terminated with a short (ca 0.4 mm), yellowish-hyaline or hyaline hair-point; margins narrowly recurved on both sides, 2–3-stratose in the upper half, in 1–2 rows of cells; costa narrow and weak, in cross-section tristratose in the lower half, bistratose above; upper laminal cells quadrate to short-rectangular, with strongly incrassate, straight or sinuose walls, becoming elongate and nodulose below; basal laminal cells long rectangular to linear, straight-walled; angular cells pellucid, quadrate to long rectangular. Autoecious. Capsules deeply immersed, straw-coloured, 0.8–1.0 mm long, cupulate or ovoid; peristome teeth lanceolate, orange-yellow, finely papillose. Spores spherical, smooth, 9–10 μm in diameter.

Remark. — This is the first record of this species from the Antarctic. It was originally described as *Grimmia cupularis* by Müller (1883, 1889) from Îles Kerguelen on the basis of the specimens collected by F. C. Naumann during the course of the "Gazelle" expedition 1874–1876. Later it was reported from this island by Brotherus (1906) and Thériot (1924) and Ochyra (1998b) transferred it to the genus *Schistidium.* The Antarctic specimen matches perfectly the Kerguelenian type [Lectotype (*nov.*): "Ex Museo botanico Berolinensi. Grimmia cupularis C. Müll. n. sp. Kerguelenland. Foundery branch in rupib. siccis Nov. 1874 Dr. Naumann" – S-Dusén!; isotypes: H-Broth!, PC-Card!, PC-Thér!). The species is readily recognized by its narrowly lanceolate leaves terminating in a very short yellow-

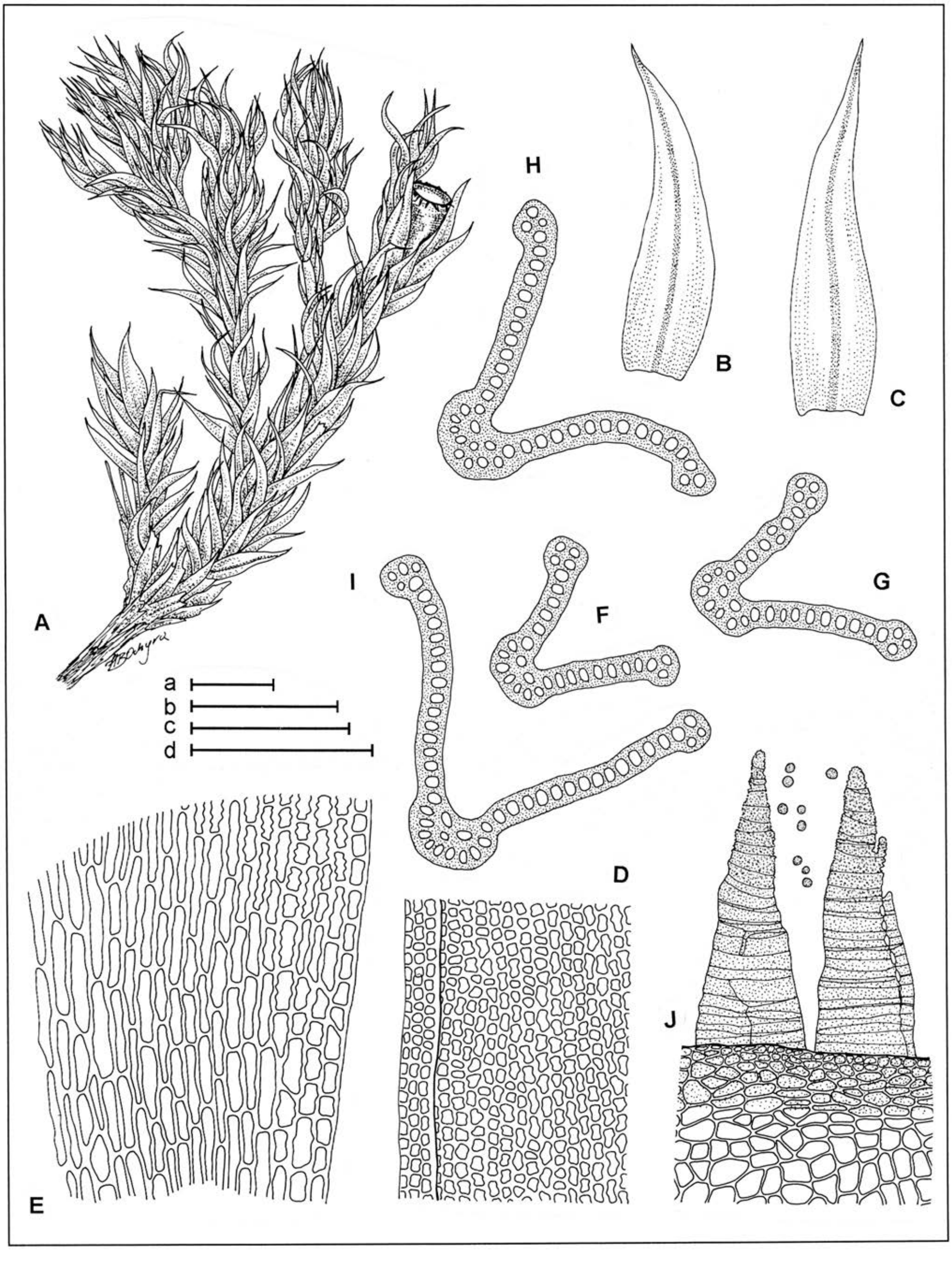


FIGURE 104. *Schistidium cupulare* (Müll. Hal.) Ochyra. — **A**. Habit. — **B–C**. Leaves. — **D**. Mid-leaf cells at margin. — **E**. Basal cells. — **F–I**. Cross-sections of leaf. — **J**. Portion of peristome and spores (all from *Ochyra 1536/80*, KRAM). Scale bars: a – 1 mm (A); b – 1 mm (B–C); c – 100 µm (D–I); d – 200 µm (J).

ish-hyaline hair-point, quadrate to short-rectangular upper cells with sinuose walls, long rectangular to linear basal cells, 2–3-stratose margins in 1–2 rows of cells in the upper half and dorsally prominent costa, bistratose in the upper part and tristratose in the lower.

Ecology. — On dry and exposed andesite waste on a rock outcrop in the fruticose lichen and moss cushion subformation association dominated by *Usnea antarctica*, *Bartramia patens* and *Dicranoweisia brevipes.*

Phytogeography. — **Amphiatlantic Subantarctic** – Îles Kerguelen; King George I. It is worth noting that exactly the same distribution pattern is exhibited the liverwort *Hygrolembidium ventrosum* (Mitt.) Grolle which is known from Îles Kerguelen and Marion Island in the Subantarctic and King George Island (Ochyra & Váňa, 1989b).

Distribution on King George Island. — An exceedingly rare species, known only from a single locality in the vicinity of Arctowski Station in the Admiralty Bay area (Fig. 105).

Specimen examined from King George Island. — ADMIRALTY BAY. ***Point Thomas***: Upłaz, 40 m, *1536/80.*

Schistidium falcatum (Hook. f. & Wils.) B. Bremer, Lindbergia 6: 110. 1980.
FIG. 109

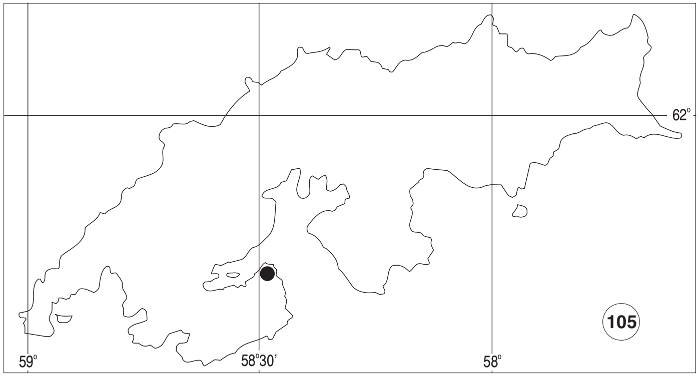
Grimmia falcata Hook. f. & Wils.

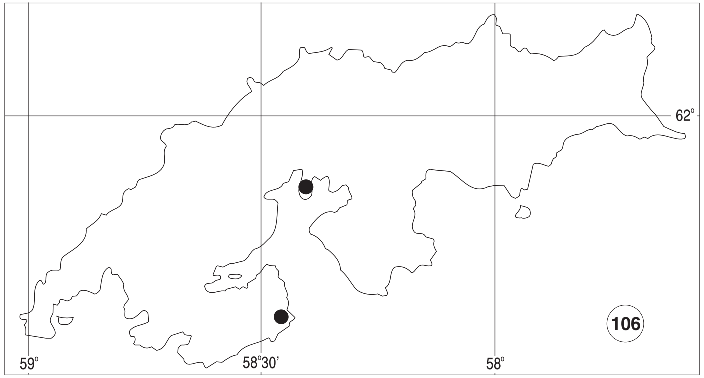
Plants medium-sized, creeping or ascending, copiously branched, 1.5–5.0 cm tall, in loose to compact, rigid tufts, red-green to rufous. Leaves crowded, imbricate, straight to falcate, erect when dry, erect-spreading when moist, distinctly falcato-secund towards the apex, 2–3 mm long, oblong-lanceolate, gradually long acuminate and subulate, concave, decurrent at base, lacking hair-point; margins entire, plane; costa strong and broad, occupying approximately one third of the width of the leaf base, 85–120 µm wide, convex on the dorsal side, gradually merging into the laminal cells, excurrent as a stout cuspidate point, in transverse section plano-convex, 4–6-stratose; upper laminal cells quadrate to short-rectangular, becoming rectangular below; basal marginal cells undifferentiated and similar to the adjacent laminal cells. Monoecious. Capsules obloid, 0.7–1.0 mm long; peristome teeth lanceolate, orange-brown, often perforate, finely papillose-striate. Spores 15–25 µm in diameter, minutely papillose.

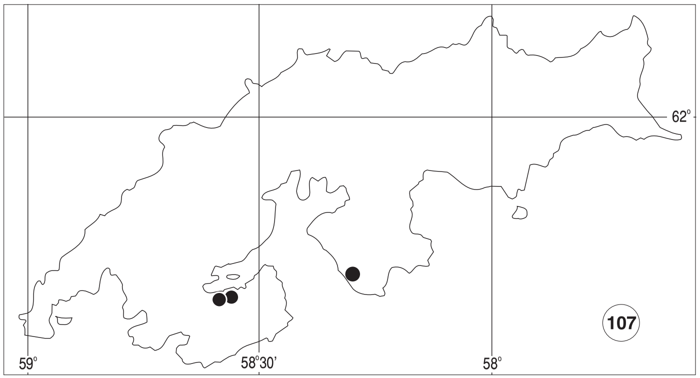
Ecology. — This typically hydrophytic species grows in Antarctica on fairly dry, gravelly soil on gently sloping ground disturbed by frost action, and on bare soil among boulders on scree.

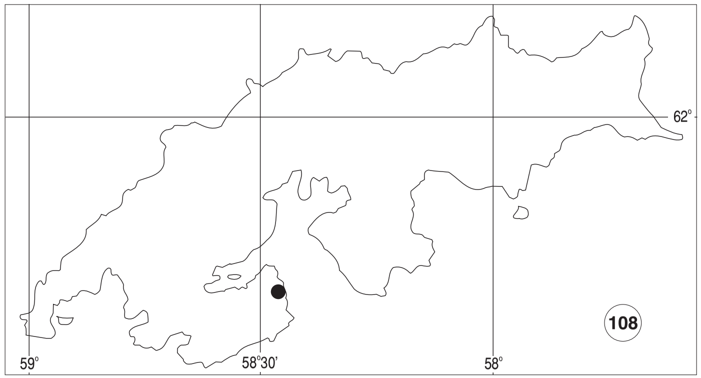
Phytogeography. — **Amphiatlantic Subantarctic** – Îles Kerguelen; Marion I.; South Georgia; South Shetland Is.; Tierra del Fuego; Magellanian Channels (Fig. 32).

Distribution on King George Island. — A rare species known from only two localities in the Admiralty Bay area (Fig. 106), occurring at higher elevations from 60–220 m.









FIGURES 105–108. Distribution maps for *Schistidium cupulare* (Müll. Hal.) Ochyra (105), *S. falcatum* (Hook. f. & Wils.) B. Bremer (106), *Schistidium halinae* Ochyra (107) and *Schistidium occultum* (Müll. Hal. *in* Neum.) Ochyra & Matteri (108) on King George Island.

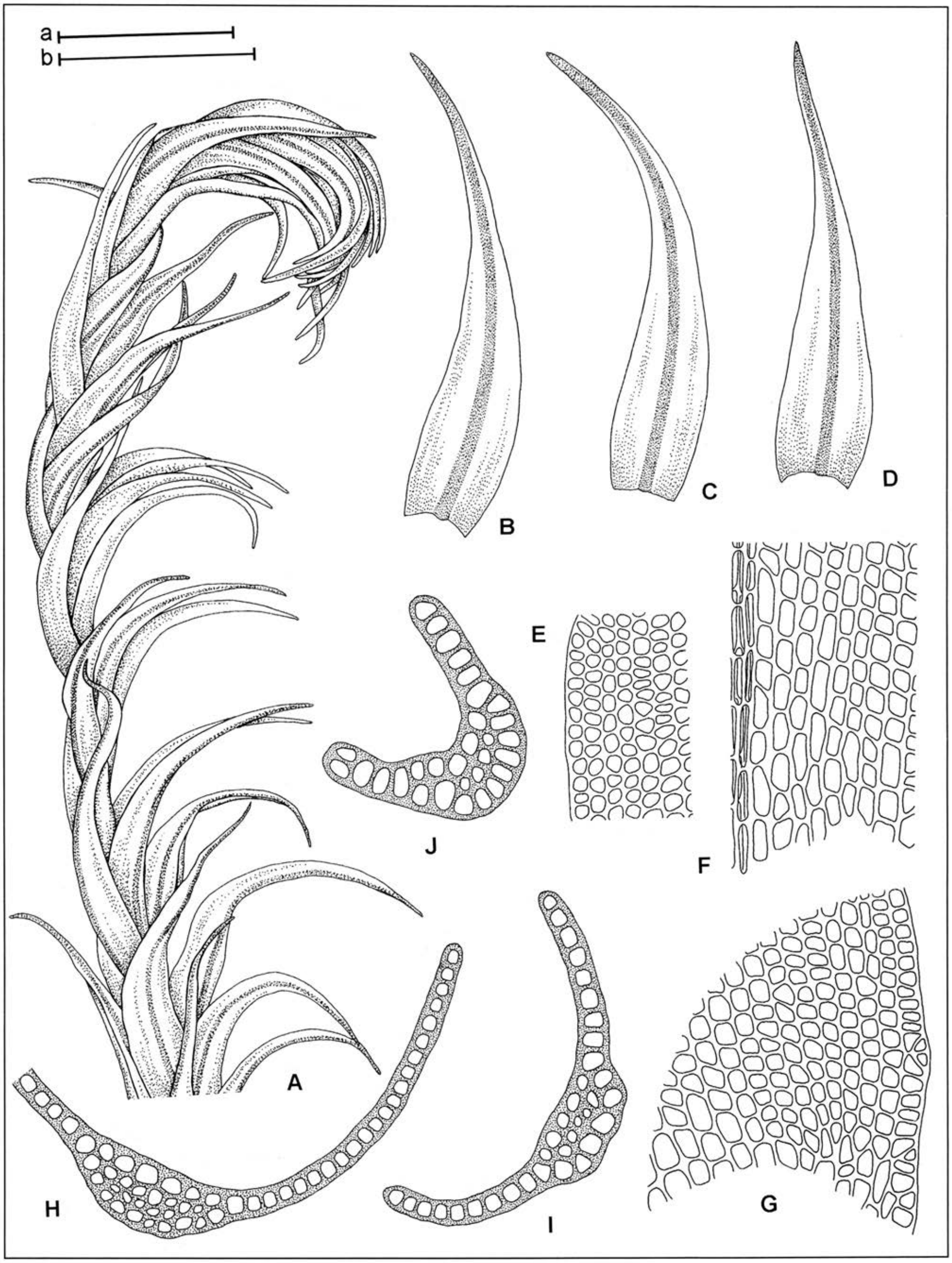


FIGURE 109. *Schistidium falcatum* (Hook. f. & Wils.) B. Bremer. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Mid-leaf cells at margin. — **F**. Basal juxtacostal cells. — **G**. Angular cells. — **H**–**J**. Cross-sections of leaf (all from *Ochyra 437/80*, KRAM). Scale bars: a – 1 mm (A–D); b – 100 µm (E–J).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Creeping Slopes, 60 m, *1380*. ***Keller Peninsula***: Tyrrell Ridge, 220 m, *437/80*.

Literature records. — Admiralty Bay (Ochyra & Bell, 1984; Ochyra, 1983, 1984b; Ochyra *et al.*, 1986; Putzke & Pereira, 1990).

Schistidium halinae Ochyra, Ann. Bot. Fennici 35: 268, *f. 1.* 1998.
FIG. 110 and frontispiece

Plants medium-sized, 1.5–2.5 cm tall, in large, compact cushions, olivaceous to brown. Leaves in 5 distinct spiral rows, 1.5–2.0 mm long, lanceolate to ovate-lanceolate, gradually acuminate; hair-points hyaline, 0.3–1.0 mm long, becoming progressively longer up the stem, flattened, finely and irregularly spinulose-denticulate; margins entire, plane in the lower half, narrowly recurved above almost to the apex, irregularly bistratose in the upper and central parts for 1–2 rows of cells; costa percurrent, in cross-section bistratose throughout; upper and median laminal cells rounded, rounded-quadrate to oblong, straight-sided to slightly sinuose, becoming short-rectangular in the lower mid-leaf; basal cells chlorophyllose to subhyaline, forming a large juxtacostal band of short- to long rectangular cells with straight and strongly incrassate longitudinal walls. Autoecious. Perichaetial leaves ending in a very long, 0.6–1.4 mm, hyaline hair-point. Capsules deeply immersed, shortly obloid-cylindrical, 0.9–1.0 mm long; peristome teeth orange, lanceolate, acute to obtuse, irregularly perforate, densely papillose. Spores spherical, smooth to very finely papillose, 10–12 μm in diameter.

Remark. — This very distinctive taxon has only recently been described as a new species (Ochyra, 1998a).

Ecology. — Growing in exposed places on stones and gravelly ground, mostly in dry situations.

Phytogeography. — **Antarctic Endemic** – South Shetland Is. (King George I., Livingston I.); East Antarctic Peninsula (Vega I., James Ross I.) (Fig. 30).

Distribution on King George Island. — A rare species, known from only two localities in the Admiralty Bay area (Fig. 107), occurring from near sea level to 150 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***: Cytadela, 20 m, *937/80* and 80 m, *947/80*. ***Viéville Glacier***: Puchalski Peak, 150 m, *2711/80* (BAE-164 as *Schistidium* cf. *hyalinocuspidatum*).

Literature records. — Admiralty Bay (Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b all as *Schistidium* cf. *hyalinocuspidatum*; Ochyra, 1998a).

Schistidium occultum (Müll. Hal.) Ochyra & Matteri, Fragm. Flor. Geobot. 43(2): 1008. 1996.
FIG. 111

Grimmia occulta Müll. Hal. *in* Neum.

Plants medium-sized, 1.5–5.5 cm tall, in loose cushions, dark brown. Leaves closely imbricate, ovate-lanceolate, gradually broadly or narrowly acuminate, with short, terete, hyaline, denticulate hair-points or often non-piliferous; margins narrowly recurved to the apex, bistratose throughout in 1–2 rows of cells; costa percurrent, strongly convex dorsally, tristratose in cross-section; laminal cells unistratose with scattered bistratose patches in the upper part, thick- and

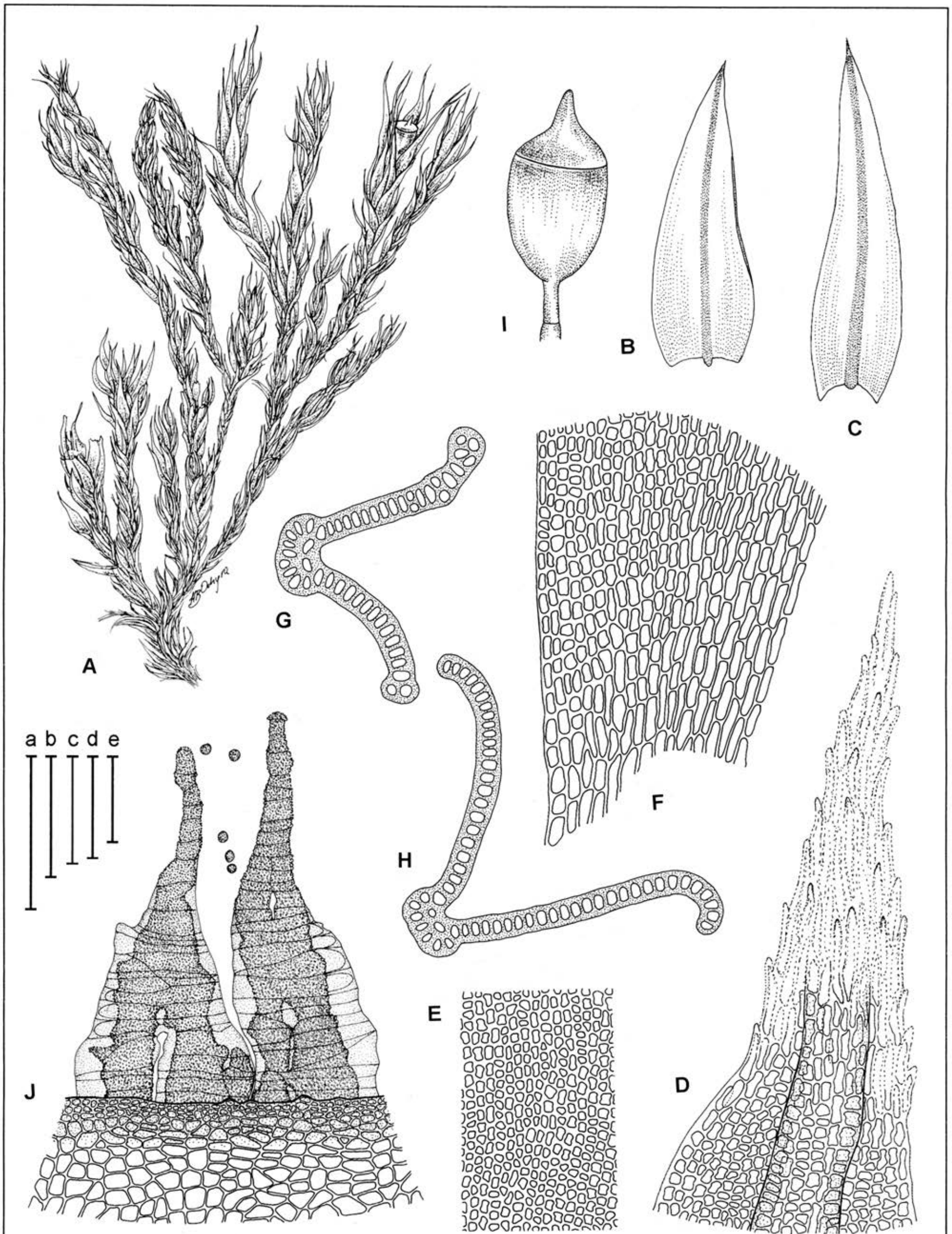


FIGURE 110. *Schistidium halinae* Ochyra. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Leaf apex. — **E**. Mid-leaf cells. — **F**. Basal cells. — **G–H**. Cross-sections of leaf. — **I**. Operculate capsule, wet. — **J**. Portion of peristome and spores (A–D, F–J from *Ochyra 2711/80*, holotype; E from *Ochyra 937/80*, paratype; both in KRAM). Scale bars: a – 1 mm (B–C); b – 3 mm (A); c – 1 mm (I) and 100 µm (D–F); d – 100 µm (G–H); e – 100 µm (J).

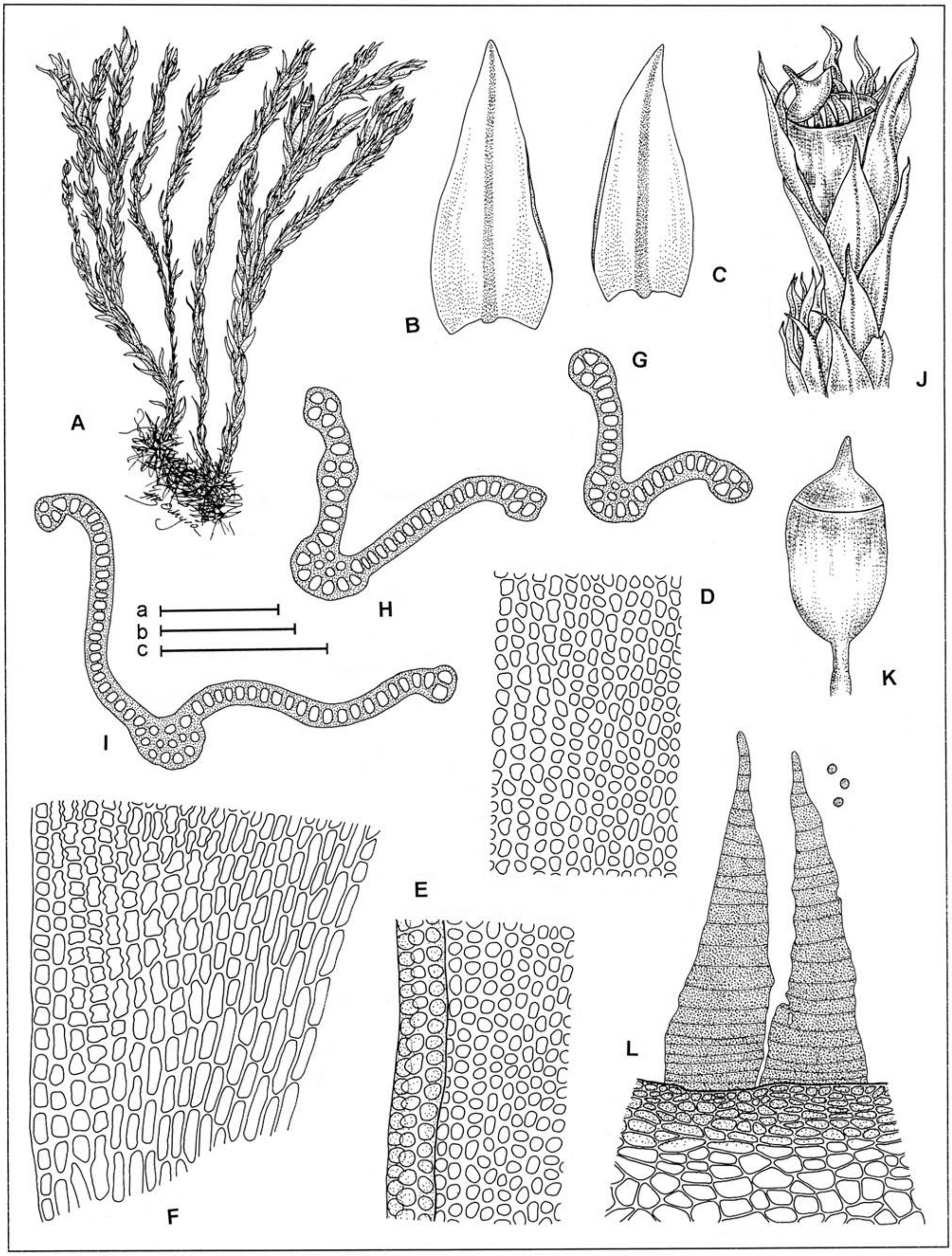


FIGURE 111. *Schistidium occultum* (Müll. Hal. *in* Neum.) Ochyra & Matteri. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Mid-leaf cells. — **E**. Upper leaf cells at margin. — **F**. Angular cells. — **G**–**I**. Cross-sections of leaf. — **J**. Perichaetium. — **K**. Operculate capsule, wet. — **L**. Portion of peristome and spores (A–B, D–E, J–K from *Ochyra 1980/80*; C, F–I, L from *Lewis-Smith 7469*; all in KRAM). Scale bars: a – 1 mm (J–K); b – 0.5 cm (A) and 100 μm (G–I); c – 1 mm (B–C), 100 μm (D–F) and 200 μm (L).

straight-walled, rounded-quadrate, becoming short-rectangular and sinuose in the median and lower parts; basal cells short-rectangular, with thick and straight walls. Autoecious. Capsules immersed, obloid, 0.8–1.2 mm long; peristome teeth deep orange, lanceolate, acute, densely papillose. Spores spherical, smooth, 10–11 µm in diameter.

Remark. — This species was originally described as *Grimmia occulta* by Müller (1889) from South Georgia and subsequently reported from southern South America (Dusén, 1907; Cardot, 1908; Cardot & Brotherus, 1923). It was eventually reduced to synonymy with *Schistidium apocarpum* by Bell (1984), but Ochyra and Matteri (1996) reinstated it as a good species, assigning it to *Schistidium*. *S. occultum* is definitely distinct from *S. apocarpum* (sensu Blom, 1996, 1998) which is a strictly Holarctic species.

Ecology. — Growing on bare ground in an exposed position in a community dominated by *Polytrichastrum alpinum.*

Phytogeography. — Apparently **American South-Temperate** – Tierra del Fuego; Magellanian Channels; West Patagonia; Valdivian region; South Georgia; South Shetland Is.; West Antarctic Peninsula; East Antarctic Peninsula (James Ross I.). It is likely that the species has a wider distribution in the Southern Hemisphere but its true geographical range cannot be established until the genus *Schistidium* has been thoroughly revised there. It is just possible that most records of *S. apocarpum* from southern South America and adjacent territories refer to this species.

Distribution on King George Island. — An exceedingly rare species, known from one locality in the Admiralty Bay area (Fig. 90).

Specimen examined from King George Island. — ADMIRALTY BAY. ***Ecology Glacier***: Rescuers Hills, 45 m, *189/80*.

Schistidium rivulare (Brid.) Podp., Beih. Bot. Centralbl. 28(2): 207. 1911.
FIG. 112

Grimmia rivularis Brid.

Medium-sized plants, 1.5–4.5 cm tall, in light olivaceous to dull blackish loose tufts. Leaves erect when dry, erecto-patent when wet, broadly ovate to broadly ovate-lanceolate, subobtuse to acute, often indistinctly denticulate at the apex, 1.8–3.2 mm long, 0.7–1.3 mm wide, somewhat concave, without hair-point; margins narrowly recurved, bistratose in 1–2 rows of cells; costa percurrent, in cross-section multistratose; upper laminal cells irregularly quadrate to rounded-quadrate, becoming shortly rectangular in the middle, thick-walled, esinuose. Autoecious. Capsules deeply immersed, dark red-brown, subspherical to obovoid, 0.9–1.1 mm long, wide-mouthed; peristome teeth lanceolate, purple-red, perforate above, densely papillose on both surfaces. Spores spherical, granulose, 17–24 µm in diameter.

Ecology. — An aquatic moss growing entirely submerged on stones and boulders at stream sides and in stream beds.

Phytogeography. — **Bipolar** – In the Northern Hemisphere the species is pantemperate but extends also to the Arctic; it is widely distributed in Europe and

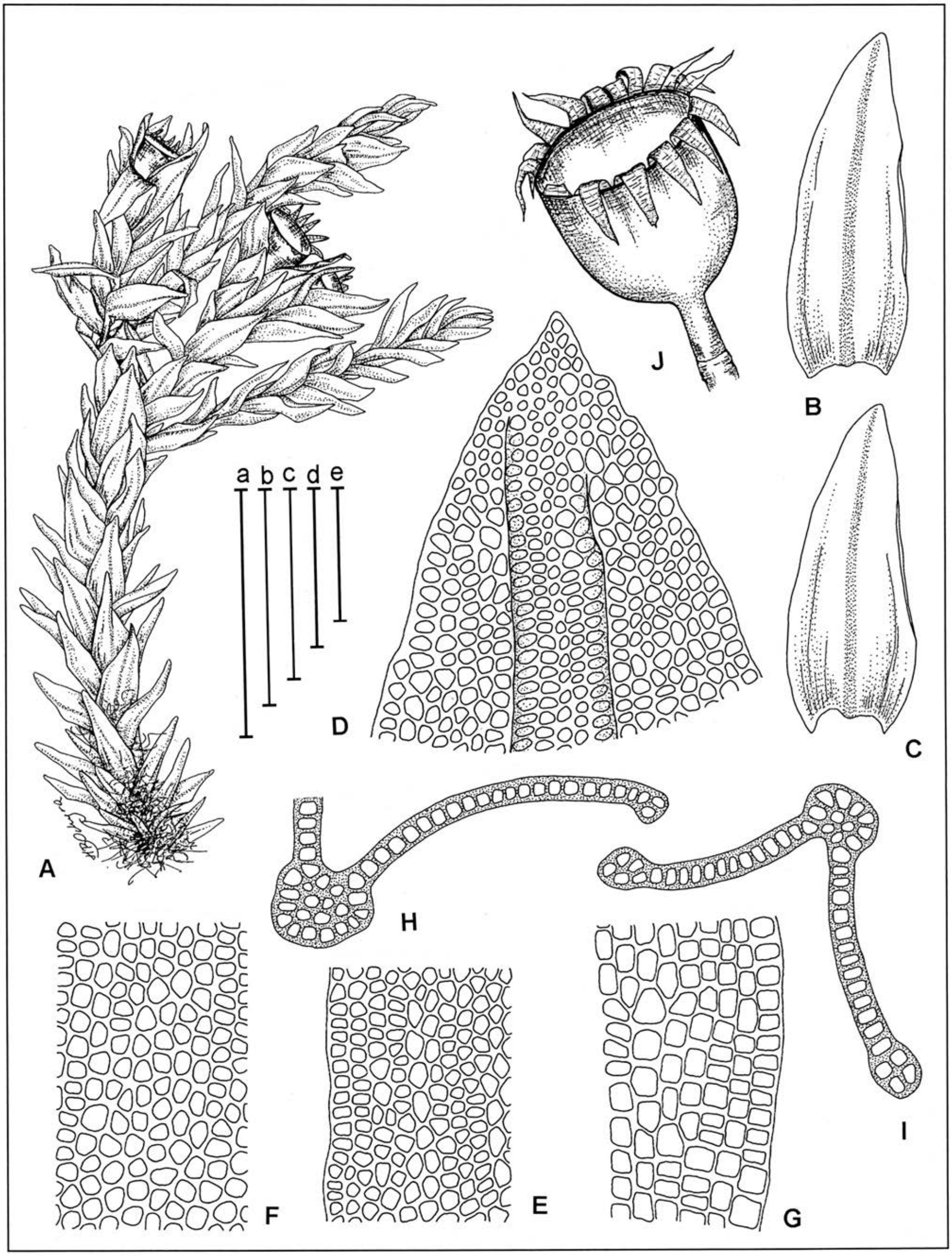
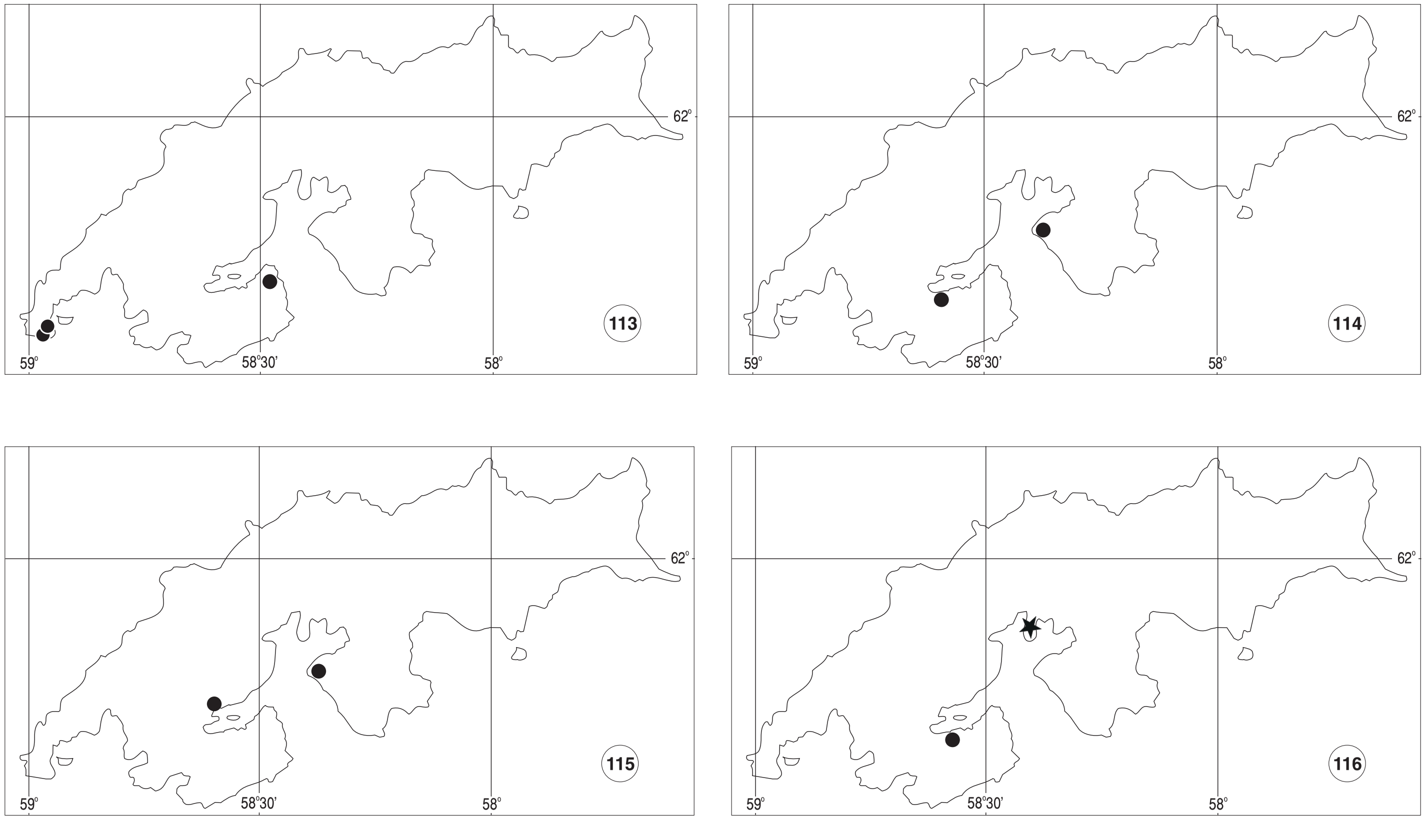


FIGURE 112. *Schistidium rivulare* (Brid.) Podp. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Leaf apex. — **E**. Upper leaf cells at margin. — **F**. Mid-leaf cells. — **G**. Angular cells. — **H**–**I**. Cross-sections of the leaf. — **J**. Deoperculate capsule, wet (all from *Ochyra 637/80*, KRAM). Scale bars: a – 0.5 cm (A); b – 100 µm (D–G); c – 1 mm (J); d – 100 µm (H–I).



FIGURES 113–116. Distribution maps for *Schistidium rivulare* (Brid.) Podp. (113), *S. steerei* Ochyra (114), *S. urnulaceum* (Müll. Hal. *in* Neum.) B. G. Bell (115) and *Bryum argenteum* Hedw. (116) on King George Island. ★ – literature record.

North America, scattered in Asia. In the Southern Hemisphere it is amphipacific temperate in distribution: New Zealand; SE Australia; Tierra del Fuego; South Georgia; South Shetland Is.; Melchior Is.; West Antarctic Peninsula (Danco Coast).

Distribution on King George Island. — A rare species, found only in the Point Thomas area and on the Fildes Peninsula (Fig. 113). It has been reported from the Barton and Fildes Peninsulas by Chen *et al.* (1993, 1995). One specimen from the former locality was studied (*Li K14*, AAS) but was actually *Ceratodon purpureus*.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Point Thomas***: Petrified Forest Creek, 25 m, *160/80* and 45 m, *637/80* (BAE-190). FILDES PENINSULA. 1.5 km W of Half Three Point, 10 m, *Schulz 1* (KRAM) and 35 m, *Schulz* 20 (KRAM).

Literature records. — Barton Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Admiralty Bay (Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991).

Schistidium steerei Ochyra, Mem. New York Bot. Gard. 45: 609, *f. 1–21*. 1987.
FIG. 117

Plants medium-sized, 1.5–2.5 cm tall, in large, compact cushions, yellowish- to brownish-green. Leaves closely imbricate, 1.3–2.0 mm long, lanceolate to ovate-lanceolate, gradually acuminate, obtuse to bluntly acute, muticous or the uppermost leaves with a very short (to 0.4 mm) hyaline awn; margins entire, strongly revolute on both sides from near the base to the apex; costa percurrent; upper and median laminal cells irregularly rounded-quadrate to transversely short-rectangular; basal marginal cells quadrate to short-rectangular, basal juxtacostal cells long rectangular. Paroecious. Capsules deeply immersed in the perichaetial leaves, yellowish-brown, browning with age, ovoid or obloid, 1.0–1.2 mm long; peristome teeth lacking or in places vestigially developed, papillose on both surfaces, yellowish-orange. Spores spherical, smooth to very finely papillose, 7–9 µm in diameter.

Ecology. — Usually growing in moist to dry situations on gravelly soil or basalt rubble, often half-buried in soil and apparently never truly saxicolous.

Phytogeography. — **Antarctic Endemic** – Known only from the type locality on King George Island.

Distribution on King George Island. — Known only from two stations in the Admiralty Bay region on King George Island (Fig. 114).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***: Cytadela, *946/80*. ***Martel Inlet***: Mt. Wawel, 110 m, *2176/80*.

Literature records. — Admiralty Bay (Ochyra, 1987a).

Schistidium urnulaceum (Müll. Hal.) B. G. Bell, Br. Antarct. Surv. Bull. 63: 99. 1984.
FIG. 118

Grimmia urnulacea Müll. Hal. *in* Neum.

Plants medium-sized, 0.5–2.0 cm tall, in small, yellow-green, hoary cushions. Leaves closely

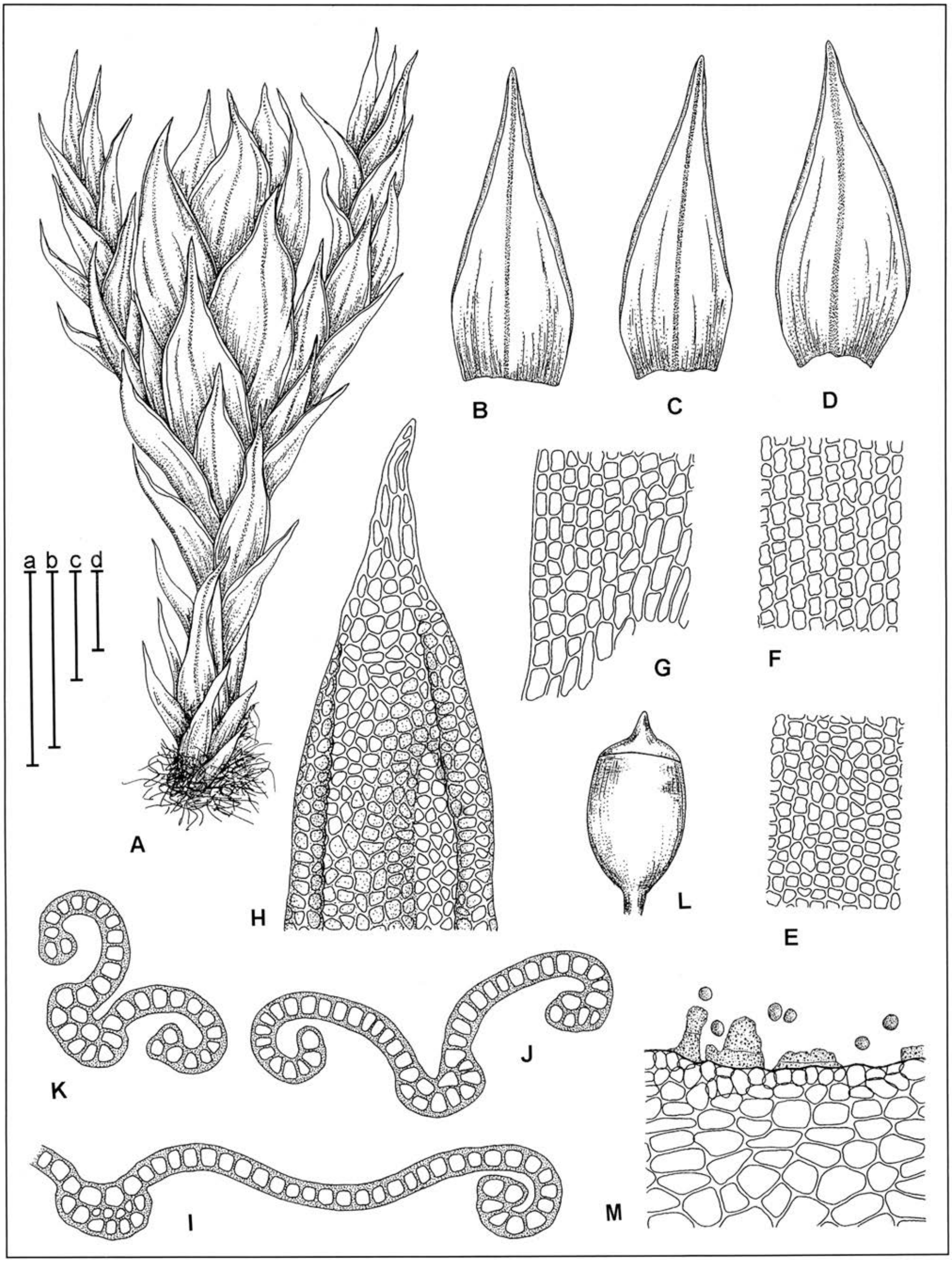


FIGURE 117. *Schistidium steerei* Ochyra. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Mid-leaf cells. — **F**. Lower laminal cells. — **G**. Angular cells. — **H**. Leaf apex. — **I**–**K**. Cross-sections of leaf. — **L**. Capsule, wet. — **M**. Exothecial cells at the orifice and rudimentary peristome (all from *Ochyra 2176/80*, holotype, KRAM). Scale bars: a – 100 µm (E–K, M); b – 1 mm (B–D); c – 1 mm (L); d – 1 mm (A).

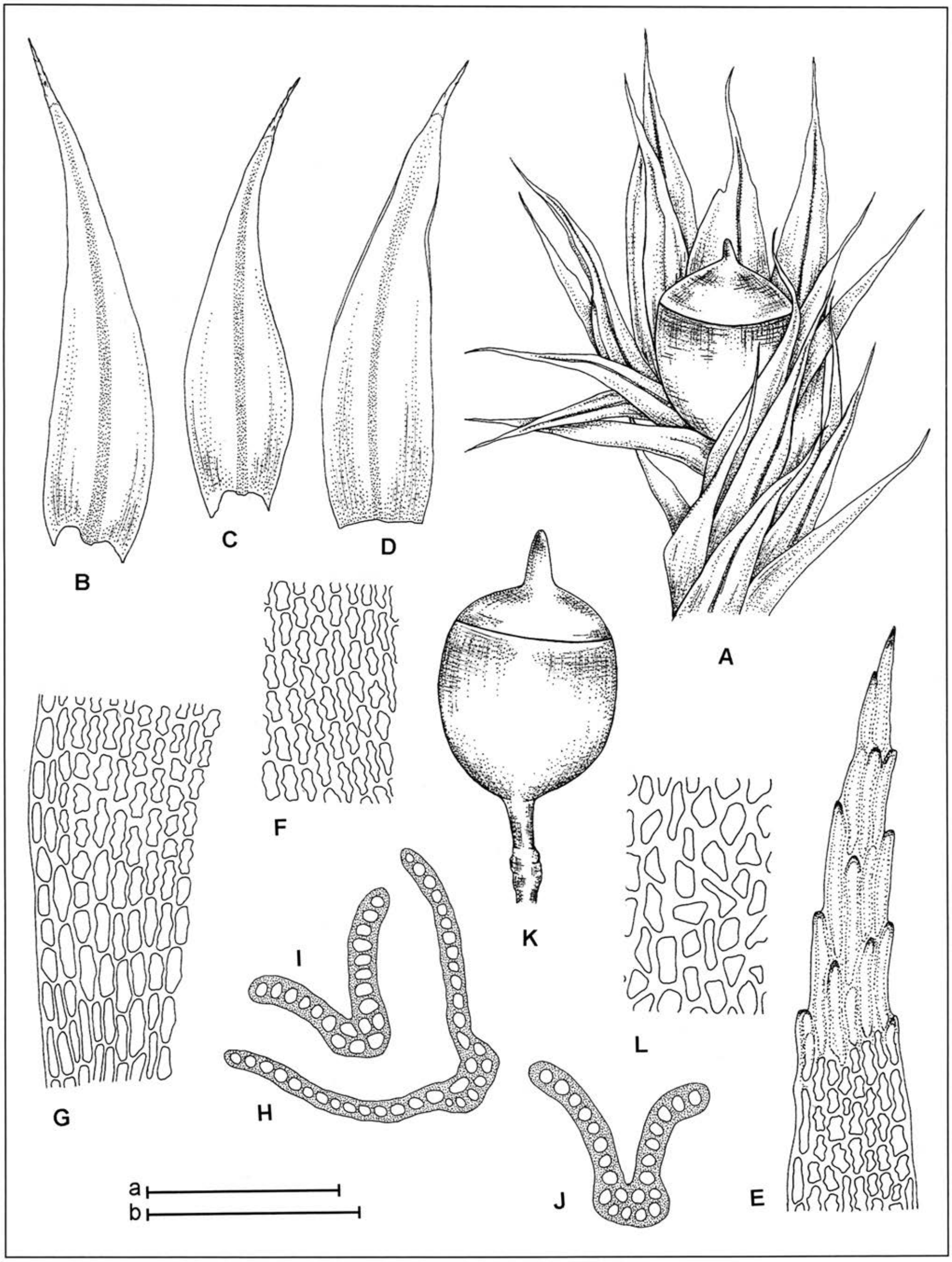


FIGURE 118. *Schistidium urnulaceum* (Müll. Hal. *in* Neum.) B. G. Bell. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells. — **G**. Angular cells. — **H**–**J**. Cross-sections of leaf. — **K**. Capsule, wet. — **L**. Exothecial cells (all from *Ochyra 2180/80*, KRAM). Scale bars: a – 1 mm (A–D & K); b – 100 µm (E–J).

imbricate, 1.0–1.8 mm long, 0.2–0.4 mm wide, narrowly lanceolate, gradually acuminate, ending in a rather short (ca 0.5 mm) hyaline hair-point; margins entire, plane or recurved on one or both sides; costa narrow and weak, in cross-section bistratose throughout; upper and median laminal cells quadrate to short-rectangular, with sinuose and strongly incrassate walls; basal cells short- to long rectangular, straight-walled. Autoecious. Capsules deeply immersed, light or yellowish-brown, 0.6–0.8 mm long, globose or cyathiform to obloid, wide-mouthed when dry and empty; exothecial cells with strongly incrassate, 4–8 µm thick, straight walls; peristome teeth lanceolate, orange- to reddish-brown, coarsely papillose. Spores spherical, smooth, 7–9 µm in diameter.

Ecology. — A saxicolous species growing on acidic rocks, on weathered andesite and basalt rocks, on scree, and in the crevices of rock outcrops.

Phytogeography. — **American Subantarctic** – King George I.; South Georgia.

Distribution on King George Island. — A rare species, but locally frequent on Mt. Wawel, known only from two stations in the Admiralty Bay area (Fig. 115), occurring at higher elevations above 80 m. It was reported also from a single locality on the Fildes Peninsula, but the relevant herbarium collection (*Li GWS3*, AAS) represents in fact *Schistidium antarctici.*

Specimens examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***: Scalpel Point, 160 m, *1816/80*. ***Martel Inlet***: Mount Wawel, 80 m, *2127/80*, 120 m, *2183/80* (BAE-139 as *S. antarctici*), 130 m, *2180/80* and 150 m, *2185/80.*

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Admiralty Bay (Ochyra, 1990a).

GRIMMIACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Racomitrium striatipilum Card.

This species was reported from a single locality on the Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998) but the voucher specimen is *Racomitrium sudeticum*. *R. striatipilum* is a Fuegian-South Georgian species (Cardot, 1905, 1908) which is now considered to be identical to the Andean-African *R. crispipilum* (Tayl.) Jaeg. (cf. also discussion in Bednarek-Ochyra, 1995). Leaving aside the true status of *R. striatipilum*, it is totally different from *R. sudeticum* in the internal structure of the costa, the presence of a very long hyaline hair-point and the basal marginal border of hyaline cells.

Schistidium apocarpum (Hedw.) Bruch & Schimp. *in* B., S. & G.

This typically northern species must be excluded from the bryoflora of King George Island. The various literature reports in all likelihood should be referred to *Schistidium antarctici*.

Schistidium chrysoneurum (Müll. Hal.) Ochyra *in* Ochyra, Vitt & D. G. Horton

The record of this species from within the Antarctic was based upon an erroneous taxonomic conclusion concerning its conspecificity with *Grimmia antarctici* (Ochyra *et al*., 1986). *Schistidium chrysoneurum* was described by Müller (1883, 1889) from material collected from Îles Kerguelen by F. C. Naumann and remains a poorly known species which has not been rediscovered since. Closer examination of the type material [Lectotype (*nov.*): "Ex Museo botanico Berolinensi. Grimmia chrysoneura C. M. Kerguelen: Foundery branch in rupibus siccis XII 1874 leg. Dr. Naumann (ex Herb. C.M.)" – PC-Thér!; isotype: PC-Card!] revealed that it is distinct in its bistratose laminal cells in the upper half, strongly thickened bulging upper margins, 3–4-stratose in several rows of cells, and sinuose laminal cells below.

BRYACEAE

The Bryaceae are a large cosmopolitan family comprising about 20 genera and roughly 1300 species, the vast majority of them in the genus *Bryum.* It is best characterized in terms of capsule shape – elongate with a well-developed apophysis tapering to the seta. The perfect double peristome resembles that of the hypnoid pleurocarpous mosses. Sporophyte characters are taxonomically important in some genera such as *Bryum* or *Pohlia* in which, to make things worse, sterile plants are especially frequent and, though easily recognizable as to genus, are usually indeterminable beyond that. This is an especially common situation in areas like Antarctica where these genera are prominent. Alas, due to severe climatic conditions, sporophytes are only rarely produced and, even when they are, are often underdeveloped. Therefore *Bryum* presents special taxonomic problems in Antarctica which cannot be satisfactorily resolved using traditional methods.

There are four genera and 14 species in Antarctica, but it is likely that the number of *Bryum* species is higher, since some collections do seem to represent other species but the lack of good fruiting material makes definite assignation impossible. Species of *Bryum* and *Pohlia* are very common and abundant, whereas the representatives of the other two genera, *Schizymenium* and *Leptobryum*, consisting of one and two species, respectively, have very restricted distributions in the Antarctic.

Key to the King George Island genera of the Bryaceae

1. Leaves relatively broad, ovate-lanceolate, usually distinctly bordered; laminal cells rather broad, generally less than four times as long as wide . . . . *Bryum*
1. Leaves oblong-lanceolate, not distinctly bordered; laminal cells narrow, relatively long, four or more times as long as wide . . . . *Pohlia*

BRYUM

Bryum Hedw. Spec. Musc. Frond.: 178. 1801.

Bryum is a large and exceedingly difficult genus of small, erect mosses nearly always growing on soil or humus, consisting of approximately 800 species widely distributed throughout the globe. Typically it is characterized by pendent, more or less pyriform capsules with a perfectly developed double peristome and broad leaves with an areolation of oblong-rhomboidal cells bordered by a band of narrow cells.

In Antarctica, species of *Bryum* are very common and abundant, and constitute an important component of plant communities, especially in the wetter places. Unfortunately, many Antarctic populations are sterile and because sporophyte characters are critical for the determination of *Bryum* species, numerous plants cannot be identified with certainty, if indeed determination is possible at all. Additionally, the genus is difficult due to its generally nondescript, often technical characters, and the tendency of leaves taken from different parts of a single plant to exhibit different morphology. Moreover, some species show great plasticity induced by different habitat conditions. As a result of these difficulties a great number of species have been described from Antarctica, often from sterile material, which do not merit taxonomic recognition.

The taxonomic concept of Antarctic species of *Bryum* was outlined by Ochi (1979) and it is largely followed in the present treatment, although the identities of some species have been changed. Additionally, Ochi's treatments of *Bryum* from adjacent territories including southern South America (Ochi, 1982), the Neotropics (Ochi, 1980, 1981), Africa (Ochi, 1972, 1973) and Australasia (Ochi, 1970) should be useful for the understanding of some species.

KEY TO THE KING GEORGE ISLAND SPECIES OF *BRYUM*

1. Plants whitish or silvery .... *B. argenteum*
1. Plants normally green 2
    2. Leaves rounded at the apex, not or scarcely bordered; leaf margins plane .... *B. orbiculatifolium*
    2. Leaves acute to acuminate, distinctly bordered; leaf margins recurved 3
3. Most upper leaf cells more than three times as long as wide; cilia of endostome normally lacking .... *B. amblyodon*
3. Most upper leaf cells three times as long as wide or less; cilia well-developed, appendiculate 4
    4. Costa percurrent to shortly excurrent; leaves ovate-lanceolate, decurrent .... *B. pseudotriquetrum*
    4. Costa long excurrent; leaves oblong-lanceolate, not decurrent .... *B. pallescens*

Bryum amblyodon Müll. Hal., Linnaea 42: 293. 1879. FIG. 119

Bryum imperfectum Card.

B. crateris Dix.

Plants small, 0.5–1.5 cm tall, in dense, green or yellow-green tufts. Stems repeatedly branched by innovations. Leaves appressed to erect when dry, erecto-patent when moist, larger and crowded in comal tufts at the stem tips, straight, 1.5–3.5 mm long, 0.8–1.2 mm wide, reddish at base, ovate-lanceolate to oblong-lanceolate, acuminate to long acuminate; margins entire, distinctly bordered with elongate, narrow cells, recurved to revolute nearly to the apex; costa stout, reddish to reddish-brown at base, long excurrent; upper laminal cells oblong-hexagonal, 3 or more times as long as wide, firm-walled becoming narrower and longer at the margins and forming a distinct unistratose border. Synoecious. Setae (8–)10–30 mm long, brownish; capsules pendulous, pale brown, clavate, symmetrical, 2.5–3.0 mm long, with a well-developed neck; outer peristome teeth pale yellow (only at the base slightly orange-yellow) with a narrow hyaline border, finely papillose; segments of endostome narrowly gaping, more strongly papillose; cilia 1–3, rudimentary or lacking. Spores 18–26 μm in diameter, finely and densely papillose.

Remark. — Ochi (1979) considered *Bryum crateris*, a species described by Dixon (1920) from Deception Island, to be conspecific with *B. pseudotriquetrum*. The type material (in BM and H) is in fine fruiting condition and the peristome lacks cilia, whereas *B. pseudotriquetrum* has well-developed, long, appendiculate cilia. The sporophyte and gametophyte characters of *B. crateris* match exactly those of *B. amblyodon* and accordingly the former is considered to be identical to the latter and not to *B. pseudotriquetrum*. It is interesting to observe that Robinson (1972) reached the same conclusion when he considered *B. crateris* to be conspecific with *B. imperfectum* which is identical to *B. amblyodon* (Ochyra & Ochi, 1986).

Ecology. — A pioneer moss growing on bare earth in slightly moist situations on scree slopes.

Phytogeography. — **Bipolar** – Pan-Holarctic in the Northern Hemisphere extending south to North Africa, Central Asia and California. Widely distributed at high elevations in the Andes from Bolivia to Rio Negro Prov. in Argentina; Tierra del Fuego; Falkland Islands; Îles Kerguelen; South Shetland Islands, West Antarctic Peninsula south to Terra Firma; Enderby Land.

Distribution on King George Island. — Inadequately known, but it seems to be widely distributed, but scattered, in the Admiralty Bay area and along the southwestern coast (Fig. 120).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Point Thomas***: Krzesanica, 50 m, *4981/79*; Upłaz, 45 m, *1532/80*; Ubocz, 90 m, *4949/79*. ***Ezcurra Inlet***: Krzymiński Point, 6 m, *944/80* and 10 m, *958/80* (BAE-165 as *Bryum dichotomum*); Cytadela, 50 m, *967/80*; Pond Hill, 70 m, *882/80* (BAE-116 as *B. dichotomum*). ***Dufayel Island***: Gdynia Point, 8 m, *1779/80*. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2281/80*. ***Martel Inlet***: Point Hennequin, 15 m, *2239/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 200 m, *2756/80*. KING GEORGE BAY. Lions Rump, *BJ-91*.

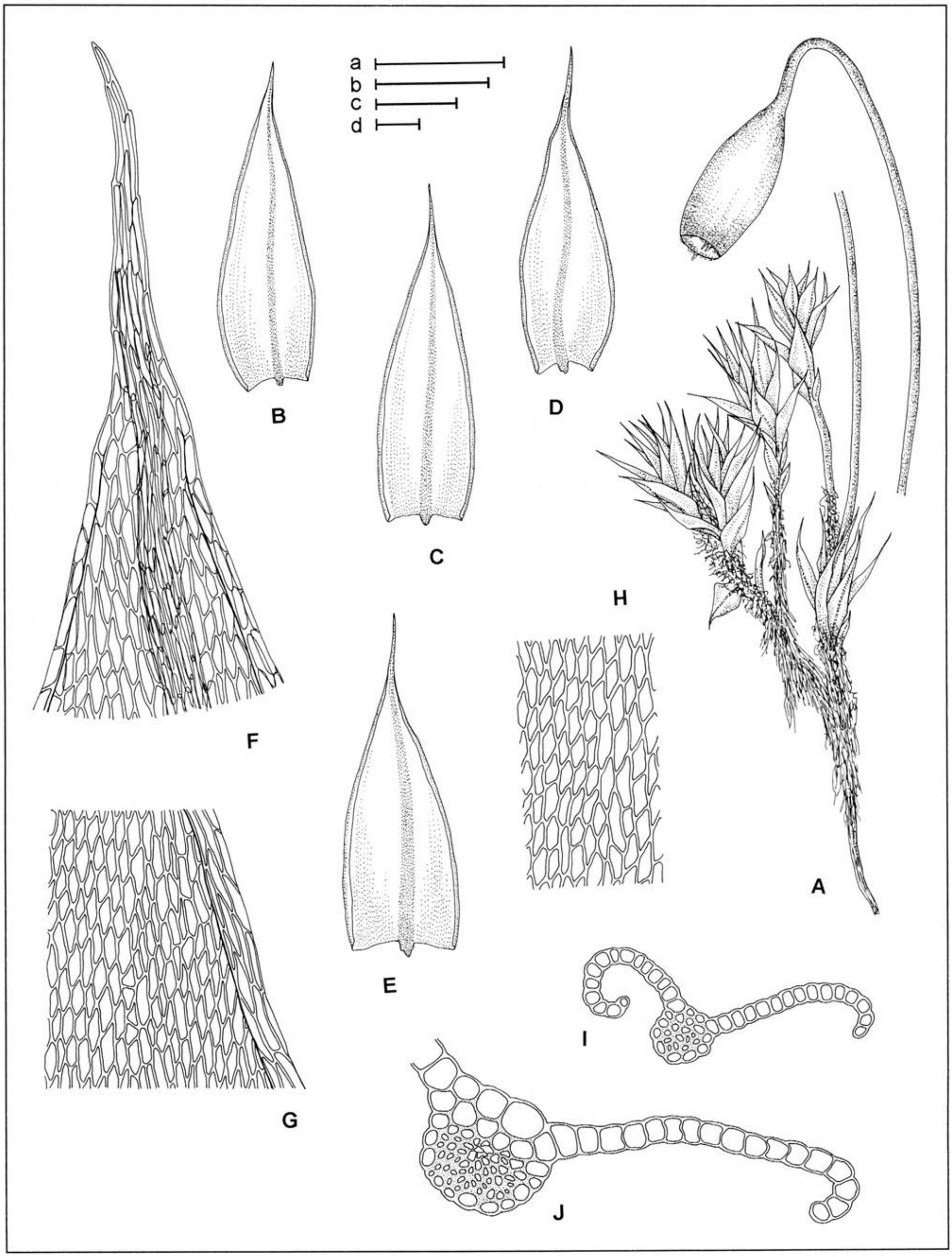


FIGURE 119. *Bryum amblyodon* Müll. Hal. — **A**. Habit. — **B–D**. Leaves. — **E**. Leaf apex. — **F.** Mid-leaf cells at margin. — **G**. Mid-leaf cells. — **H–I**. Cross-sections of leaf (A–C, E–I from *Ochyra 967/80*, KRAM; D from *Robbins 451*, lectotype of *B. crateris*, BM). Scale bars: a – 100 µm (H–I); b – 1 mm (B–D); c – 100 µm (E–G); d – 1 mm (A).

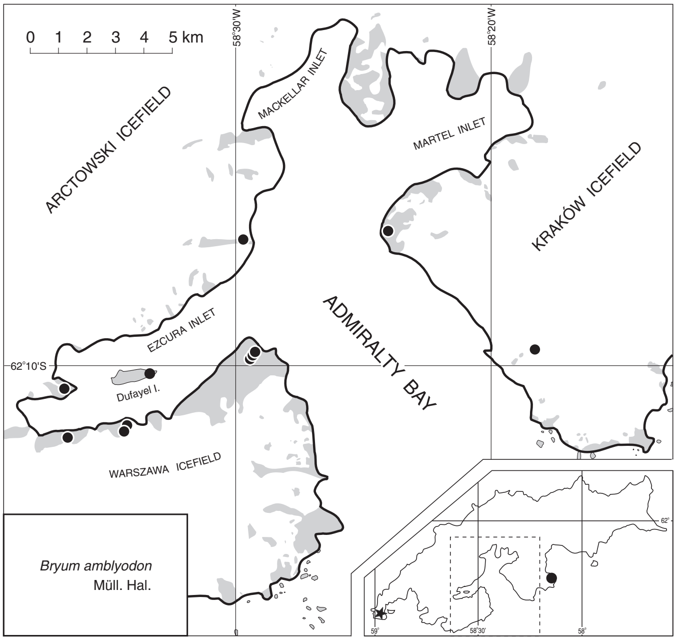


FIGURE 120. Distribution map for *Bryum amblyodon* Müll. Hal. in the Admiralty Bay area. Inset: distribution of the species on King George Island. ★ – literature data or oral communication.

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Ochyra, 1984b as *Bryum dichotomum*; Ochyra & Ochi, 1986; Ochyra *et al.*, 1986 as *B. dichotomum*; Kanda, 1987b; Putzke & Pereira, 1990).

Bryum argenteum Hedw., Spec. Musc. Frond.: 181. 1801. FIG. 121

Small plants, 5–10 mm tall, in loose or dense tufts, silvery-green or whitish because of the absence of chlorophyll in the upper leaf cells. Stems very slender, reddish, simple or subflorally branched, sparsely radiculose at base. Leaves appressed and imbricate when wet or dry, broadly ovate with hyaline apical part, 0.5–1.0 mm long, 0.4–0.5 mm wide, concave, more or less acuminate; margins entire, plane or slightly reflexed, marginal border missing or weakly developed; costa slender, short and barely discernible, ending well below the apex to shortly excurrent; upper laminal cells rhomboidal, hyaline and thin-walled – thicker-walled and yellowish below; basal cells subquadrate to short-rectangular, reddish. Sterile.

Remark. — Robinson (1972) and Ochi (1979) considered *Bryum amblyolepis* to be a synonym of *B. argenteum.* The species so named had been described from Canal de Gerlache on the Danco Coast on the West Antarctic Peninsula (Cardot, 1900, 1901) and is characterized by having broadly rounded leaf apices, without any apiculus. It represents a different "silvery" species of *Bryum*, *B. subrotundifolium* Jaeg., which is widely distributed but scattered in West and East Antarctica.

Ecology. — On disturbed soil in moist situations on moraines.

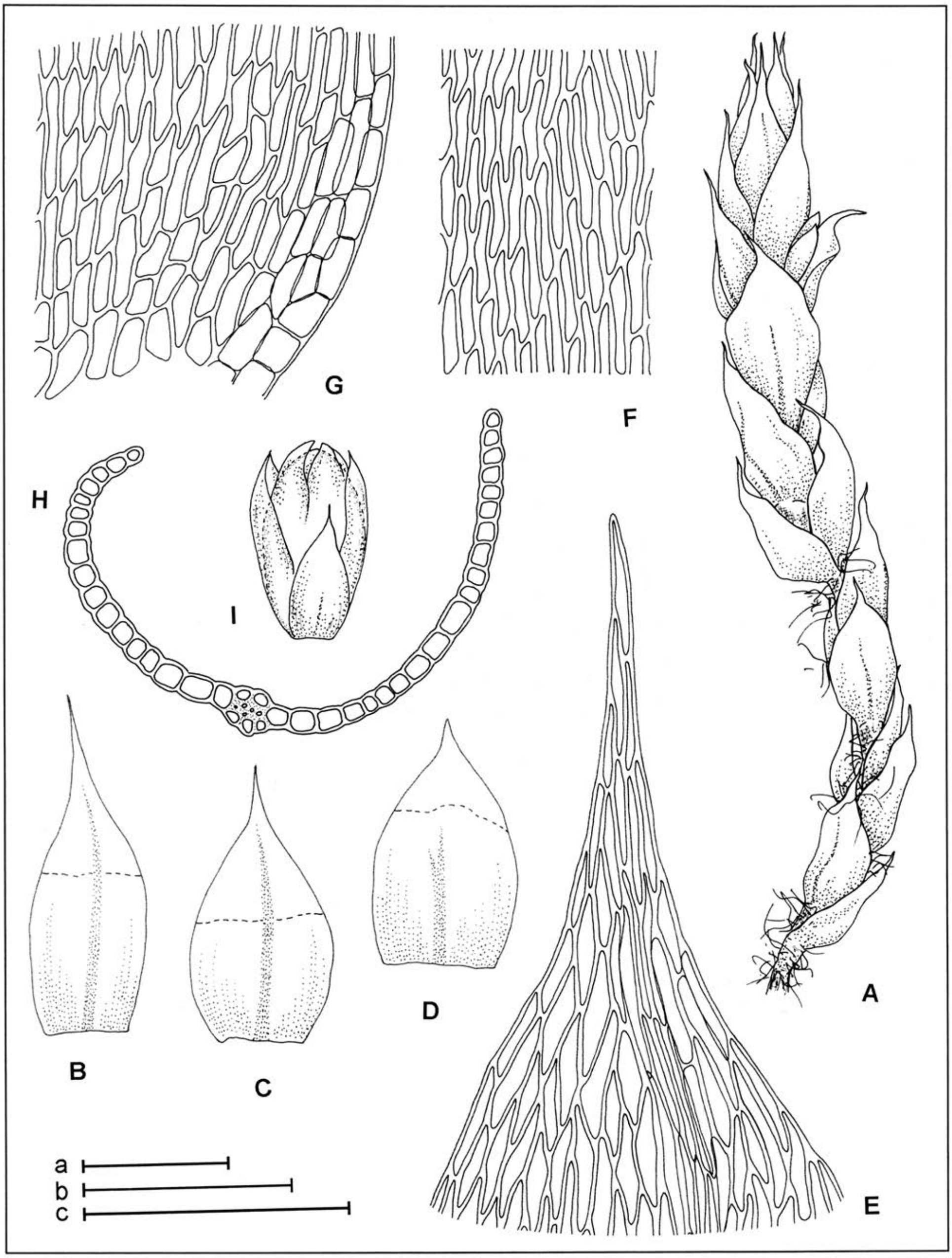


FIGURE 121. *Bryum argenteum* Hedw. — **A**. Habit. — **B–D**. Leaves. — **E**. Leaf apex. — **F.** Mid-leaf cells. — **G**. Basal cells. — **H.** Cross-section of leaf. — **I.** Gemma (A from *Kennett* 41A; B–G from *Ochyra 972/*80; H from *Seppelt* 19601; I from *Burn 208B*; all in KRAM). Scale bars: a – 100 μm (E–H); b – 1 mm (A); c – 1 mm (B–D & I).

Phytogeography. — **Pan-continental** – A ubiquitous and weedy species. In Antarctica it is widely distributed but scattered; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Alexander I.; East Antarctic Peninsula to Oscar II Coast; Enderby Land; Queen Mary Land; Victoria Land; Marie Byrd Land.

Distribution on King George Island. — A very rare species known only from the Admiralty Bay area (Fig. 116).

Specimen examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***. Cytadela, 10 m, *972/80* (BAE-41).

Literature records. — Potter Peninsula (Kanda, 1987b); Admiralty Bay (Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b; Putzke & Pereira, 1990).

Bryum orbiculatifolium Card. & Broth., K. Svensk. Vet. Ak. Handl. 63(10): 42. 1923. FIG. 122

Plants small, soft, in dense, lustrous tufts about 1.0–2.5 cm tall, light green above, brown below. Stems filiform, pale-yellowish to brown, simple or sparingly branched. Leaves imbricate, closely and evenly spaced almost all along the stem, slightly contorted in the upper part of the stem when dry, suborbicular to broadly oblong, narrowed at the base, not or scarcely decurrent, 1.0–1.3 mm long, 0.8–1.0 mm wide, strongly concave, obtuse and apiculate, sometimes cucullate; margins plane or sometimes slightly recurved below, entire, not bordered; costa percurrent or shortly excurrent; upper laminal cells rhomboidal to oblong-rhomboidal, rather thin-walled; lower cells subquadrate to shortly rectangular. Sterile.

Ecology. — A pioneer species growing on wet bare gravelly ground on lake shores and in places inundated with melt-water.

Phytogeography. — **Amphiatlantic South-Temperate** – South Sandwich Is.; South Shetland Is.; Tristan da Cunha; Magellanian Channels.

Distribution on King George Island. — A rare species known only from a few localities on the Fildes Peninsula (Fig. 123).

Specimens examined from King George Island. — FILDES PENINSULA. Great Wall Station, *Li GWS24(A)* (AAS); Ardley Island, *Kühnemann 147* (AAS, KRAM); Lake Kitezh, 15 m, *2456/80.*

Literature records. — Fildes Peninsula (Ochyra & Ochi, 1986; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995 as *Bryum muehlenbeckii*).

Bryum pallescens Schleich. *ex* Schwägr., Spec. Musc. Suppl. **1**(2): 107, *f. 75*. 1816. FIG. 127

Bryum inconnexum Card.

B. inconnexum var. *tomentosum* Card.

Plants medium-sized, up to 2 cm tall, densely tufted, scarcely lustrous, green to yellowish-green. Leaves more or less flexuose, spirally twisted when dry, erect-spreading when moist, soft, narrowly ovate or oblong to oblong-lanceolate, long acuminate, not decurrent; margins

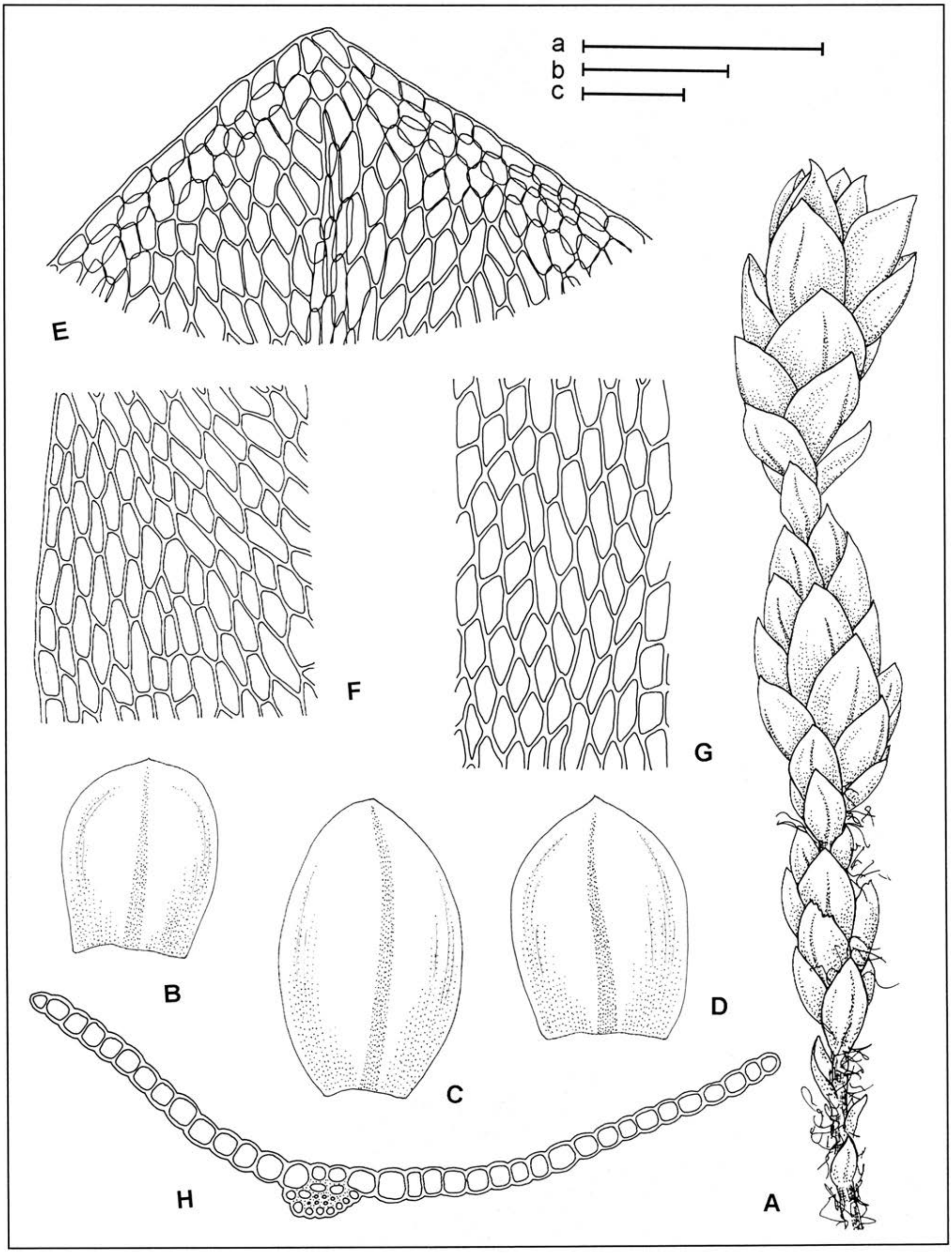
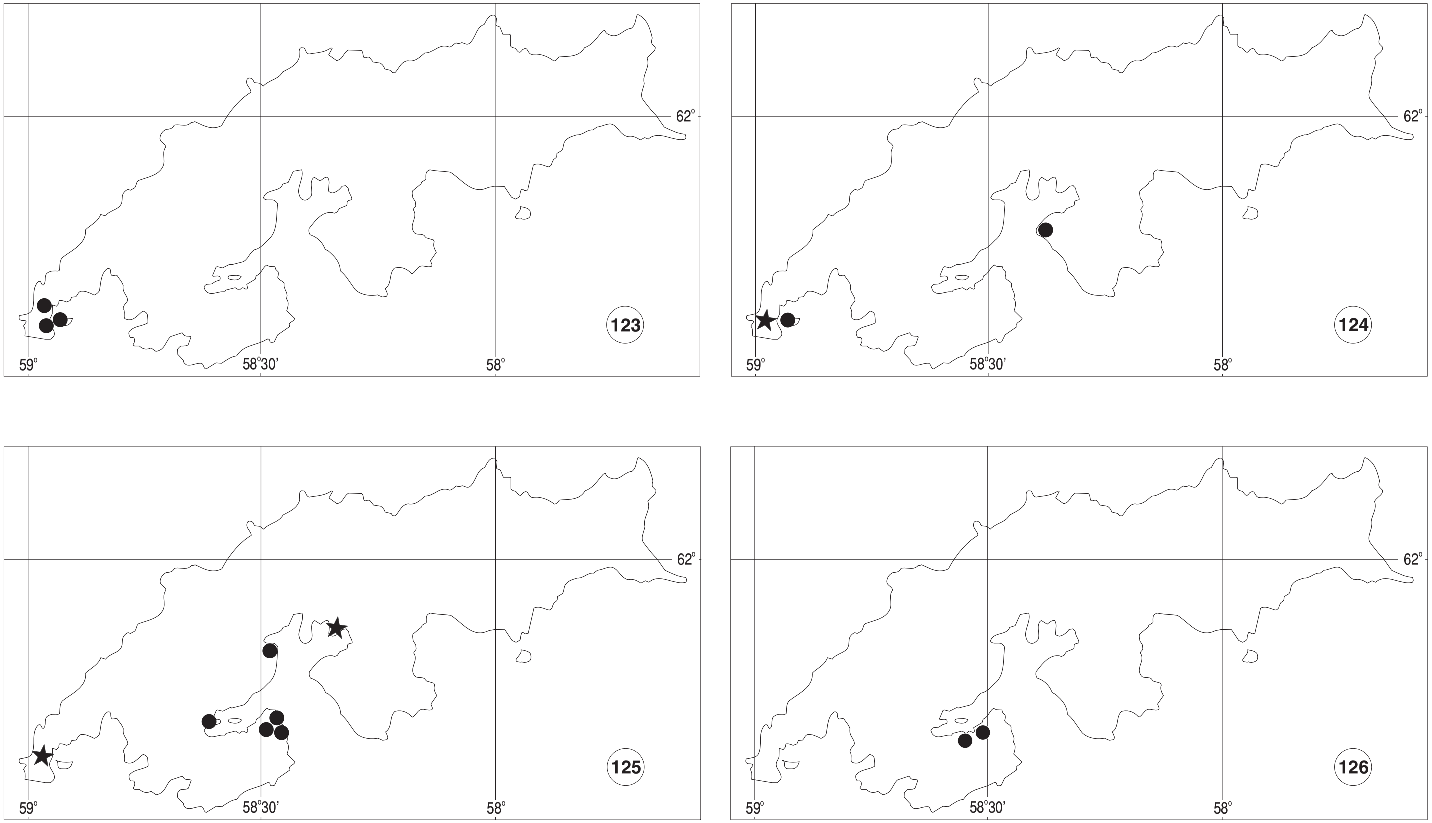


FIGURE 122. *Bryum orbiculatifolium* Card. & Broth. — **A**. Habit. — **B–D**. Leaves. — **E.** Leaf apex. — **F.** Mid-leaf cells at margin. — **G**. Mid-leaf cells. — **H.** Cross-section of leaf (all from *Ochyra 2456/80,* KRAM). Scale bars: a – 1 mm (B–D); b – 100 µm (E–H); c – 1 mm (A).



FIGURES 123–126. Distribution maps for *Bryum orbiculatifolium* Card. & Broth. (123), *B. pallescens* Schleich. *ex* Schwägr. (124), *Pohlia drummondii* (Müll. Hal.) Andrews *in* Grout (125) and *P. wahlenbergii* (Web. & Mohr) Andrews *in* Grout (126) on King George Island. ★ – literature data or oral communication.

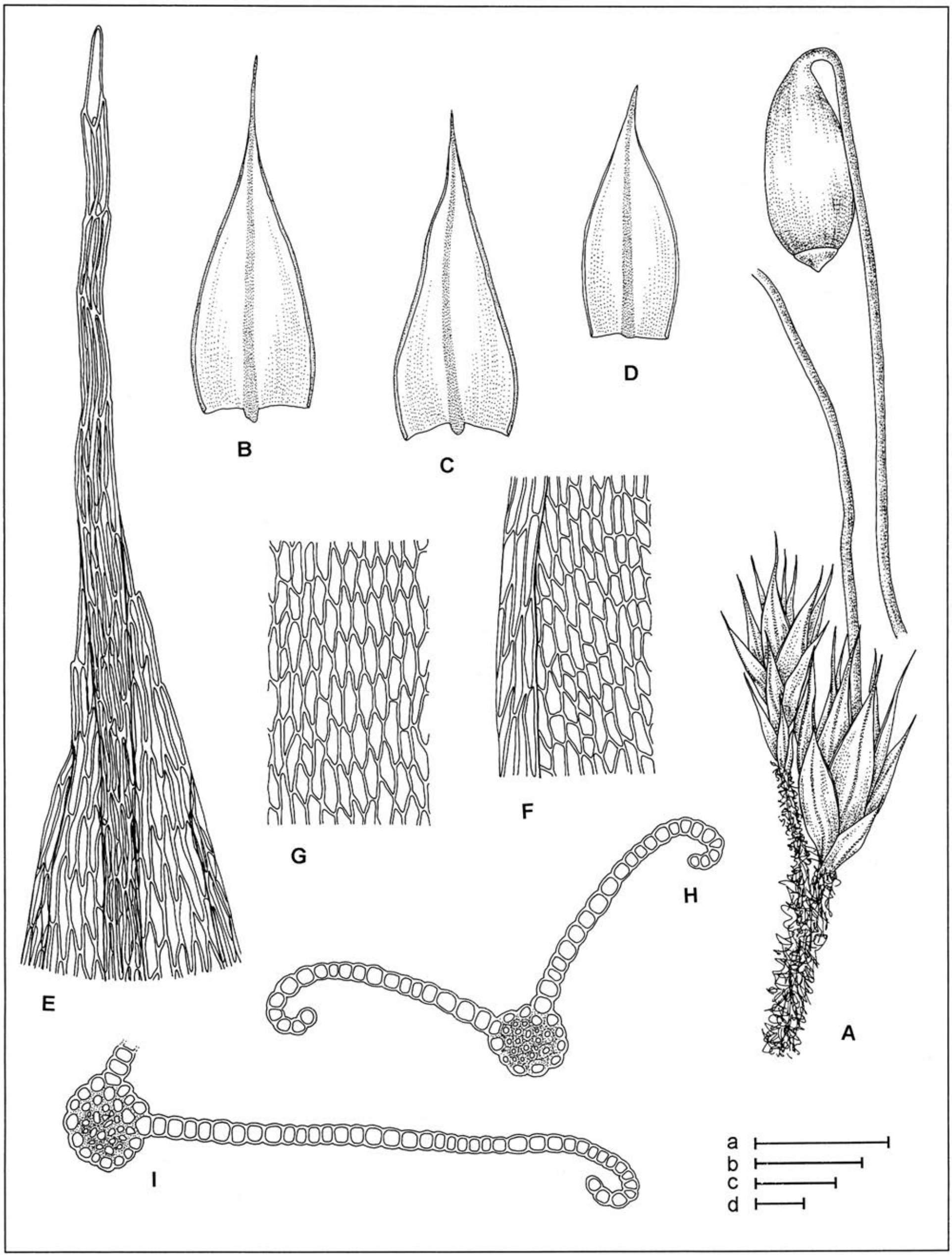


FIGURE 127. *Bryum pallescens* Schleich. *ex* Schwägr. — **A**. Habit. — **B–E**. Leaves. — **F**. Leaf apex. — **G**. Upper laminal cells at margin. — **H**. Mid-leaf cells. — **I–J**. Cross-sections of leaf (A, E–J from *Komárková 601*, KRAM; B–C from *Racovitza 268a*, holotype of *B. inconnexum*, PC; D from *Charcot 244a*, holotype of *B. inconnexum* var. *tomentosum*, PC). Scale bars: a – 100 µm (I–J); b – 1 mm (B–E); c – 100 µm (F–H); d – 1 mm (A).

narrowly recurved or revolute almost throughout except for the extreme apical part; costa strong, red in the basal part, rather abruptly thinner towards the tip and then long excurrent as a slender, smooth awn; laminal cells thin-walled, oblong-hexagonal above, becoming broader and more markedly rectangular in the basal part, narrowed towards the margin; marginal cells elongate and thicker-walled forming a distinct border of 3–4 rows. Sterile.

Remark. — Although Ochi (1979) interpreted *Bryum inconnexum* and *B. inconnexum* var. *tomentosum*, two taxa described by Cardot (1900, 1901, 1906b, 1907a) from the Antarctic Peninsula region, as being identical to *B. pseudotriquetrum*, I consider these names as synonyms of *B. pallescens*. The leaves are oblong-lanceolate with margins strongly recurved from base to apex and the costa is very long excurrent, while the upper laminal cells are shortly oblong-hexagonal up to three times as long as wide. These characters are all typical of *B. pallescens* and therefore, despite the sterile condition of the plants, I consider them to be identical with this species and not *B. pseudotriquetrum*.

Ecology. — On stony ground in relatively moist situations.

Phytogeography. — **Bipolar** – Pan-boreal-temperate in the Northern Hemisphere south to Mexico, North Africa and Taiwan. In the Southern Hemisphere scattered and infrequent: Central Africa; New Zealand; South America at high elevations in the Andes from Colombia to the Chubut Province of Argentina; Falkland Is.; South Shetland Is.; Palmer Archipelago.

Distribution on King George Island. — A very rare species in the Admiralty Bay area and reported from the Fildes Peninsula (Fig. 124). I have not seen any of the specimens reported by Chen *et al.* (1995) from the Fildes Peninsula, but I studied the specimens from Nelson Island named by Chen Fu-dong which do represent this species.

Specimens examined from King George Island. — **ADMIRALTY BAY.** ***Martel Inlet***. Point Hennequin, 15 m, *2239/80*. **FILDES PENINSULA**. Ardley Island, *Kühnemann 92A* (AAS, KRAM).

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1998; Li *et al.*, 1998).

Bryum pseudotriquetrum (Hedw.) C. F. Gaertn., B. Mey. & Scherb., Oek. Techn. Fl. Wetterau 3(2): 102. 1802. FIG. 128

Mnium pseudotriquetrum Hedw.

Webera gerlachei Card.

Bryum gerlachei (Card.) Card.

B. austropolare Card.

B. algens Card.

B. perangustidens Card.

Webera racowitzae Card. var. *laxirete* Card.

Bryum korotkevicziae L. I. Savicz & Smirnova

B. korotkevicziae var. *hollerbachii* L. I. Savicz & Smirnova

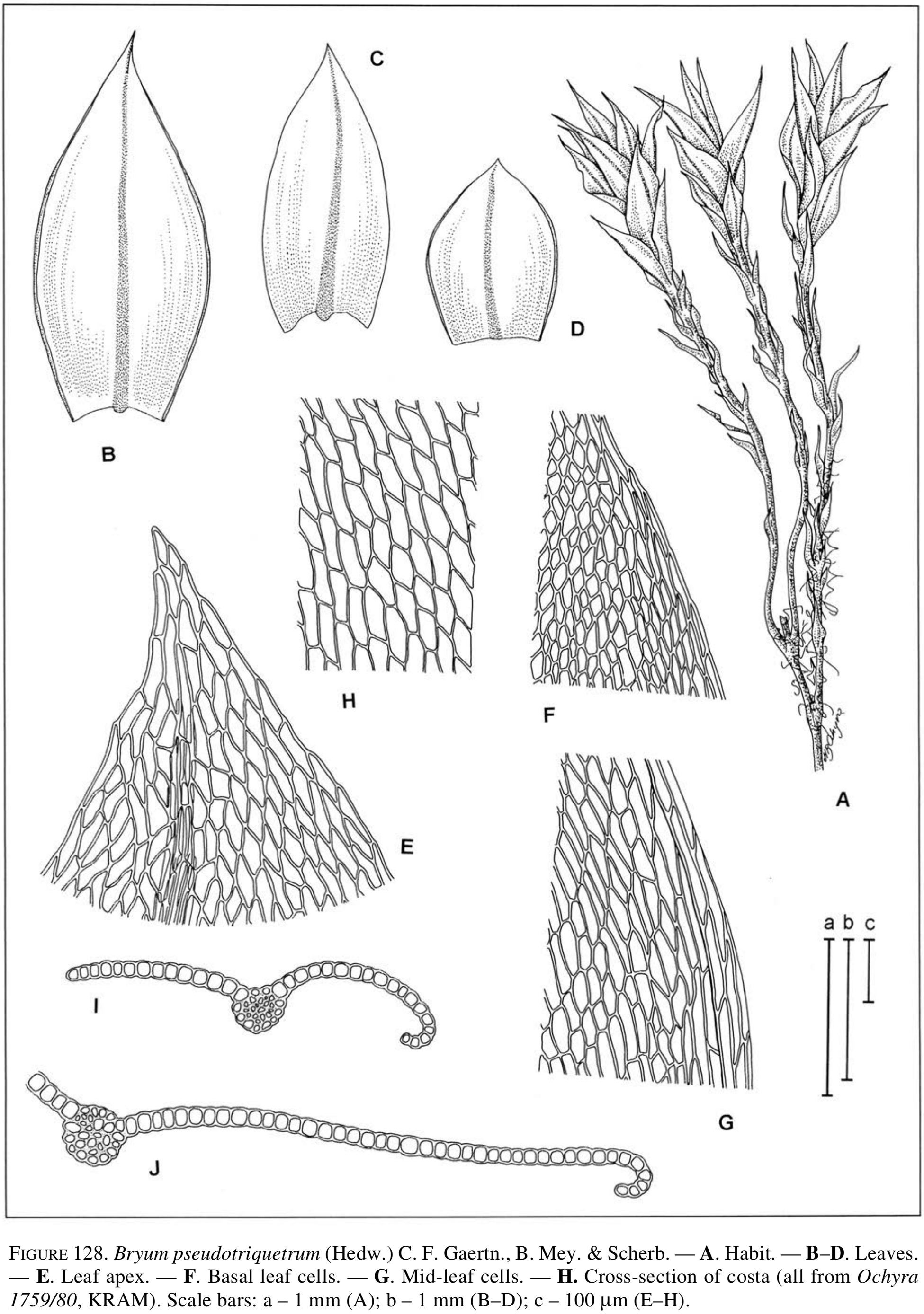


FIGURE 128. *Bryum pseudotriquetrum* (Hedw.) C. F. Gaertn., B. Mey. & Scherb. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Basal leaf cells. — **G**. Mid-leaf cells. — **H.** Cross-section of costa (all from *Ochyra 1759/80*, KRAM). Scale bars: a – 1 mm (A); b – 1 mm (B–D); c – 100 μm (E–H).

B. inconnexum var. *fragile* Horik. & Ando
B. ongulense Horik. & Ando

Medium-sized to large plants, 1–6 cm tall, growing in dense, dark green, reddish-green or brownish-green tufts, often matted with brown rhizoids. Leaves usually rather distant, somewhat larger and more crowded above, twisted and contorted when dry, erecto-patent when wet, 1.5–3.0 mm long, oblong-lanceolate to ovate-lanceolate, acute and often cuspidate or acuminate, narrowed at the insertion but shortly and narrowly decurrent; margins entire to slightly serrulate at the apex, strongly revolute throughout, bordered by 2–3 rows of narrower, elongate cells; costa strong, red-brown or brownish above, percurrent to shortly excurrent; upper laminal cells usually green, oblong-hexagonal, 2–3 times longer than wide, with firm walls; basal cells short to fairly long, subquadrate to rectangular near the margins. Dioecious or synoecious. Setae 2–4 cm long, flexuose. Capsules 2.5–3.5 mm long, inclined to pendulous, straight, clavate, with a long distinct neck; peristome double; exostome teeth 16, lanceolate, acuminate, brownish-yellow below, hyaline at the tip, densely papillose on the outer surface; endostome pale, finely papillose with a well-developed basal membrane giving rise to keeled, perforated segments and 1–3 well-developed, appendiculate cilia. Spores spherical, 11–16 µm in diameter, smooth to faintly roughened.

Remark. — In the Antarctic botanical literature, especially from the 1960s and 1970s, this species is reported as *Bryum algens*. It was described by Cardot (1907b) from Victoria Land and later it was considered to be the most widespread species in East Antarctica (Savicz-Lyubitskaya & Smirnova, 1972). Ochi (1979) discussed the status of this species, but having examined only a few sterile stems of the type collection from PC, he hesitated to express a definite opinion with regard to its status. While searching in PC and BM I found very large type specimens of *B. algens* bearing numerous sexual organs [Lectotype (*nov.*): “Bryum algens Card. <u>sp. nova.</u> Terre Victoria: Granite Harbour, l. S 77° Exped. de la Discovery 20/1 1902” – PC!; isolectotype: BM!, PC!]. These specimens fit perfectly other Antarctic populations of *B. pseudotriquetrum* and therefore *B. algens* is here synonymized with the latter name.

Ecology. — In moist or wet places, on banks of pools, along melt-water channels and in low lying flushed areas, less commonly in dry, sheltered or exposed, crevices of rocks, between boulders, on stony ground, rock ledges and outcrops, sometimes submerged in lakes. It is particularly frequent in various communities of the moss hummock subformation but it is also to be found in various moss assemblages of the fruticose lichen and moss cushion subformation.

Phytogeography. — **Bipolar** – It is very common and widespread in the Northern Hemisphere from the High Arctic to Mexico, North Africa and Taiwan. In the tropics it occurs at high elevations in the mountains: Central and East Africa; Hispaniola; South America at montane elevations in the Andes from Colombia and Venezuela south to Santa Cruz Province. In the austral regions it is recorded from New Zealand; SE Australia; Tasmania; Îles Kerguelen; South Georgia; Falkland Is.; South Sandwich Is.; South Orkney Is.; South Shetland Is.; the Antarctic Peninsula south to Alexander Is.; Queen Maud Land; Princess Elizabeth Land; Wilhelm II Land; Queen Mary Land; Victoria Land; Queen Maud Mts.

Distribution on King George Island. — A very common and locally abundant species found in almost all ice-free areas (Fig. 129). It has its optimum occurrence at lower elevations and decreases in frequency above 150 m.

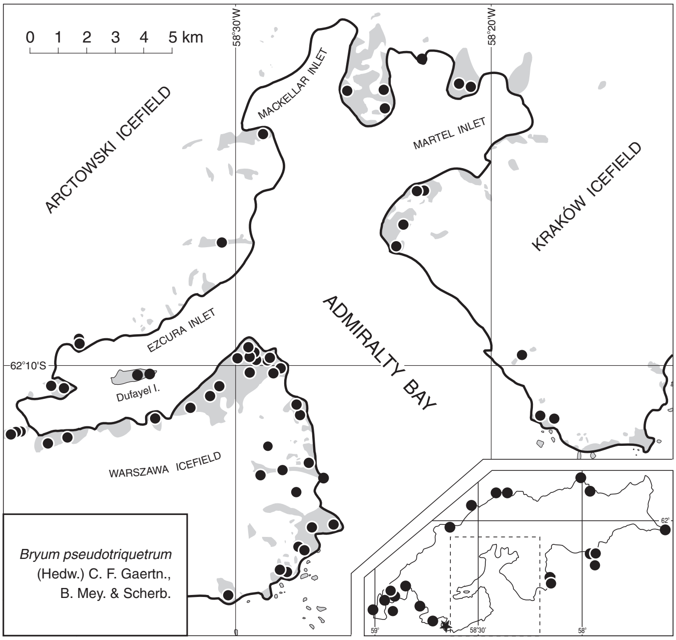


FIGURE 129. Distribution map for *Bryum pseudotriquetrum* (Hedw.) C. F. Gaertn., B. Mey. & Scherb. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 80 m, *1120/80*; Blue Dyke, 5 m, *1208/80* and 135 m, *1140/80*; Uchatka Point, 10 m, *1329/80* and 20 m, *1049/80*; Demay Point, *VK-383, 410, 417, 424, 429, 448 & 457*; Creeping Slopes, 100 m, *1256/80*. ***Ecology Glacier***: Siodło, 95 m, *781/80*; Agat Point, 15 m, *364/80* (BAE-91); Zamek, 330 m, *26/80*; Błaszyk Moraine, 5 m, *2631/80* (BAE-65); Sphinx Hill, 5 m, *411/80* and 130 m, *197/80*; Czajkowski Needle, 240 m, *681/80*; Rescuers Hills, 7 m, *4889/79* (BAE-166); Llano Point, 4 m, *2632/80* (BAE-141). ***Point Thomas***: without specific locality, 20 m, *Lindsay 696* (AAS, KRAM); moraines by the northern edge of Ecology Glacier, 20 m, *902/80*; Rakusa Point, 6 m, *330/80* and 7 m, *315/80*; Penguin Ridge, 25 m, *1405/80* and 40 m, *1438/80*; Jasnorzewski Gardens, 4 m, *1491/80 & 1496/80*; Hala, 35 m, *5221/79* and 45 m, *2389/80*; Upłaz, 45 m, *1526/80* and 50 m, *1524/80*; Geographers Creek, 90 m, *1614/80*; Skua Cliff, 100 m, *625/80*; Ubocz, 90 m, *2364/80* and 94 m, *4950/79*; south-western branch of Panorama Ridge, 1 m, *1718/80*. ***Ezcurra Inlet***: Kasprowy Hill, 200 m, *68/80*; Italia Valley, 65 m, *55/80* and 100 m, *120/80*; Dutkiewicz Cliff, 10 m, *5085/79*; Breccia Crag, 140 m, *917/80*; Cytadela, 10 m, *971/80* and 60 m, *945/80*; Belweder, 80 m, *1592/80*, 85 m, *1591/80* and 120 m, *1597/80*; Barrel Point, 1 m, *891/80*; Pond Hill, 70 m, *870/80 & 882/80* (BAE-116); Emerald Point, 2 m, *852/80* and 12 m, *828/80*. ***Dufayel Island***: Gdynia Point, 8 m, *1759/80* and 10 m, *1980/80*. ***MacKellar Inlet***: Klekowski Crag, 110 m, *2279/80*; Crépin Point, 15 m, *2045/80*. ***Kel-***

ler Peninsula: Speil Point, 4 m, *545/80*; British Point, 3 m, *457/80 & 459/80* (BAE-66) and 5 m, *453/80*; Moraine Point, 25 m, *469/80*. ***Martel Inlet***: Stenhouse Bluff, 4 m, *2617/80*; Ullman Spur, 3 m, *564/80* and 70 m, *563/80*; Smok, 5 m, *2097/80* and 15 m, *2059/80*; Basalt Point, 20 m, *2226/80*; Mount Wawel, 130 m, *2181/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 200 m, *2742/80*; Vauréal Peak, 50 m, *5255/79*; Cape Vauréal, 35 m, *5253/79* (BAE-92) *& 5256/79*. **LEGRU BAY**. Low Head, *BJ-84*. **KING GEORGE BAY**. Lions Rump, *BJ-9*; Turret Point, *BJ-136 & BJ-140*; Penguin Island, *BJ-61 & BJ-71*. **SHERRATT BAY**. Three Sisters Point, *BJ-125*. **DESTRUCTION BAY**. Cape Melville, *BJ-79*. **DRAKE PASSAGE**. Pyrites Island, *BJ-33*; False Round, *BJ-75*; Pottinger Point, 10 m, *BJ-30*; Stigant Point, *BJ-15*; Tartar Point, *BJ-5*; Davey Point, *BJ-50*. **FILDES PENINSULA**. Flat Top Peninsula, 10 m, *John & Sudgen 15A* (AAS, KRAM); Ardley Island, *Booth RILS 5296C* (AAS, KRAM); Bellingshausen Station, 15 m, *2421/80*; Lake Kitezh, 15 m, *2469/80* (BAE-115); Suffield Point, 30 m, *2435/80 & 2439/80*; Green Point, *BJ-19*. **MARIAN COVE**. North Spit, *BJ-145*. **BARTON PENINSULA**. Winship Point, *BJ-191*.

Literature records. — Fildes Peninsula (Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Seppelt & Kanda, 1986; Kanda. 1987b); Admiralty Bay (Ochyra, 1984b; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Ochyra & Ochi, 1986; Seppelt & Kanda, 1986; Kanda, 1987b; Myrcha *et al.*, 1991).

POHLIA

Pohlia Hedw., Spec. Musc. Frond.: 171. 1801.

This genus may be confused with *Bryum*, but the Antarctic species at least can be distinguished by their narrow leaves with linear-rhomboidal or oblong-rhomboidal laminal cells and the lack of a marginal border. With about 110 species described, *Pohlia* is represented on every continent. In Antarctica there are four species, revised partly by Greene *et al.* (1970), which are quite frequent in some areas. For students of the Antarctic flora, the revision of the South Georgian species of *Pohlia* (Clarke, 1973a) will prove useful. In the present treatment the genus is interpreted to include *P. wahlenbergii* which is sometimes segregated into the separate genus *Mniobryum.*

KEY TO THE KING GEORGE ISLAND SPECIES OF *POHLIA*

1. Leaf areolation lax, cells more than 15 µm wide . . . . *P. wahlenbergii*
1. Leaf areolation not lax, the majority of cells less than 15 µm wide 2
    2. Plants bearing axillary gemmae; leaves long decurrent . . . . *P. drummondii*
    2. Plants without axillary gemmae; leaves non-decurrent 3
3. Leaves lustrous, with a conspicuous metallic sheen . . . . *P. cruda*
3. Leaves not lustrous . . . . *P. nutans*

Pohlia cruda (Hedw.) Lindb., Musci Scand.: 18. 1879. FIG. 130

Mnium crudum Hedw.

Webera cruda Hedw. var. *imbricata* Card.

Pohlia cruda (Hedw.) Lindb. var. *imbricata* (Card.) Bartr.

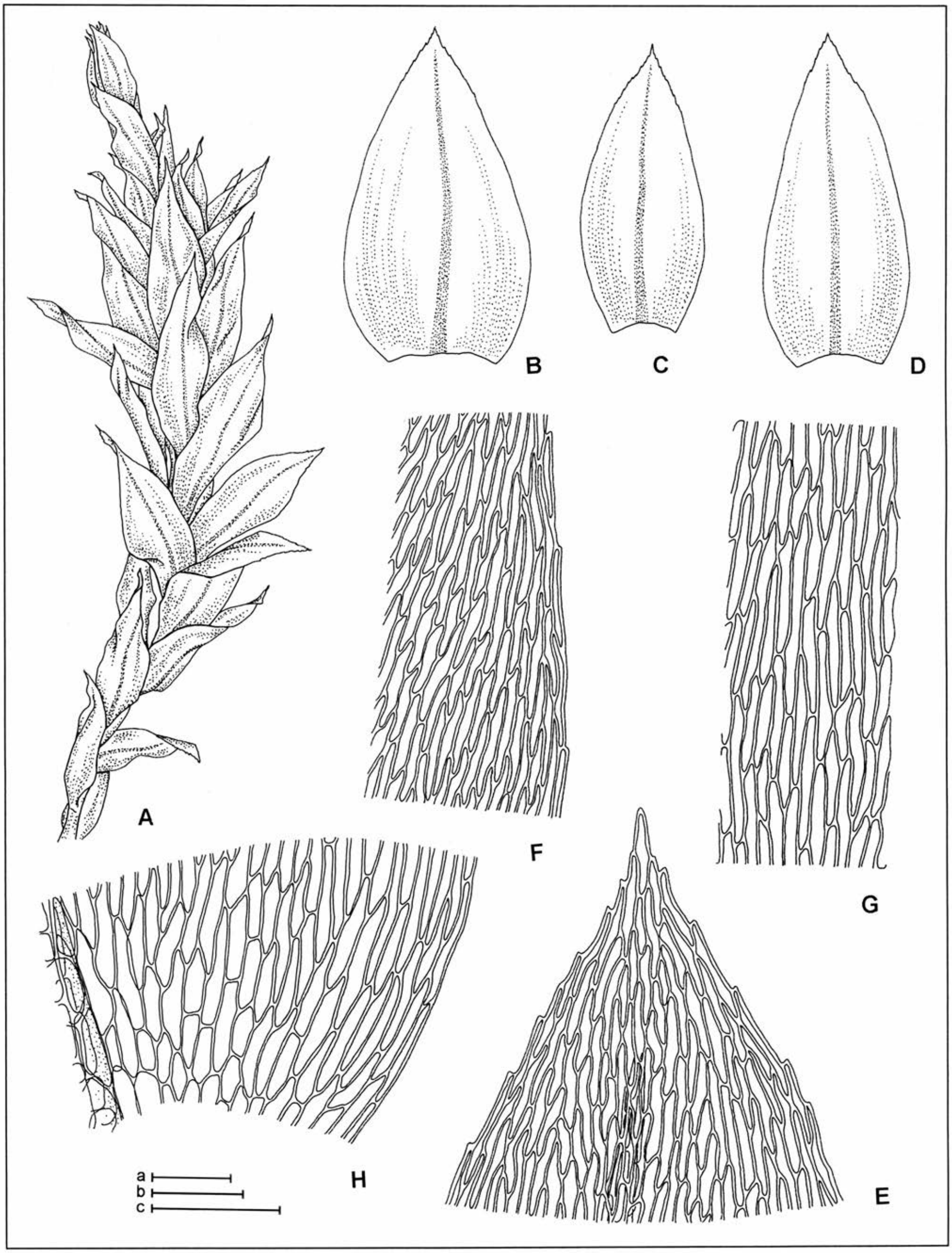


FIGURE 130. *Pohlia cruda* (Hedw.) Lindb. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F.** Upper leaf cells at margin. — **G**. Mid-leaf cells. — **H**. Basal leaf cells (A–B, D & F–H from *Ochyra 555/80*; C & E from *Ochyra 4958/79*; all in KRAM). Scale bars: a – 1 mm (A); b – 100 µm (E–H); c – 1 mm (B–D).

Plants medium-sized to large, 1–5 cm tall, more or less julaceous, forming compact turfs or occasionally scattered among other mosses, pale green with a characteristic metallic sheen. Leaves crowded, slightly shrunken, closely appressed and imbricate or more spreading on drying, not much altered when wet, 1.5–2.5 mm long, 0.8–1.2 mm wide, ovate or elliptical, narrowed at the insertion, not or somewhat decurrent, gradually acuminate, weakly keeled; margins plane, slightly recurved at the base on one side, entire or variously serrulate or crenulate from about mid-leaf to the apex; costa single, strong, red below, flexuose above, ceasing near or considerably below the apex; upper laminal cells very long and narrow, fusiform, thin-walled, (60–)80–120(–160) µm long, 11–18 µm wide; basal cells little different. Sterile.

Remark. — The Antarctic plants grow in short, dense tufts and have more julaceous stems than those which occur elsewhere. This prompted Cardot (1900, 1901) to recognize them as a separate taxon, *Webera cruda* var. *imbricata* [Lectotype (*nov.*): "Voyage de la Belgica. 270c. Webera cruda Sch. var. imbricata Card. var. nova Canal de la Gerlache XXème débarquement, sur les rochers isolées au milieu d'un glacier, alt. 50 m. Leg. Racovitza 12 février 1898" – PC-Card!; isolectotype: BR!]. However, this variety seems to be nothing other than a habitat modification induced by the harsh climatic conditions. Similar expressions have often been recorded from high elevations in European mountains and variously recognized as *Webera cruda* var. *compacta* Velen., var. *alpina* I. Hag. or var. *densa* Thér. Their ostensible similarity with var. *imbricata* was emphasized in its original diagnosis. Moreover, Arctic plants which have a quite similar habit are not recognized as separate taxa. Therefore I see no reason to maintain the Antarctic plant as a taxon in its own right and reduce var. *imbricata* to a synonym of *P. cruda*.

Ecology. — In dry or sometimes moist situations, on bare gravelly soil or on humus covering rock ledges, in damp rock fissures and under rock overhangs.

Phytogeography. — **Bipolar** – Pan-Holarctic in the Northern Hemisphere, scattered in the tropics at high elevations; Central America (Guatemala, Costa Rica, Panama, Hispaniola); Hawaiian Is.; Southern Africa; Australia; Tasmania; New Zealand; Auckland I.; Îles Kerguelen; Galápagos Is.; South America (temperate Chile and Argentina); Tierra del Fuego; South Georgia; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to George VI Sound; Charcot I.; Alexander I.; East Antarctic Peninsula (Foyn Coast, Wilkins Coast).

Distribution on King George Island. — A widespread and locally frequent species, especially in the Admiralty Bay region, but found also along the southwestern coast (Fig. 131), occurring predominantly at higher elevations above 100 m, but sometimes descending to near sea level.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 110 m, *1115/80*; Blue Dyke, 110 m, *1170/80*; Bastion, 240 m, *985/80*; Creeping Slopes, 60 m, *1237/80*. ***Ecology Glacier***: Siodło, 130 m, *751/80*; Zamek, 300 m, *28/80*; Sphinx Hill, 6 m, *412/80* and 120 m, *235/80*; Czajkowski Needle, 240 m, *685/80*. ***Point Thomas***: Ambona, 75 m, *1613/80*; Skua Cliff, 106 m, *639/80*; Ubocz, 90 m, *4858/79* (BAE-39) *& 4966/79*. ***Ezcurra Inlet***: Jardine Peak, 275 m, *5197/79*; Italia Valley, 60 m, *47/80* and 100 m, *94/80*; Dutkiewicz

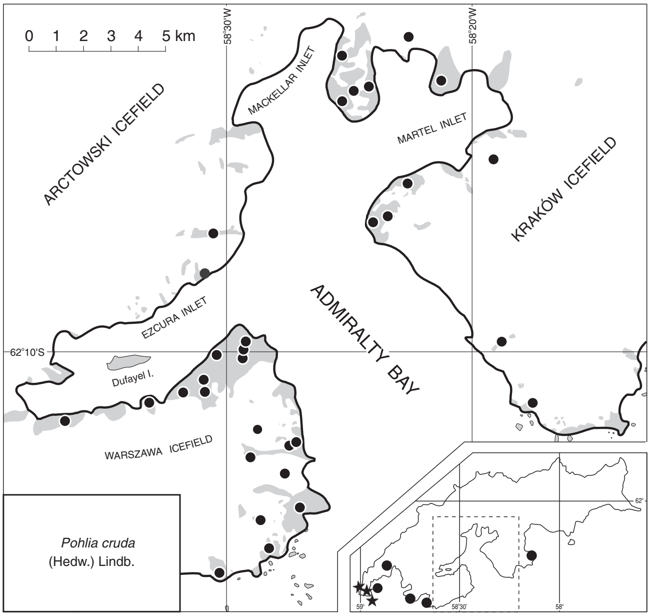


FIGURE 131. Distribution map for *Pohlia cruda* (Hedw.) Lindb. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Cliff, 15 m, *5082/79*; Breccia Crag, 140 m, *927/80*; Cytadela, 155 m, *968/80*; Urbanek Crag, 110 m, *2347/80*. ***MacKellar Inlet***: Klekowski Crag, 220 m, *2263/80*. ***Keller Peninsula***: without specific locality, *Taylor 272A* (BM, LE), *299A* (AAS) *& 302A* (BM, S); Ore Point, 8 m, *524/80*; Harpoon Point, 60 m, *555/80* (BAE-63); Moraine Point, 60 m, *486/80*; Mount Flagstaff, 120 m, *427/80*. ***Martel Inlet***: without specific locality, *Discovery Investigation St. 1481/3* (BM); Shark Fin, 160 m, *2656/80*; Ullman Spur, 70 m, *586/80*; Tern Nunatak, 260 m, *2512/80*; Smok, 30 m, *2103/80*; Mount Wawel, 40 m, *2156/80* and 120 m, *2178/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 200 m, *2743/80*; Vauréal Peak, 60 m, *5249/79*. **KING GEORGE BAY**. Lions Rump, *Lindsay 799A* (AAS). **FILDES PENINSULA**. Ardley Island, *Kühnemann 1954/32a* (AAS); Suffield Point, *2438/80*. **BARTON PENINSULA**. Noel Hill, *BJ-199*. **POTTER PENINSULA**. Three Brothers Hill, *BJ-159*.

Literature records. — Fildes Peninsula (Greene *et al.*, 1970; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Greene *et al*. 1970; Kuta *et al.*, 1982; Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1986, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Okada & Kanda, 1984).

Pohlia drummondii (Müll. Hal.) A. L. Andrews *in* Grout, Moss Fl. N. Am. 2: 196. 1935. FIG. 132

Bryum inflexum Müll. Hal. *in* Neum.
Pohlia inflexa (Müll. Hal. *in* Neum.) Wijk & Marg.

Plants small and slender, 5–15 mm tall, growing in loose, dull green turfs. Leaves distant, erect and appressed when dry, erect-spreading when moist, 1.0–2.5 mm long, 0.5–0.9 mm wide, ovate to shortly ovate-lanceolate, broadly acute, carinate, long decurrent; margins frequently recurved below, bluntly and remotely serrulate at the apex; costa ending below the apex or

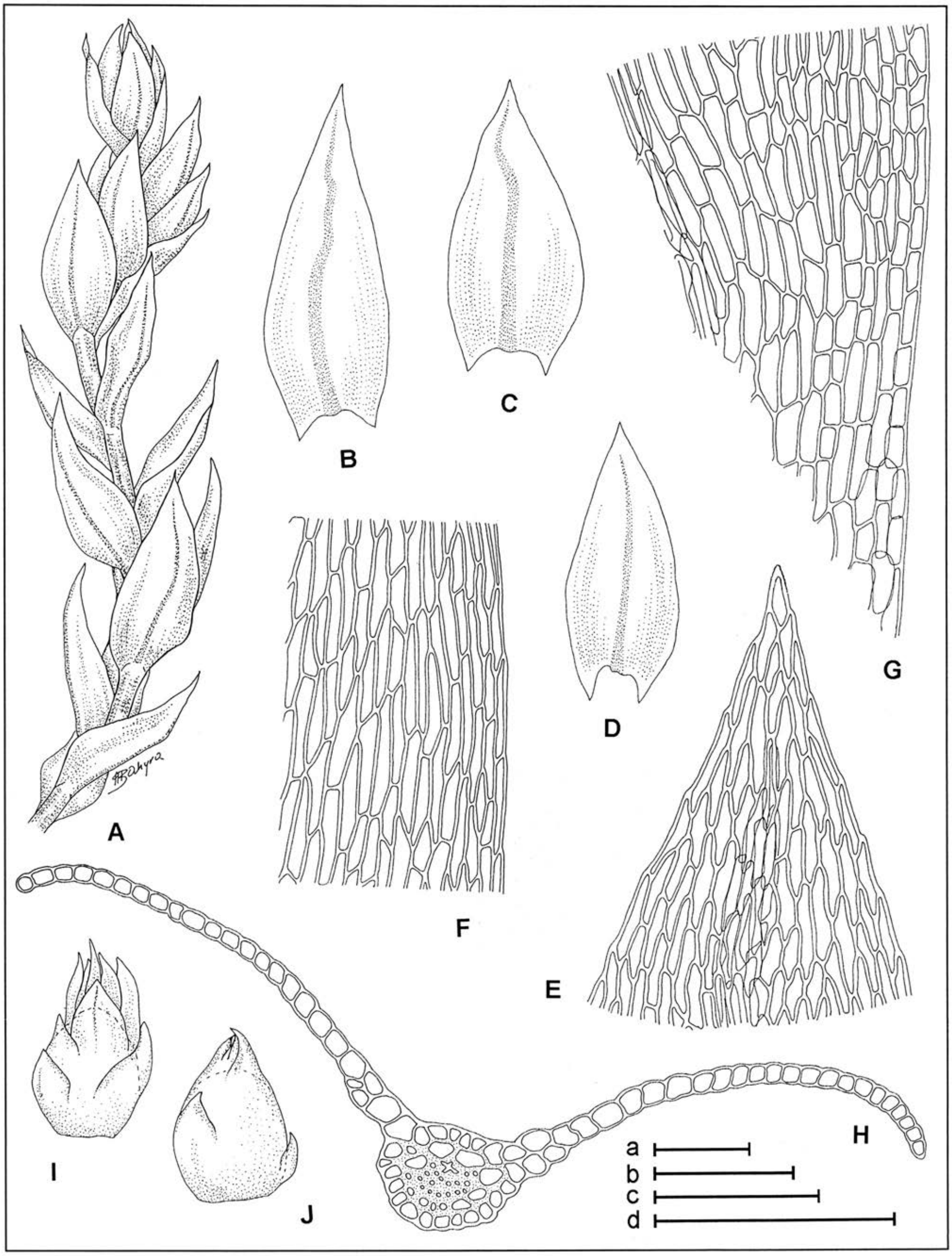


FIGURE 132. *Pohlia drummondii* (Müll. Hal.) Andrews *in* Grout. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F.** Mid-leaf cells at margin. — **G**. Basal leaf cells. — **H.** Cross-section of leaf. — **I**–**J.** Gemmae (A, D & H from *Lewis-Smith 3986*; B from *Ochyra 2392/80*; C from *Ochyra 4915/79*; E–G & I–J from *Ochyra 873/80*; all in KRAM). Scale bars: a – 1 mm (A); b – 100 µm (E–H); c – 1 mm (B–D); d – 1 mm (I–J).

sometimes percurrent; upper laminal cells elongate-hexagonal, rather thin-walled, becoming shorter and laxer towards the base; gemmae arising singly in 1–3(–5) upper leaf axils, ovoid, 300–600 µm long, green when young, orange to orange-brown when older, frequently becoming black when dry, with 3–6 rather stiff, green to pale, triangular-lanceolate leaf primordia at the apex and sometimes below. Sterile.

Remark. — The South Georgian *Pohlia inflexa* (for type see Clarke, 1973b) is here considered to be conspecific with *P. drummondii*, the latter name having priority. The austral plant has gemmae arising singly in the leaf axils. They are ovoid, 300–600 µm long, have 3–6 green, triangular-lanceolate leaf primordia and are of exactly the same size and shape as those in the northern *Pohlia drummondii* (Shaw, 1981, 1982). Further, in addition to identically shaped gemmae the two species share identical gametophyte features. Consequently I see no reason to regard them as separate entities.

Ecology. — In wet places by stream sides on gravelly or sandy soil, occasionally submerged in pools.

Phytogeography. — **Bipolar** – Pan-boreal in the Northern Hemisphere south to California and New England in North America (Shaw, 1981, 1982; Czernyadjeva, 1997). Rare in the Southern Hemisphere: Magellanian Channels; South Georgia; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula (Danco Coast, Graham Coast).

Distribution on King George Island. — A rather rare and infrequent species widely scattered in the Admiralty Bay area (Fig. 125). It prefers low altitudes near sea level and only occasionally does it occur higher up.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Ecology Glacier***: Rescuers Hills, 15 m, *4915/79*. ***Point Thomas***: Jasnorzewski Gardens, 4 m, *1495/80*; Hala, 18 m, *5216/79*, 20 m, *5209/79* (BAE-114) & *5212/79*, 25 m, *2392/80* and 30 m, *5219/79*. ***Ezcurra Inlet***: Pond Hill, 140 m, *873/80*. ***MacKellar Inlet***: Crépin Point, 10 m, *2048/80* (BAE-191).

Literature records. — Admiralty Bay (Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1986, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991).

Pohlia nutans (Hedw) Lindb., Musci Scand.: 18. 1879. FIG. 133

Webera nutans Hedw.
W. racovitzae Card.

Plants small to medium-sized, 0.5–2.5 cm tall, forming dense, dull, green or yellowish-green tufts, or, occasionally, occurring singly intermixed with other mosses. Leaves crowded at the stem tips, erect, closely imbricate, shrunken and flexuose on drying, not much altered when wet, 1.1–2.4 mm long, 0.5–0.9 mm wide, ovate to ovate-lanceolate, gradually tapering to an acute apex, moderately keeled; margins plane or weakly recurved at the base on one side, entire to variously serrulate from about mid-leaf to the apex; costa single, strong, dark green to brownish, occasionally reddish, gradually tapering towards the leaf tip, ending at or below the apex; upper laminal cells linear to narrowly elongate-hexagonal, thick-walled, 30–80 µm long, 11–20 µm wide, becoming shorter and laxer towards the base. Sterile.

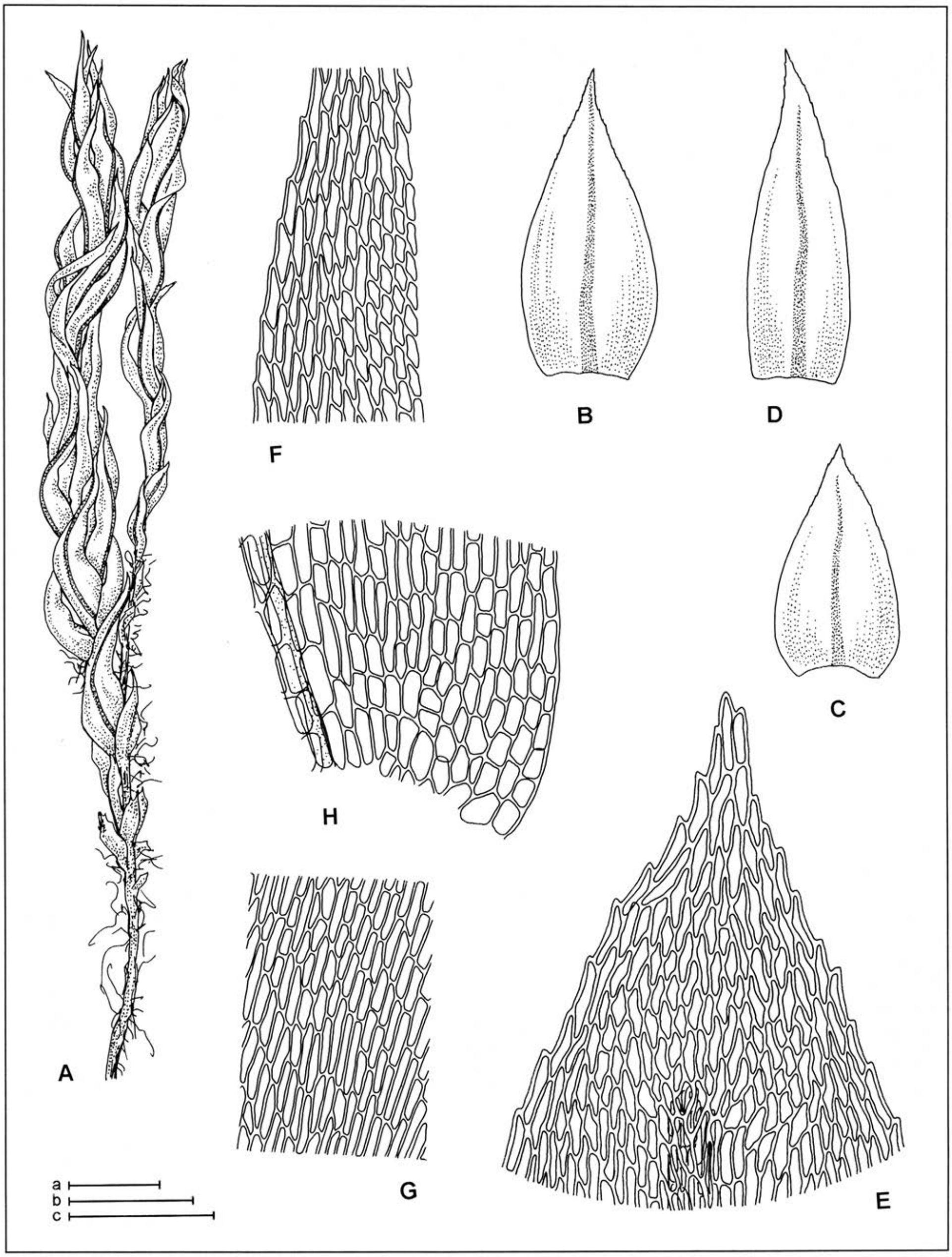


FIGURE 133. *Pohlia nutans* (Hedw.) Lindb. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F.** Upper leaf cells at margin. — **G**. Mid-leaf cells. — **H**. Basal leaf cells (A from *Ochyra 722/80*; B–C & E–F from *Ochyra 707/80*; D & G–H from *Scott* 134a; all in KRAM). Scale bars: a – 100 μm (E–H); b – 1 mm (A); c – 1 mm (B–D).

Ecology. — The species shows a broad ecological tolerance growing in a wide range of habitats, preferably on wet or moist, less commonly on dry, sheltered or exposed rock ledges and outcrops, between boulders and pebbles, on stony ground, but also on humus and soil. It forms pure tufts or often grows intermixed in tufts of *Polytrichastrum alpinum* or *Chorisodontium aciphyllum*.

Phytogeography. — **Bipolar** – Pan-Holarctic in the Northern Hemisphere extending south to Mexico, very rare in the tropics at high elevations (East Africa, Galápagos Is.) and widely scattered at high latitudes in the Southern Hemisphere: New Zealand, SE Australia; Patagonia; Tierra del Fuego; Falkland Is.; South Georgia; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Marguerite Bay; Charcot I.; Alexander I.; Queen Mary Land; Victoria Land; Ellsworth Land.

Distribution on King George Island. — A rather infrequent species, scattered all round the coast (Fig. 134), preferring lower elevations, but sometimes found on isolated nunataks as high as 260 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Creeping Slopes, 60 m, *1238/80*. ***Point Thomas***: without specific locality, *Discovery Investigation St. 1954/4* (AAS, BM); moraines by the northern edge of Ecology Glacier, 5 m, *722/80* and 15 m, *707/80 & 711/80*; Penguin Ridge, 45 m, *1431/80* (BAE-90); Ornithologists Creek, 18 m, *718/80* (BAE-64). ***MacKellar Inlet***: Crépin Point, 5 m, *2036/80*. ***Keller Peninsula***: Ore Point, 15 m, *512/80* (BAE-40). ***Martel Inlet***. Tern Nunatak, 260 m, *2520/80*. SHERRATT BAY. Three Sisters Point, *BJ-123*. DRAKE PASSAGE. Pyrites Island, 10 m, *BJ-32*. VENUS BAY. North Foreland, *BJ-103*. FILDES PENINSULA. Ardley Island, *2485/80*; Bellingshausen Station, 15 m, *2424/80 & 2432/80*. BARTON PENINSULA. Winship Point, *BJ-188*. POTTER PENINSULA. Stranger Point, *BJ-111*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Chen *et al*., 1993, 1995; Li *et al*., 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Greene *et al*., 1970; Furmańczyk & Ochyra, 1982; Kuta *et al*., 1982; Lindsay & Ochyra, 1984; Ochyra, 1984b; Ochyra *et al*., 1986; Kanda, 1987b; Putzke & Pereira, 1990; Myrcha *et al*., 1991; Olech, 1992, 1993; Gumińska *et al*., 1994; Okada & Kanda, 1994).

Pohlia wahlenbergii (Web. & Mohr) A. L. Andrews *in* Grout, Moss Fl. N. Am. 2: 203. 1935. FIG. 135

Hypnum wahlenbergii Web. & Mohr
Mniobryum wahlenbergii (Web. & Mohr) Jenn.

Small plants, erect, branching by innovations, 0.5–2.5 cm tall, in loose turfs, whitish or glaucous-green to somewhat pinkish, not shiny. Leaves shrunken when dry, erecto-patent to patent when moist, remote, 0.9–1.8 mm long, ovate to ovate-lanceolate, acute to acuminate, slightly decurrent; margins plane, indistinctly crenate near the apex; costa reddish below, ending below the apex; laminal cells broadly elongate-hexagonal, 65–110 µm long, 13–20 µm wide, lax, gradually longer and narrower near the margin. Sterile.

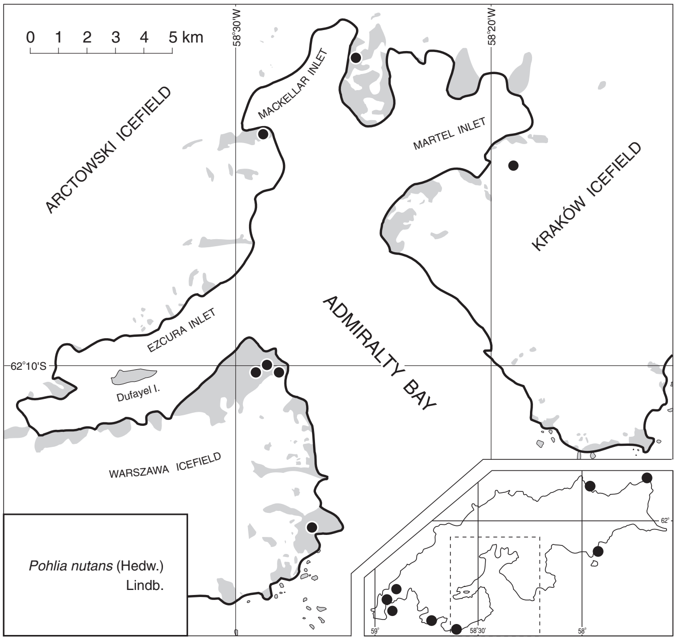


FIGURE 134. Distribution map for *Pohlia nutans* (Hedw.) Lindb. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Remark. — The specimen from Pond Hill (*867/80*) distributed in *Bryophyta Antarctica Exsiccata* as No. 117 is actually *Pohlia drummondii*. Thus, the chromosome count $n = 11$ established for that material should refer to *P. drummondii*. It represents the second chromosome count for the species and confirms the previous one from the British Isles (Ramsay, 1969). Some populations of *Pohlia cruda* may mimic *P. wahlenbergii*, particularly in cell laxity (Lightowlers, 1983), but plants of the latter are never glossy and the colour of the leaves varies between green and pink.

Ecology. — In wet places in crevices of andesite rocks with trickling water and on banks of melt-water channels.

Phytogeography. — **Bipolar** – Pan-Holarctic in the Northern Hemisphere extending to Mexico, North Africa and Taiwan. In the tropics scattered at high elevations: Guatemala; Hispaniola; northern Andes from Colombia to Peru. In the Southern Hemisphere infrequent: New Zealand; SE Australia; Îles Kerguelen; Tristan da Cunha; South Georgia; West Patagonia; Magellanian Channels; Falkland Is.; South Shetland Is.

Distribution on King George Island. — A rare species known from only two stations on the Ezcurra Inlet in the Admiralty Bay area (Fig. 126). Reported also from the Keller Peninsula (Putzke & Pereira, 1990) but no specimens have been available for examination; cited too for the Fildes and Barton Peninsulas (Chen *et*

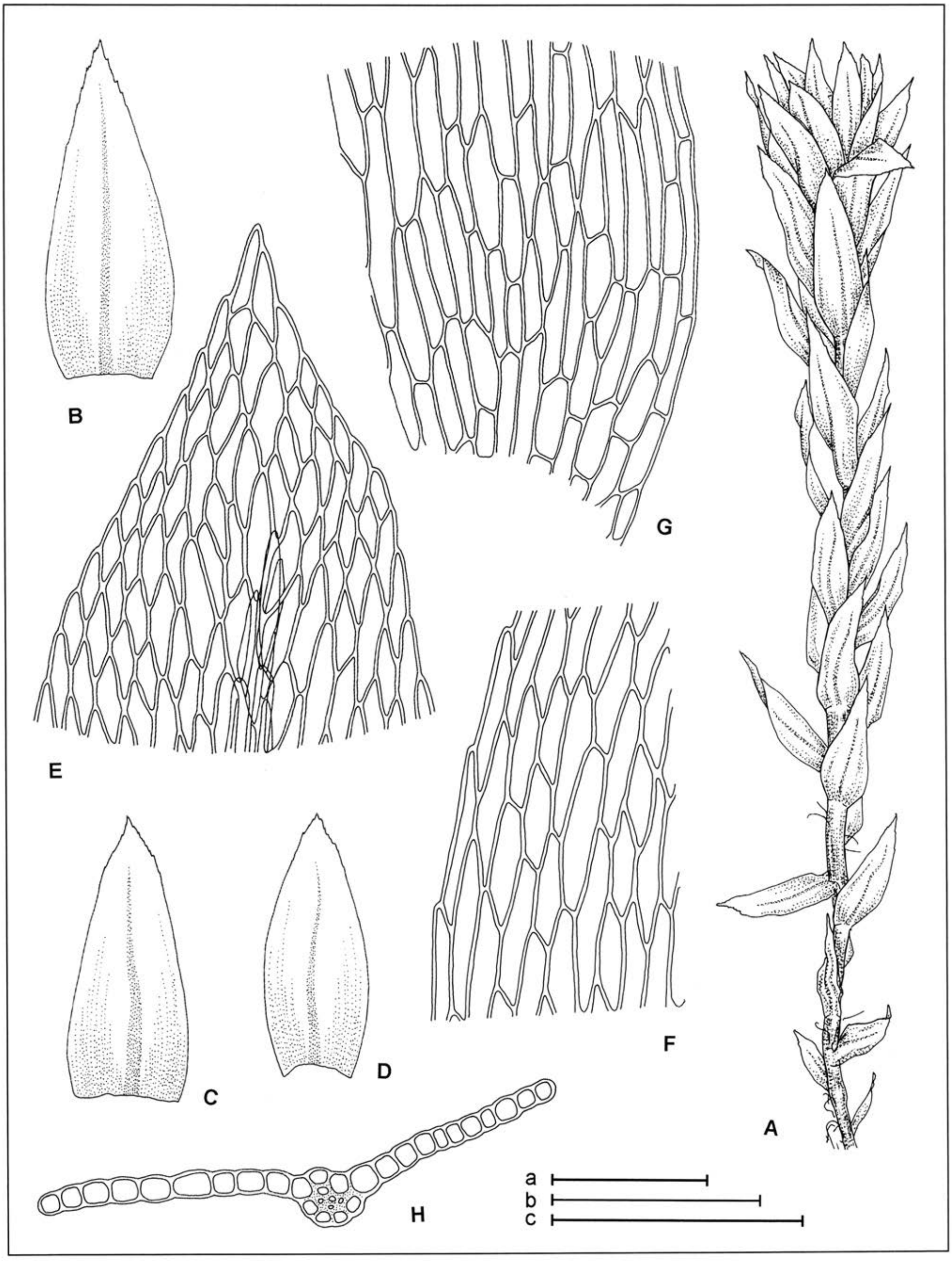


FIGURE 135. *Pohlia wahlenbergii* (Web. & Mohr) Andrews *in* Grout. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F.** Mid-leaf cells at margin. — **G**. Basal cells. — **H.** Cross-section of leaf (A, C–E & G–H from *Ochyra 5086/79*; B from *Ochyra 922/80*; F from *Ochyra 5079/79*; all in KRAM). Scale bars: a – 100 µm (E–G); b – 100 µm (H); c – 2 mm (A) and 1 mm (B–D).

al., 1993, 1995; Li *et al.*, 1998), but a specimen from the latter area only was available for study (*Li K4*, AAS) and it proved to be the typical phenotype of *Bryum pseudotriquetrum*.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***: Dutkiewicz Cliff, 5 m, *5079/79*, 10 m, *5080/79* and 20 m, *5086/79*; Breccia Crag, 30 m, *922/80.*

Literature records. — Fildes Peninsula (Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Barton Peninsula (Chen *et al.*, 1995). The specimen cited from the Admiralty Bay area by Przywara *et al.* (1984), Ochyra (1984b), Ochyra *et al.* (1986), Kanda (1987b) and Okada & Kanda (1994) should actually be referred to *Pohlia drummondii* (see above).

BRYACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Bryum dichotomum Hedw.

Careful re-examination of all specimens reported by Ochyra (1983) and Ochi and Ochyra (1986) from King George Island revealed a lack of gemmae and the presence strongly recurved leaf margins. I interpret them as *Bryum amblyodon* because of the rudimentary cilia and the oblong-hexagonal, more than 3 times as long as wide, upper laminal cells. *B. dichotomum* does occur in the Antarctic on Deception Island (Pendulum Cove, *Lewis-Smith 3663*, AAS, KRAM) and on Alexander Island (Fossil Bluff, *Lewis-Smith 5671*, AAS, KRAM) and the plants there bear rich axillary gemmae.

Bryum muehlenbeckii Bruch & Schimp. *in* B., S. & G.

This species has been recorded from several stations on the Fildes Peninsula and Nelson Island (Chen *et al.*, 1993, 1995; Li *et al.*, 1998). I was able to examine one of these specimens (Nelson I., *Li NN25*, AAS) and I interpret it as *Bryum orbiculatifolium*. *B. muehlenbeckii* has ovate to elongate-ovate leaves, whereas the examined material has suborbicular to broadly oblong leaves which are typical of *B. orbiculatifolium.*

Bryum urbanskyi Broth. *in* Dryg.

The specimens reported from King George Island as *Bryum urbanskyi* (Ochyra & Ochi, 1986) represent in fact *B. pseudotriquetrum*. The leaves are red at the base, recurved at the margin and gemmae are absent. In the Kerguelenian type of *B. urbanskyi* the basal leaf cells have the same colour as those above, the margins are plane and gemmae copious, characters which led me to interpret this plant as *B. dichotomum* with which it shares all the gametophyte characters and possesses gemmae of identical shape.

MEESIACEAE

This is a small family consisting of four genera, *Amblyodon*, *Paludella*, *Neomeesia* and *Meesia*, which, except for the last, are monotypic. They are mostly distributed in the Northern Hemisphere in moist or wet habitats in the north temperate zone and the Arctic; only *Neomeesia paludella* is endemic to southern South America. The species of the Meesiaceae are strongly diversified gametophytically, but sporophyte characters such as pyriform capsule with well-developed apophysis, curved urn, and double peristome lacking cilia but possessing a low basal membrane, serve to unify them. In the Antarctic the family is represented by a single species.

MEESIA

Meesia Hedw., Spec. Musc. Frond.: 173. 1801, *nom. cons.*

A small genus of about 5–6 species widely distributed in the Northern Hemisphere and less frequent in the austral regions. It has only recently been reported from Antarctica and is here represented by a single species, *Meesia uliginosa*, which is confined to the northern maritime Antarctic (Ochyra & Lewis-Smith, 1999).

Meesia uliginosa Hedw., Spec. Musc. Frond.: 173. 1801. FIG. 136

Ceratodon kinggeorgicus Kanda

Plants small, erect, unbranched or forked, 0.5–1.5 cm tall, growing in compact tufts, somewhat glossy, dark to blackish-green. Leaves appressed when dry, erect-spreading when wet, oblong-lanceolate to ligulate, gradually tapering to a short obtuse tip, often apiculate, 1.0–1.5 mm long, 0.3–0.4 mm wide; leaf margin plane or incurved, entire throughout or slightly crenulate near the apex; costa broad, occupying almost half the leaf base, vanishing below the apex; upper and median laminal cells subquadrate to short-rectangular, 18–25 µm long, 13–20 µm wide; basal cells elongate, rectangular. Sterile.

Remark. — This species was first reported from the Antarctic as *Ceratodon kinggeorgicus* which was described as a new species by Kanda (1986) from material collected on the Potter Peninsula on King George Island. It is now considered to be conspecific with *Meesia uliginosa* (Ochyra & Lewis-Smith, 1999).

Ecology. — Grows in acidic, moist to relatively dry sites, usually on gravelly or sandy ground or in soil-filled fissures and crevices in rocks, less frequently on wet or damp soil on the banks of melt-water channels and at the base of slopes where winter snow lies late into spring.

Phytogeography. — **Bipolar** – A widespread pan-Holarctic species in the Northern Hemisphere having an arctic-boreal-montane range extending to the Himalayas and central China in the south. In the Southern Hemisphere rare and occasional in

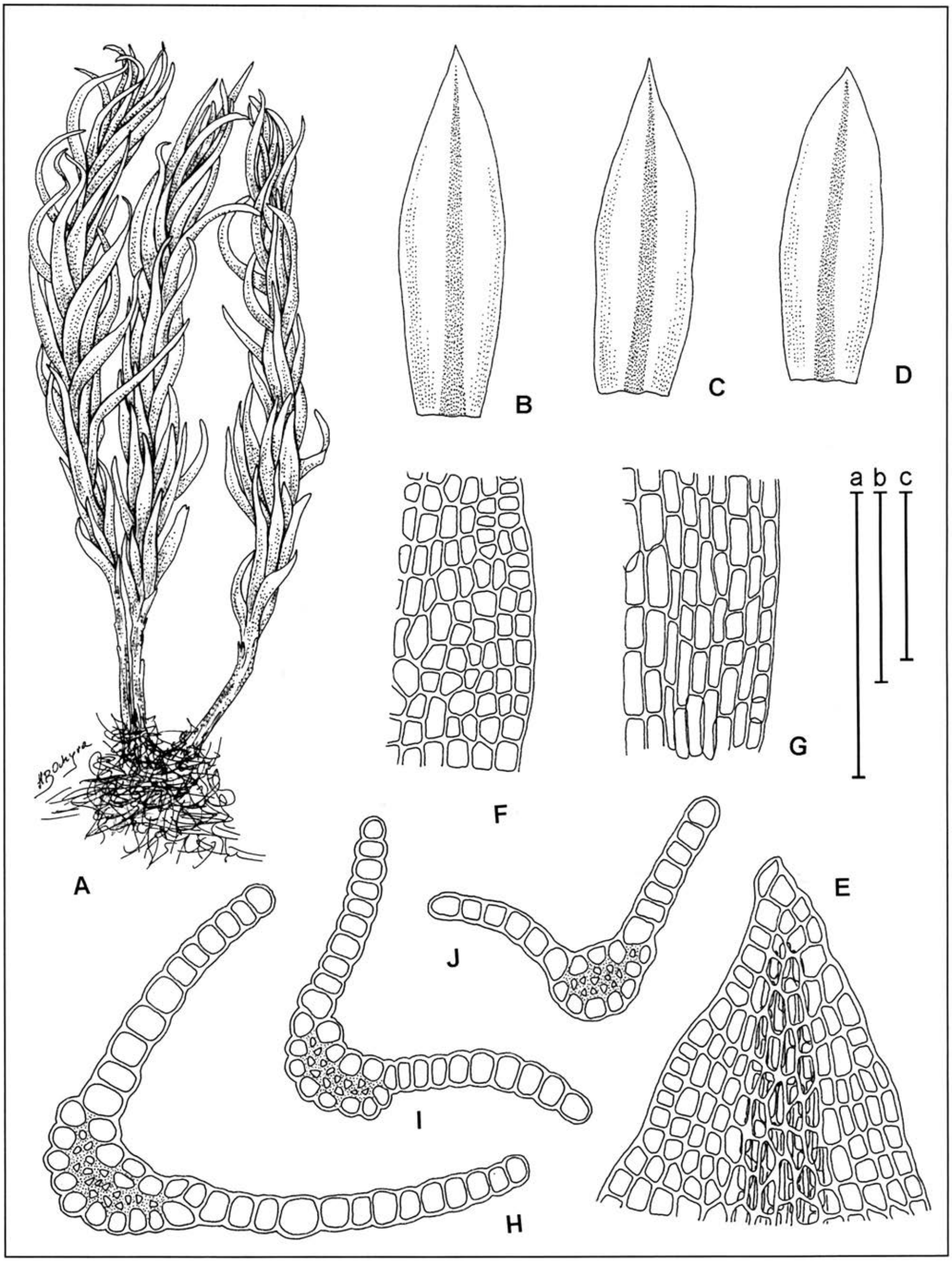


FIGURE 136. *Meesia uliginosa* Hedw. — **A**. Habit, dry. — **B–D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells at margin. — **G**. Basal leaf cells. — **H–I**. Cross-sections of leaf (A, G & J from *Ochyra 1157/80*; B–F from *Ochyra 1240/80*; H–I from *Ochyra 1625/80*; all in KRAM). Scale bars: a – 1 mm (B–D) and 200 µm (E–G); b – 100 µm (H–J); c – 1 mm (A).

southern South America: West Patagonia; Tierra del Fuego; South Georgia; South Orkney Is.; South Shetland Is.; James Ross I.

Distribution on King George Island. — A relatively frequent and locally abundant species, particularly in the Point Thomas area, occurring from sea level to 130 m and occasionally found as high as 200 m (Fig. 137). Outside Admiralty Bay it is frequent on the Potter and Fildes Peninsulas.

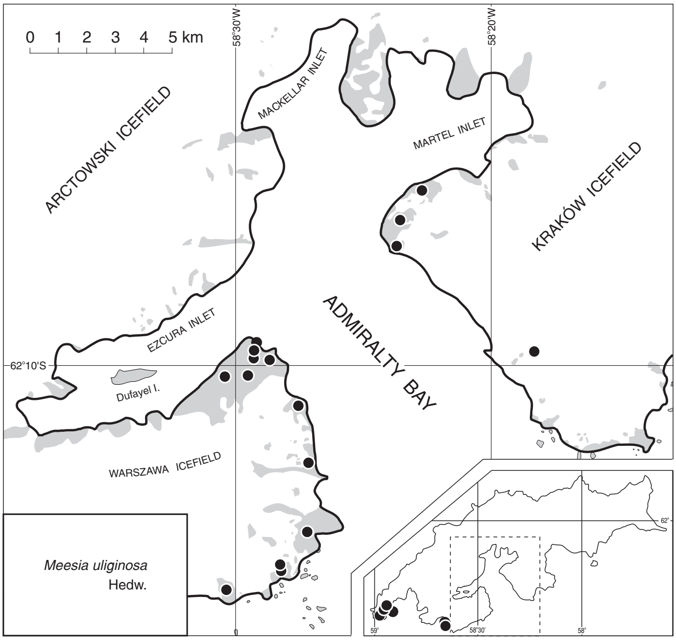


FIGURE 137. Distribution map for *Meesia uliginosa* Hedw. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1091/80*; Blue Dyke, 120 m, and 130 m, *1171/80*; Creeping Slopes, 140 m, *1240/80*. ***Ecology Glacier***: Sphinx Hill, 95 m, *250/80*; Llano Point, 50 m, *4901/79*. ***Point Thomas***: without specific locality, *Lindsay 692A* (AAS, KRAM); Hala, 30 m, *5202/79* and 35 m, *5203/79 & 2386/80*; Krzesanica, 130 m, *1661/80*; Ambona, 75 m, *1639/80* and 80 m, *1625/80*; Skua Cliff, 105 m, *613/80*; Ubocz, 95 m, *4956/79*, 120 m, *2372/80* and 125 m, *2378/80*; Jersak Hills, 180 m, *5144/79*; Smok Hill, 5 m, *2056/80*; Basalt Point, 10 m, *2210/80*; Mount Wawel, 40 m, *2116/80*; Rembiszewski Nunataks, 200 m, *2725/80*. FILDES PENINSULA. Fildes Strait, *Li WS16* (AAS); Ardley Island, *Kühnemann 32B* (AAS, KRAM); Bellingshausen Station, 15 m, *2420/*80. POTTER PENINSULA. Stranger Point, 5 m, *Kanda 112* (NIPR), 8 m, *Kanda 113* (NIPR), 12 m, 28 Jan 1979, *Kanda s.n.* (NIPR), 20 m, *Kanda 116 & 117* (NIPR) and 45 m, 30 Jan 1979, *Kanda s.n.* (NIPR); Three Brothers Hill, 70 m, *Kanda 120* (NIPR – type of *Ceratodon kinggeorgicus*) and 125 m, 1 Feb 1979, *Kanda s.n.* (NIPR).

Literature records. — Fildes Peninsula (Chen *et al*., 1993, 1995; Li *et al*., 1998 all as *Ceratodon kinggeorgicus*; Ochyra & Lewis-Smith, 1999); Potter Peninsula (Kanda, 1986, 1987b); Admiralty Bay (Ochyra & Lewis-Smith, 1999).

BARTRAMIACEAE

The capsule shape is the most distinctive feature of the family – apple-shaped with an oblique mouth and longitudinal furrows clearly visible on drying and frequently inclined. Members of the Bartramiaceae are recognized by the generally dull appearance of the appressed or widely spreading leaves, common occurrence of a reddish tomentum on the stem, and the mostly incrassate leaf cells with papillae often displaced towards the cell ends. The family is cosmopolitan in distribution and consists of ten genera with some 300–350 species. Three genera and four species of the Bartramiaceae are known from the Antarctic. Of these, two species belonging within two genera are represented in the study area. Useful taxonomic treatments of the austral Bartramiaceae have been published by Newton (1973, 1974b) and Matteri (1984, 1985a).

KEY TO THE KING GEORGE ISLAND GENERA OF THE BARTRAMIACEAE

1. Leaves erect-spreading, not ranked, with a sheathing base .... *Bartramia*
1. Leaves appressed, in 5 distinct, straight ranks, without a sheathing base ..... *Conostomum*

BARTRAMIA

Bartramia Hedw., Spec. Musc. Frond.: 164. 1801, *nom. cons.*

Bartramia is a genus of about 100 species occurring in every continent. It consists of generally large and robust mosses and most of them can be recognized in the field by their rigid appearance, the lack of whorled, subfloral innovations and the leaves which in many species comprise echlorophyllose, non-plicate bases closely sheathing the stem and linear or subulate limbs which are serrate on the margins and strongly papillose. In the Antarctic the genus is represented by a single species, *B. patens*. It is one of the commonest and most abundant mosses in this biome which, in addition, produces sporophytes in plenty, making it absolutely unmistakable for any other moss species.

Bartramia patens Brid., Musc. Rec. 2(1): 56.1803. FIG. 138

Bartramia diminutiva Müll. Hal.
B. oreadella Müll. Hal. *in* Neum.
B. pycnocolea Müll. Hal. *in* Neum.
B. patens fo. *austrogeorgica* (Par.) Card.

Plants medium-sized in dense, dull tufts, 1.0–4.5 cm tall, dark green, glaucous or yellowish. Leaves rigid, strict, 2.5–6.5 mm long, erect when dry, erecto-patent or patent when wet, rapidly constricted from an oblong, sheathing base into a linear-subulate limb, 2–5 mm long, 2–3-stratose in cross-section; margins plane, serrate to serrulate in the limb, entire below; costa strong, percurrent, gradually merging into the laminal cells and appearing to fill the whole of the subu-

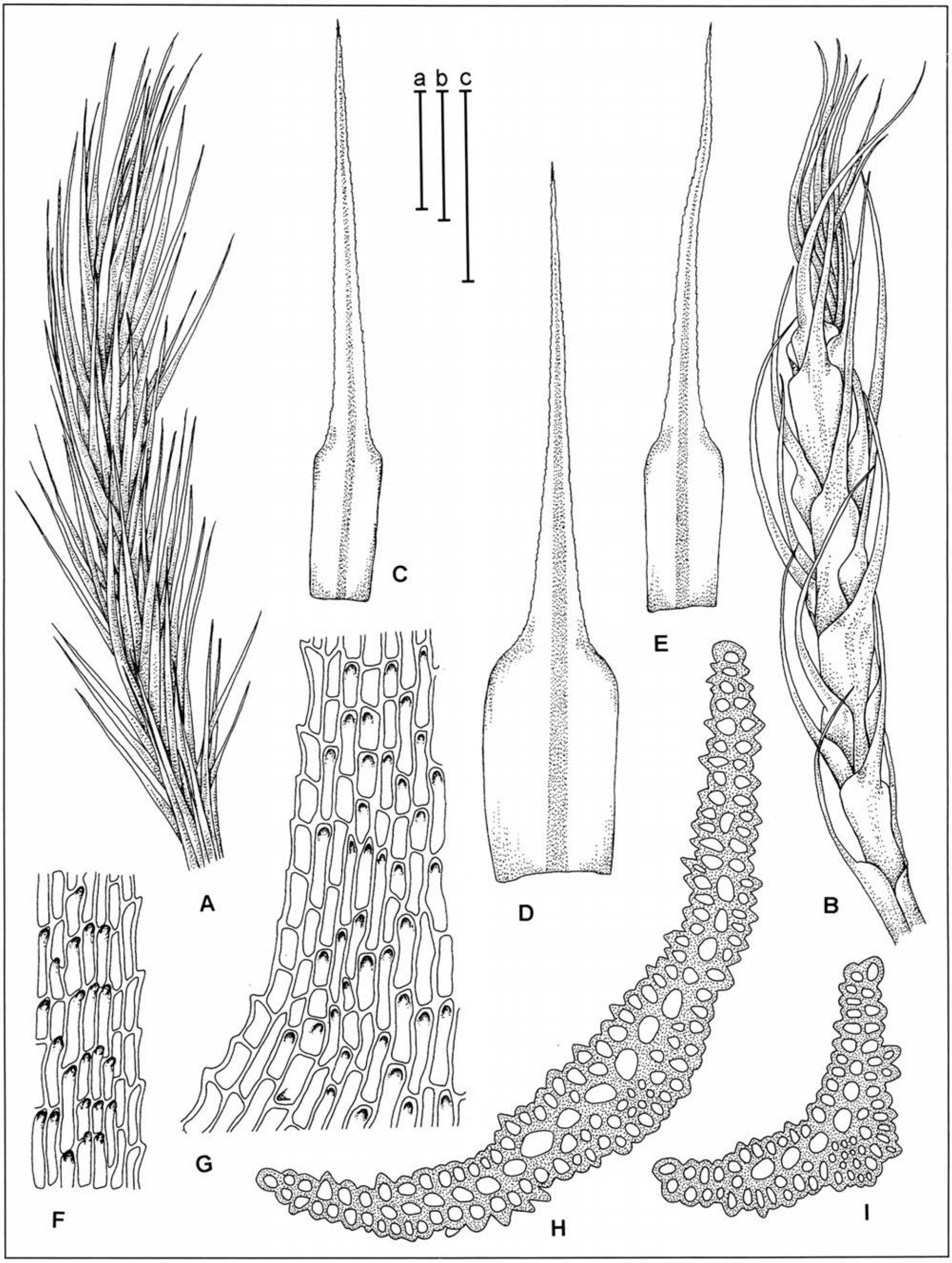


FIGURE 138. *Bartramia patens* Brid. — **A**–**B**. Habit. — **C**–**E**. Leaves. — **F**. Cells in the leaf subula. — **G**. Cells at leaf shoulder. — **H**–**I**. Cross-sections of leaf (A from *Ochyra 2554/80*; B from *Ochyra 916/80*; C from *Ochyra 924/80*; D–I from *Ochyra 2619/80*; all in KRAM). Scale bars: a – 1 mm (A–B); b – 50 μm (F–I); c – 1 mm (C–E).

la; upper laminal cells oblong to short-rectangular, 2–stratose except at the margin, papillose because of projecting cell ends. Synoecious. Setae 10–30 mm long, erect, reddish-brown; capsules inclined, subglobose, longitudinally furrowed when dry; peristome double, with yellow-brown, finely papillose exostome teeth and rudimentary endostome segments. Spores reniform, 23–45 μm in diameter, brown, with large irregular papillae or sometimes finely papillose.

Ecology. — In a very wide range of habitats including boulders, damp rock crevices, rock outcrops and ledges, stony ground, occasionally on peaty soil. It is most frequently associated with various communities of the fruticose lichen and moss cushion subformation.

Phytogeography. — **Amphiatlantic South-Temperate** – Juan Fernandez Is.; Valdivian and Magellanian regions; Tierra del Fuego; Falkland Is.; South Georgia; Tristan da Cunha; Marion I.; Îles Kerguelen; Heard I.; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Marguerite Bay; Charcot I. (Fig. 37).

Distribution on King George Island. — One of the commonest species in the Admiralty Bay area and along the south-east and south-west coasts (Fig. 139), extending from sea level to the summits of the highest nunataks.

Specimens examined from King George Island. — ADMIRALTY BAY. Without specific locality, 150 m, *Gain 303* (PC). ***Bransfield Strait***: Red Hill, 100 m, *1095/80*; Blue Dyke, 130 m, *1150/80*; Bastion, 240 m, *1003/80*; Demay Point, 35 m, *1371a/80*; Creeping Slopes, 120 m, *1267/80*; Brama, 200 m, *799/80*. ***Ecology Glacier***: Siodło, 120 m, *735/80* and 130 m, *769/80*; Zamek, 330 m, *16/80*; Sphinx Hill, 95 m, *226/80*; Czajkowski Needle, 230 m, *683/80*; Rescuers

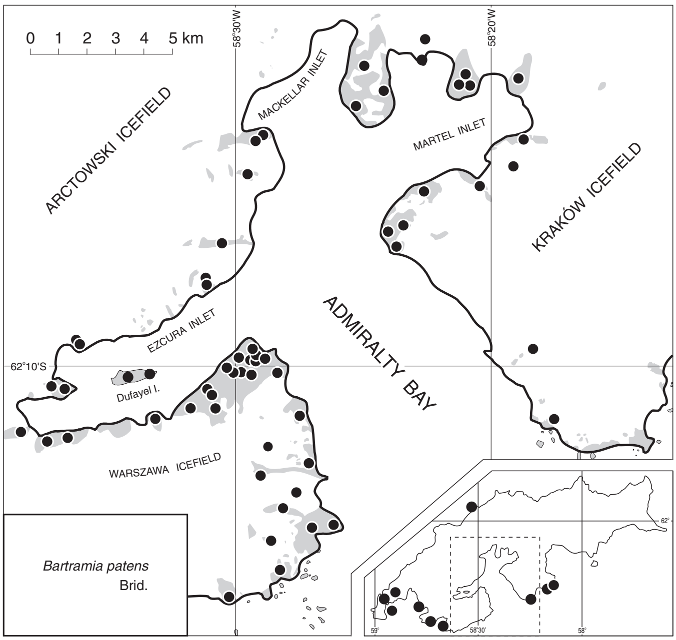


FIGURE 139. Distribution map for *Bartramia patens* Brid. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Hills, 25 m, *4890/79* (BAE-118). ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 25 m, *907/80*; Upłaz, 50 m, *1523/80* and 110 m, *2380/80*; Krzesanica, 50 m, *4983/79983/80*; Ambona, 85 m, *1641/80*; Skua Cliff, 100 m, *624/80*; Ubocz, 95 m, *4955/79* and 150 m, *5828/79*; Krokiew, 165 m, *1694/80*; Jersak Hills, 170 m, *5117/79*, 185 m, *5128/79* and 200 m, *5089/79*; south-western branch of Panorama Ridge, 140 m, *1715/80*; unnamed hill between Jersak Hills and Krokiew, 150 m, *157/80*. ***Ezcurra Inlet***: Jardine Peak, 275 m, *5171/79*; Italia Valley, 5 m, *5077/79*, 60 m, *46/80* and 200 m, *65/80*; Dutkiewicz Cliff, 15 m, *5084/79*; Breccia Crag, 140 m, *924/80* and 190 m, *916/80*; Cytadela, 5 m, *935/80* and 50 m, *959/80*; Belweder, 85 m, *1600/80*; Pond Hill, 60 m, *887/80* and 120 m, *2777/80*; Emerald Point, 24 m, *849/80* and 40 m, *470/80*; Urbanek Crag, 100 m, *2317/80* and 160 m, *2341/80*. ***Dufayel Island***: Gdynia Point, 10 m, *1777/80*; Sopot Peak, 150 m, *1579/80*. ***MacKellar Inlet***: Klekowski Crag, 230 m, *2270/80*; Komandor Peak, 290 m, *1954/80*; Crépin Point, 10 m, *2996/80* and 20 m, *2049/80* (BAE-14). ***Keller Peninsula***: Harpoon Point, 5 m, *554/80*; Moraine Point, 30 m, *487/80* (BAE-67) and 35 m, *466/80*; Piasecki Pass, 200 m, *431/80*; without specific locality, *VK-943*. ***Martel Inlet***: Shark Fin, 180 m, *2638/80*; Stenhouse Bluff, 25 m, *2619/80*; Ullman Spur, 15 m, *593/80 & 598/80*, 80 m, *589/80* and 100 m, *601/80* (BAE-167); Precious Peaks, 100 m, *2667/80*; Szafer Ridge, 250 m, *2554/80*; Tern Nunatak, 265 m, *2510/80*; Warkocz, 300 m, *2528/80*; Smok, 4 m, *2085/80*; Point Hennequin, 10 m, *2241/80*; Basalt Point, 10 m, *2233/80*; Mount Wawel, 40 m, *2136/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 200 m, *2746/80*; Vauréal Peak, 50 m, 29 Dec 1979, *Jabłoński s.n.* LEGRU BAY. Malczewski Point, *BJ-1*; Cinder Spur, *BJ-12*; Low Head, *BJ-86*. DRAKE PASSAGE. Davey Point, *BJ-48*. FILDES PENINSULA. Ardley Island, *Kühnemann 32A* (AAS, KRAM); Bellingshausen Station, 15 m, *2430/80*; Lake Kitezh, *2454/80*. BARTON PENINSULA. North Spit, *BJ-150*; Winship Point, *BJ-182*. POTTER PENINSULA. Three Brothers Hill, *BJ-157 & BJ-196*.

Literature records. — Fildes Peninsula (Pizarro & Sáiz, 1977; Putzke & Pereira, 1990; Chen *et al.*, 1993, 1995; Li *et al.*, 1998; Liu & Li, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Cardot, 1911a, 1911b, 1913; Steere, 1961 both as *B. pycnocolea*; Kuta *et al.*, 1982; Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Gumińska *et al.*, 1994; Okada & Kanda, 1994).

CONOSTOMUM

Conostomum Sw. *ex* Web. & Mohr, Natur. Reise Schwed.: 122. 1804.

A small but very prominent genus, easily recognized by its leaves, which are arranged in five distinct ranks, and the peristome teeth whose tips are fused forming a perforate cone (hence the name). It is a predominantly Southern Hemisphere genus where seven of the eight species belonging within it occur. Two species are infrequently found in the northern maritime Antarctic, one of which is known from the study area.

Conostomum magellanicum Sull., Kew J. Bot. 2: 316. 1850. FIG. 140

Plants small to medium-sized, simple or sparingly branched, 1–3 cm tall, growing in rather loose tufts or scattered among other mosses, dull, yellow-green. Leaves closely appressed, imbricate, arranged in five spiral rows, ovate to oblong, 0.9–1.5 mm long, 0.4–0.6 mm wide,

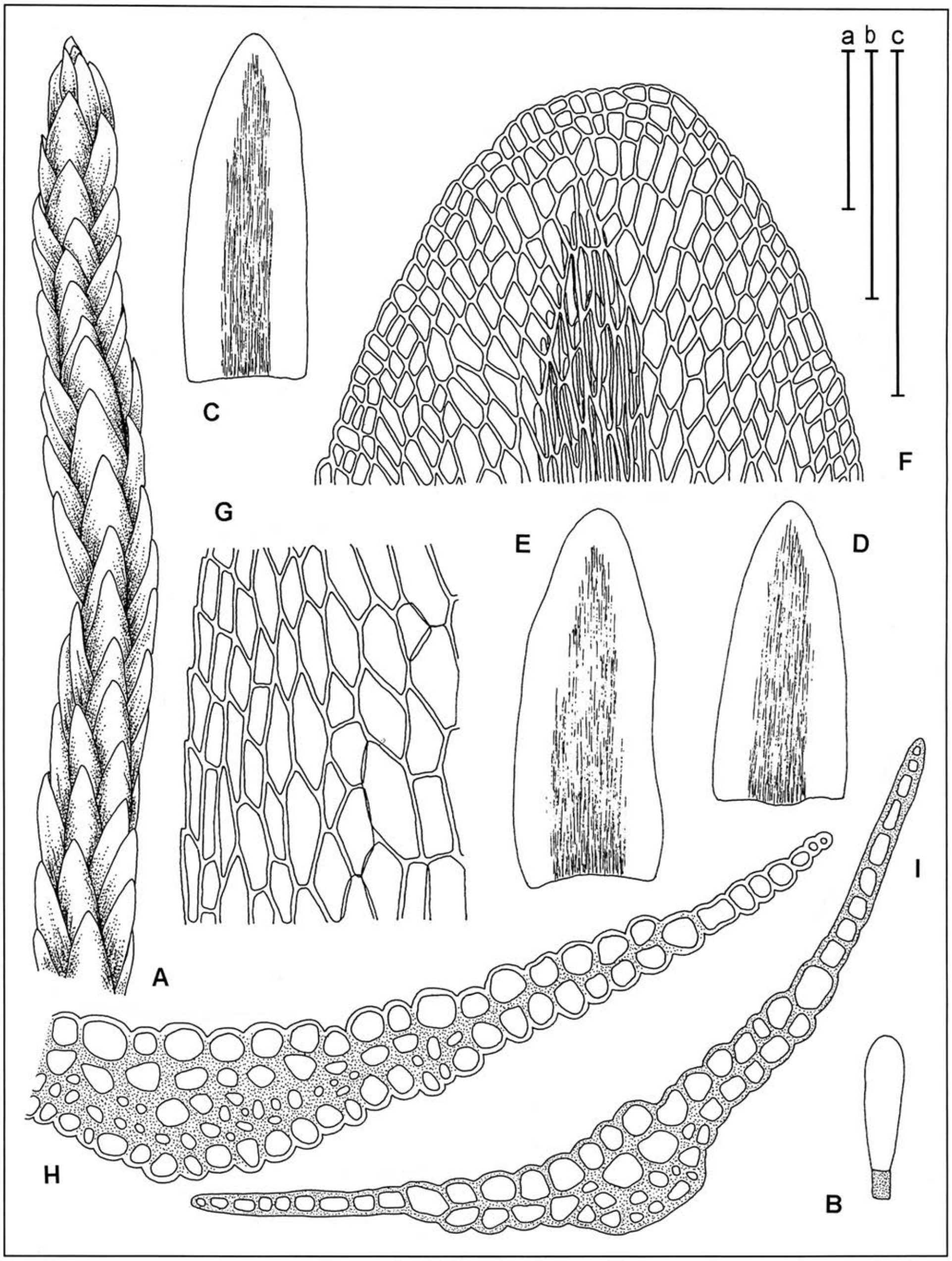


FIGURE 140. *Conostomum magellanicum* Sull. — **A**. Habit. — **B**. Axillary hair. — **C**–**E**. Leaves. — **F**. Leaf apex. — **G**. Mid-leaf cells at margin. — **H**–**I**. Cross-sections of leaf (A from *Ochyra 559/80*; B from *Lewis-Smith 605*; C–D & H–I from *Ochyra 1638/80*; E–G from *Lewis-Smith 605*; all in KRAM). Scale bars: a – 1 mm (A) and 50 µm (G–I); b – 100 µm (F); c – 50 µm (B) & 1 mm (C–E).

broadly obtuse at the apex; margins plane or frequently crenulate towards the apex; costa very broad, more than one third of the width of the leaf base, 100–200 μm wide, not sharply defined and diffusing into the laminal cells, ending below the apex; upper laminal cells rhomboidal to short-rectangular, firm-walled, smooth or weakly papillose near the costa because of projecting ends, becoming rectangular below and narrowed towards the margins, forming a narrow border. Sterile.

Ecology. — On soil and stony ground in moist to wet situations, on rock ledges and outcrops in sheltered places, often in late snow patches.

Phytogeography. — **American South-Temperate** – Magellanian Channels; Tierra del Fuego; Isla de los Estados; South Georgia; South Orkney Is.; South Shetland Is. (Fig. 35).

Distribution on King George Island. — A rather infrequent species scattered throughout the Admiralty Bay area and on the Fildes Peninsula (Fig. 141), occurring at various elevations from near sea level to 275 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1108/80*. ***Point Thomas***: Ambona, 85 m, *1638/80*; Ubocz, 95 m, *4852/79*; unnamed hill between Jersak Hills and Krokiew, 3 Jan 1980, *Ochyra s.n.* ***Ezcurra Inlet***: Jardine Peak, 275 m, *5196/79* (BAE-15); Italia Valley, 100 m, *114/80* (BAE-68). ***Keller Peninsula***: without specific locality, ca 13 m, *Lewis-Smith 712* (BM). ***Martel Inlet***: Ullman Spur, 90 m, *559/80*; Mount Wawel, 20 m, *2150/80* and 40 m, *2121/80*. FILDES PENINSULA. Fossil Hill, 90 m, *Schulz 11* (KRAM).

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Admiralty Bay (Kuta *et al.*, 1982; Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Okada & Kanda, 1994).

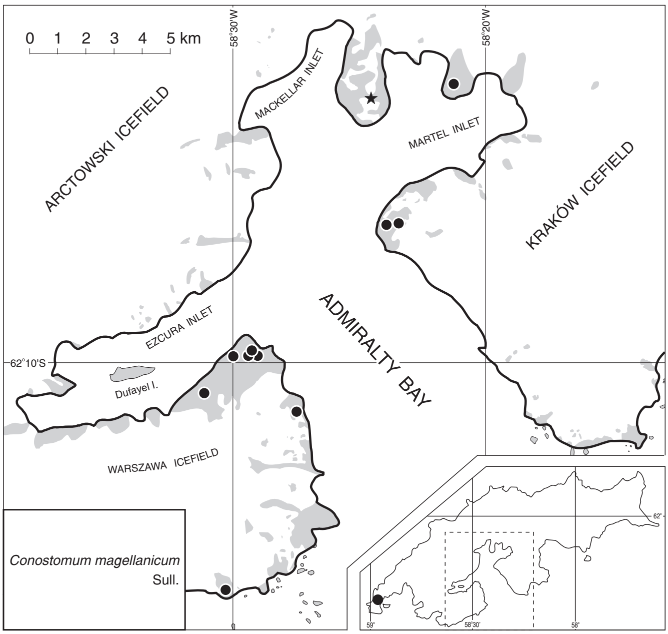


FIGURE 141. Distribution map for *Conostomum magellanicum* Sull. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

ORTHOTRICHACEAE

The Orthotrichaceae are a large family distributed throughout the globe. Its members are similar to the pottiaceous mosses gametophytically, but they have a diplolepidous peristome which consists of 16 exostome teeth alternating with 16 endostome segments, although various stages of reduction occur, extending even to its total absence. The calyptra is mostly mitriform and hairy and the capsules are exserted or immersed. The mosses of this family are mostly xerophytes associated with epiphytic or epilithic habitats. In the Antarctic the family is poorly represented and only two species from two genera are found occasionally in the northern maritime Antarctic. Of these, one is known from King George Island.

MUELLERIELLA

Muelleriella Dusén, Bot. Notiser 1905: 304. 1905, *nom. cons.*

A small genus of four species and one subspecies which are strictly subantarctic in distribution. It is closely related to *Orthotrichum* but differs in its multicellular spores, single peristome with a preperistome, 2–3-stratose upper laminal cells, smooth capsule and the blackish coloration of the plants. Additionally, it is unique in being halophytic, an unusual feature in mosses. *Muelleriella* has been recently monographed by Vitt (1976) and its synonymy has been discussed by Ochyra (1997c). A single species is known from the Antarctic and its distribution in this biome has been reviewed by Clarke and Lightowlers (1983) and Ochyra (1986).

Muelleriella crassifolia (Hook. f. & Wils.) Dusén, Bot. Notiser 1905: 304. 1905.
FIG. 142

Orthotrichum crassifolium Hook. f. & Wils.

Plants small, erect, 0.5–1.5 cm tall, in dense or loose blackish- or brownish-green cushions. Leaves erect when dry, erect-spreading to spreading when moist, 1.3–2.0 mm long, 0.4–0.6 mm wide, ligulate-lanceolate to ligulate, acute; margins plane, entire, 2–4-stratose, usally forming swollen limbidia in the upper part; costa single, sharply demarcated from the laminal cells in its lower part, rather indistinct and gradually merging into the laminal cells above, subpercurrent; upper laminal cells rounded to rounded-hexagonal, smooth, thick-walled; basal cells quadrate to shortly rectangular, about twice as long as wide, thick-walled, becoming elongate and nodulose towards the costa. Sterile.

Ecology. — A strict saxicole growing on coastal rocks in the intertidal zone up to about 5 m above high-water mark. The rocks may be dry but are more usually splashed by seawater and enriched with nitrogen from the seabirds' nests situated above. The only associates are nitrophilous crustose lichens of the genera *Caloplaca*, *Buellia* and *Lecidea*, forming a distinct crustose lichen subformation in this type of habitat.

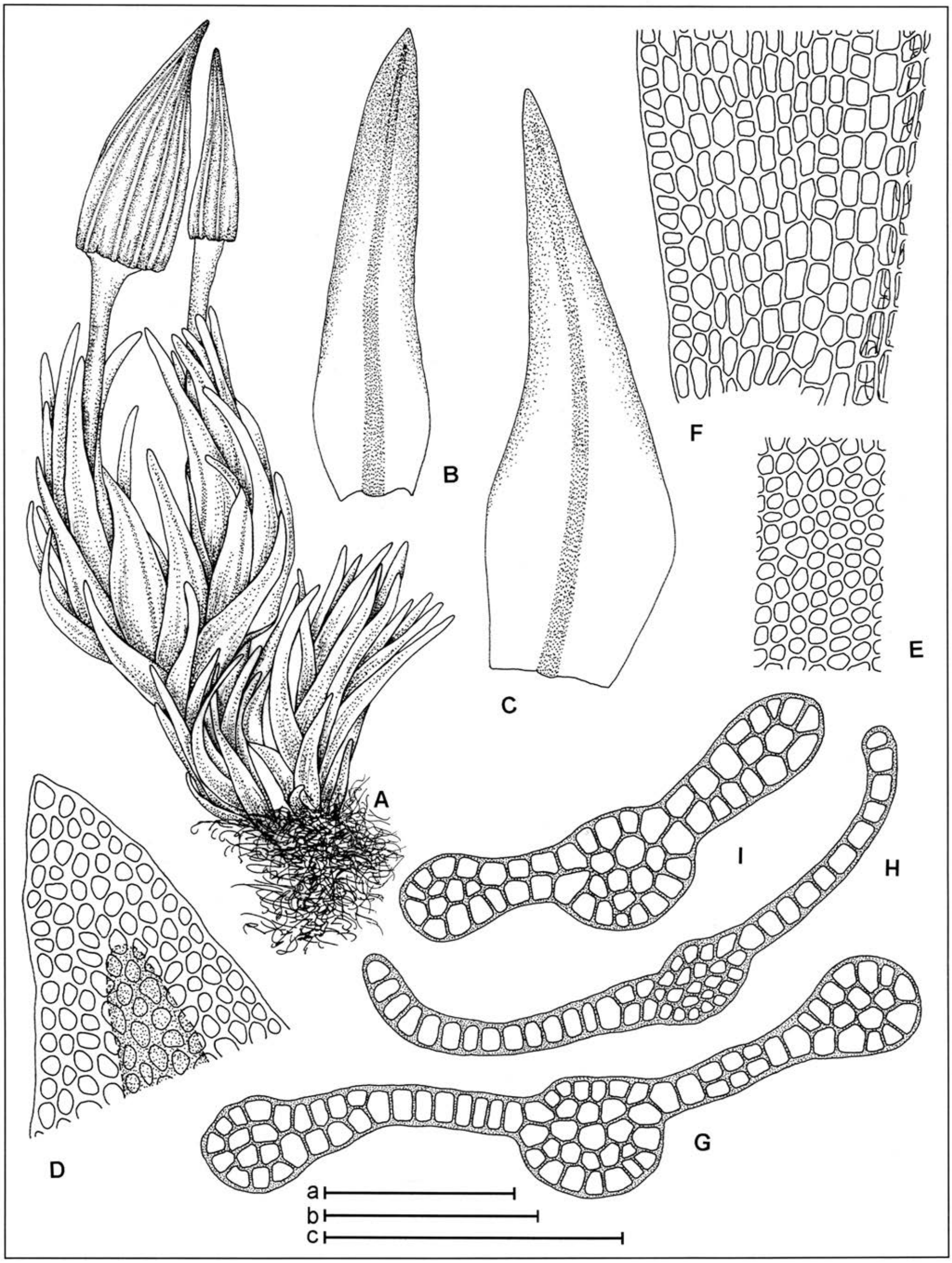
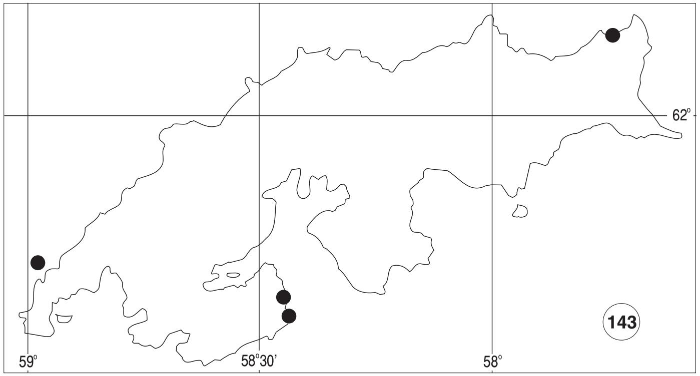
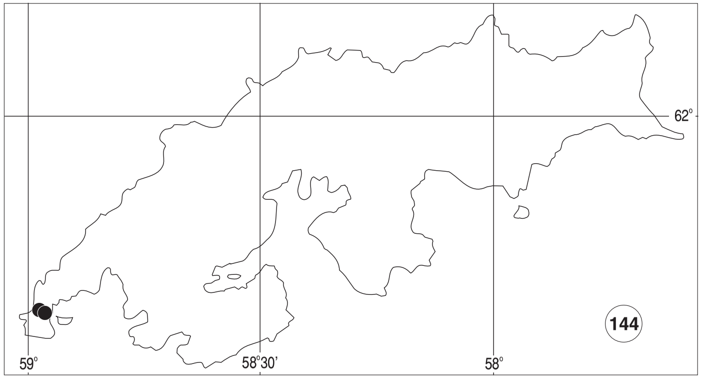
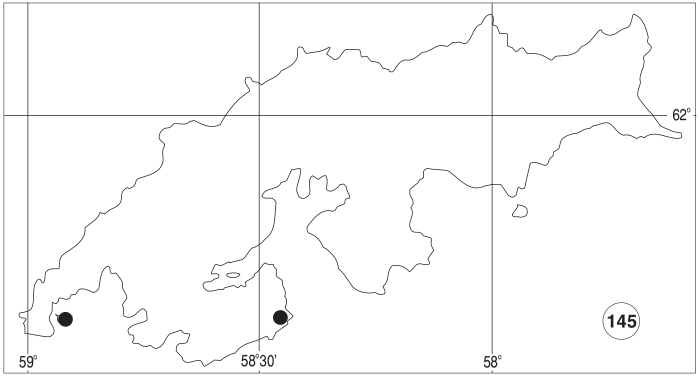
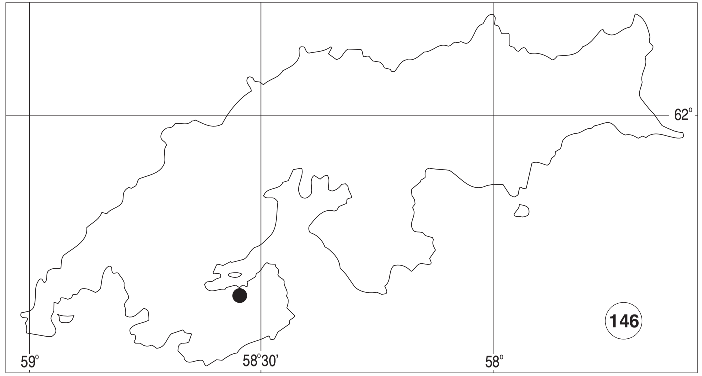


FIGURE 142. *Muelleriella crassifolia* (Hook. f. & Wils.) Dusén. — **A**. Habit. — **B**–**C**. Leaves. — **D**. Leaf apex. — **E**. Mid-leaf cells. — **F**. Basal laminal cells. — **G**–**I**. Cross-sections of leaf (A, C & H from *Matteri 1286*; B, D–G & I from *Ochyra 367/80*; all in KRAM). a – 1 mm (A); b – 100 μm (D–I); c – 1 mm (B–C).









FIGURES 143–146. Distribution maps for *Muelleriella crassifolia* (Hook. f. & Wils.) Dus. (143), *Campylium polygamum* (Schimp. *in* B., S. & G.) Lange & C. Jensen (144), *Orthotheciella varia* (Hedw.) Ochyra (145) and *Platydictya jungermannioides* (Brid.) Crum (146) on King George Island.

Phytogeography. — **Pan-Subantarctic** – New Zealand; Campbell I.; Auckland I.; Macquarie I.; Îles Kerguelen; Îles Crozet; Marion I.; South Georgia; Falkland Is.; Tierra del Fuego; Magellanian Channels; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Cape Tuxen (Fig. 33).

Distribution on King George Island. — A rare species scattered along the coasts, but never abundant (Fig. 143).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Demay Point, *1393/80*. ***Ecology Glacier***: Agat Point, *357/80 & 367/80* (BAE-16). VENUS BAY. Brimstone Peak, *BJ-7*. DRAKE PASSAGE. Atherton Island, *BJ-115*.

Literature records. — Admiralty Bay (Ochyra, 1984b, 1986; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Myrcha *et al.*, 1991).

AMBLYSTEGIACEAE

The Amblystegiaceae are too large and diverse a family to be characterized except in generalities. It comprises a long array of taxa, many of which are associated with aquatic or wet habitats. Some species are very often important constituents of various types of peat-land vegetation. The family is diagnosed by having a perfect hypnaceous peristome and plicate inner perichaetial leaves with a single and usually long and well-developed costa. The last character separates it from the closely related family Hypnaceae. In addition, most species have unicostate leaves with well-developed alar cells. Generally though, species of the Amblystegiaceae are very variable morphologically because of fluctuating conditions of growth in habitats subject to seasonally changing water levels. Therefore the family is difficult taxonomically and some complexes present serious problems in identification.

Amblystegiaceae species are predominantly distributed in the cool and temperate areas of the Northern Hemisphere, but many of them are also common in the temperate and cold zones of the Southern Hemisphere, and at high elevations in tropical mountains. They are prominent in the Antarctic moss flora and some of them are important constituents of various hydrophytic plant communities. So far, five genera and seven species have been detected in this biome, of which only one is missing from King George Island.

KEY TO THE KING GEORGE ISLAND GENERA OF THE AMBLYSTEGIACEAE

1. Paraphyllia present, uniseriate to narrowly lanceolate; angular cells diffusely delimited, never auriculate; small plants .... *Orthotheciella*
1. Paraphyllia lacking; angular cells forming distinct, more or less well-delimited and often auriculate groups; medium-sized to large plants 2
    2. Leaves erect-spreading, straight, broadly lanceolate, gradually tapering into a fine, channelled acumen; costa single, often branched from the base, or short and double .... *Campylium*

2. Leaves erect, straight or falcato-secund (at least at tips of stems and branches), lanceolate, ovate or oblong, gradually narrowed to a plane acumen or rarely rounded and cucullate at the apex; costa single 3

3. Stem with a perfect ring of hyalodermis; leaves usually distinctly plicate; nematogen cells at the leaf apex absent; reddish colour always absent . . . . *Sanionia*
3. Stem without or with an incomplete hyalodermis; stem leaves not or indistinctly plicate; nematogen cells present at the apex; reddish colour often present . . . . *Warnstorfia*

CAMPYLIUM

Campylium (Sull. *in* A. Gray) Mitt., J. Linn. Soc. Bot. 12: 631. 1869.

A small genus consisting of seven species, widely distibuted and locally common and abundant in cold and temperate areas in the Northern Hemisphere. Some of them occur in the Southern Hemisphere and/or at high montane elevations in the tropics. The genus has been variously been interpreted by bryologists and is a rather unnatural taxon, comprising remotely related taxa with variously developed costae. In the present treatment *Campylium* is considered to comprise small to medium-sized plants with erect-spreading, straight and broadly lanceolate leaves, gradually tapering into a fine channelled acumen and having a costa which is single, often branched from the base, or short and double. One species is known from the Antarctic and from South Georgia (Newton, 1983).

Campylium polygamum (Schimp. *in* B., S. & G.) Lange & C. Jens., Medd. Grønland 3: 329. 1887. FIG. 147

Amblystegium polygamum Schimp. *in* B., S. & G.
Campyliadelphus polygamus (Schimp. *in* B., S. & G.) Kanda

Plants medium-sized to large, in loose or dense, yellowish- to brownish-green, somewhat lustrous mats; stems creeping or ascending, irregularly branched, 2–7 cm long. Stem and branch leaves similar in shape, usually densely set, erect-spreading to widely spreading or recurved, 2–3 mm long, 0.7–1.0 mm wide, broadly lanceolate, gradually tapering to a long, slender canaliculate acumen, markedly narrowed at the insertion, non-decurrent; margins plane, entire; costa variable, usually branched above or almost from the base, rarely single, generally reaching midleaf or very short; laminal cells linear-flexuose, 10–18 times as long as wide, thick-walled and often porose above the base; basal cells shorter and broader, with incrassate and pitted walls; alar cells inflated and hyaline, becoming thick-walled and brownish with age, forming distinct, somewhat inflated auricles. Sterile.

Ecology. — In wet sites on lake shores, often submerged in pools.

Phytogeography. — **Bipolar** – Pan-temperate in the Northern Hemisphere, altimontane in the tropics: New Guinea; East Africa; Northern Andes. Widely distributed in temperate and cool regions in the Southern Hemisphere: New Zealand; SE Australia; Southern Africa; Tristan da Cunha; West Patagonia; Tierra del Fuego; Falkland Is.; South Georgia; South Orkney Is.; South Shetland Is.; Alexander Island.

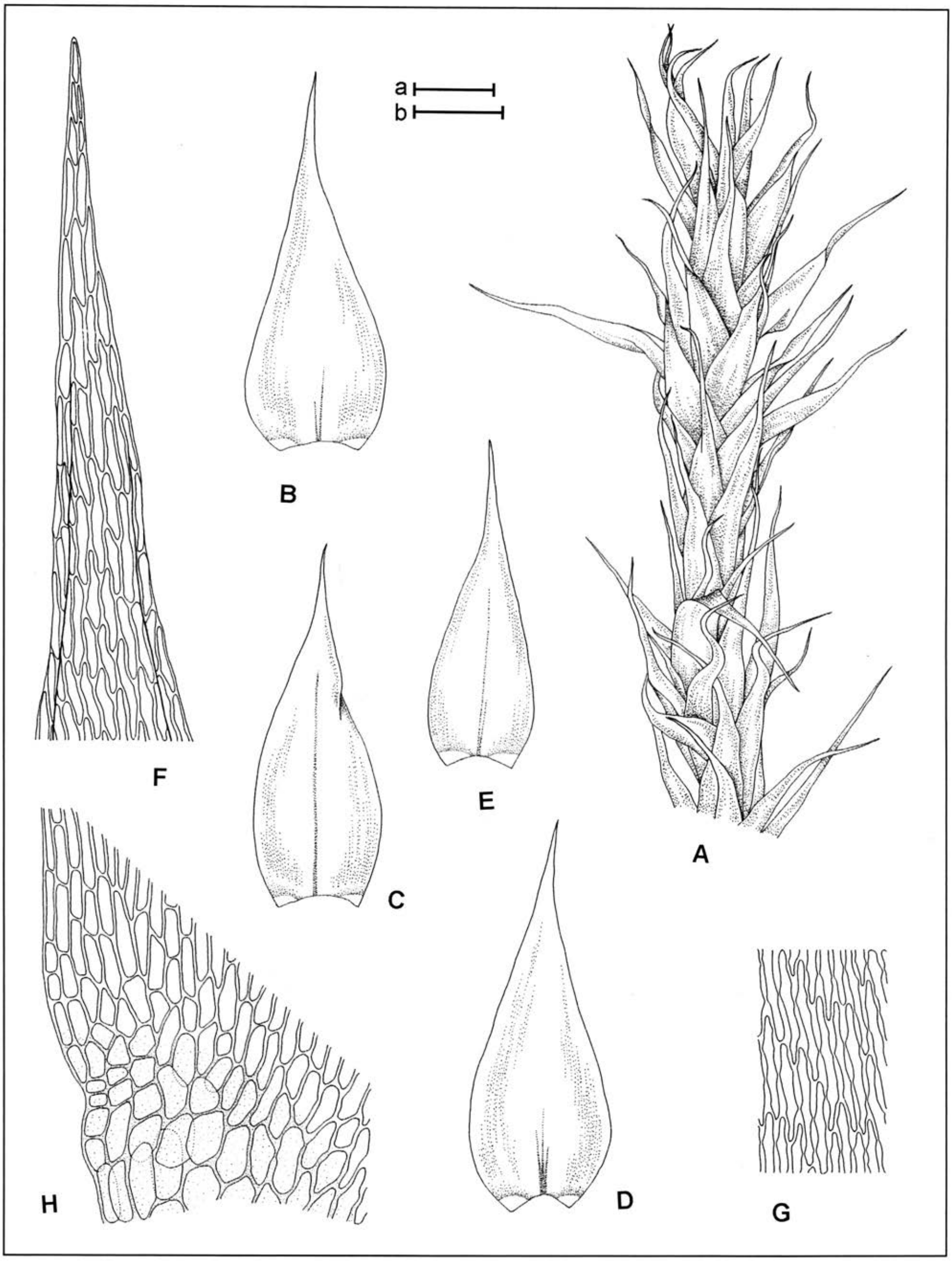


FIGURE 147. *Campylium polygamum* (Schimp. *in* B., S. & G.) Lange & C. Jensen. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Leaf apex. — **G**. Mid-leaf cells. — **H**. Alar cells (A, C–D & F–G from *Ochyra 2458/80*; B & E from *Ochyra 2478/80* (*Bryophyta Antarctica Exsiccata* No. 18); H from *Lewis-Smith 603*; all in KRAM). Scale bars: a – 1 mm (A); b – 1 mm (B–E) and 50 µm (F–H).

Distribution on King George Island. — Known only from the Fildes Peninsula where it seems to be a frequent and locally abundant species in flushed areas and lakes (Fig. 144).

Specimens examined from King George Island. — FILDES PENINSULA. Gemmel Peaks, ca 15 m, *2475/80 & 2478/80* (BAE-18); Lake Kitezh, 15 m, *Montecino 20553* (KRAM) and *2458/80* (BAE-42), *2459/80 & 2462/80.*

Literature records. — Fildes Peninsula (Przywara *et al.*, 1982; Ochyra, 1983, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b; Putzke & Pereira, 1990; (Chen *et al.*, 1993, 1995; Okada & Kanda, 1994; Li *et al.*, 1998).

ORTHOTHECIELLA

Orthotheciella (Müll. Hal. *in* Engl.) Ochyra, *stat. et comb. nov.*

Hypnum Hedw. sect. *Orthotheciella* Müll. Hal. *in* Engl., Forschungsr. Gazelle 4 (Bot.): 36. 1889. – *Pseudoleskea* Schimp. *in* B., S. & G. sect. *Orthotheciella* (Müll. Hal. *in* Engl.) Broth. *in* Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1002. 1907. – Lectotype (*nov.*): *Hypnum filum* Müll. Hal. *in* Engl. [=*Orthotheciella varia* (Hedw.) Ochyra (*Leskea varia* Hedw.)].

This genus is here recognized as new to accommodate the single species *Orthotheciella varia* and is placed in the family Amblystegiaceae. It shares many gametophyte and sporophyte characters with such genera as *Amblystegium* and *Hygroamblystegium*, including leaf shape and areolation, but the basic character separating it from them is the presence of uniseriate, filiform paraphyllia on the surface of the stem and branches. Their occurrence in *O. varia* has generally been overlooked and I (Ochyra, 1987b) discovered them for the first time in the southern *Pseudoleskea chilensis* (which is here considered to be conspecific with *O. varia*) and Hedenäs (1990) confirmed their presence in northern populations of this species.

Orthotheciella shares also some features with *Cratoneuron* and *Cratoneuropsis*, especially the strong and percurrent to excurrent costa and the presence of paraphyllia. These are large and foliose in *Cratoneuron* which, in addition, has prominent, pellucid, convex alar cells, while *Cratoneuropsis* admittedly has filiform paraphyllia but its laminal cells are elongate, linear-flexuose to oblong-rhomboidal. *O. varia* has had a very unstable taxonomic position and it has been moved from genus to genus taking in *Amblystegium*, *Hygroamblystegium*, *Hypnum*, *Rigodium*, *Leskea*, *Stereodon* and *Pseudoleskea*. This confirms its isolated position and justifies recognition of a separate genus for it.

Orthotheciella varia (Hedw.) Ochyra, *comb. nov.* FIG. 148

Leskea varia Hedw., Spec. Musc. Frond.: 216, *t. 53, f. 15–20.* 1801. – Type: North America, Pennsylvania, Lancaster, leg. D. Mühlenberg [Lectotype (*nov.*): “Leskea varia Sp. Musc. p. 216. t. 53. f. 15–20 Lancastriae in Pensylv. legit Muhlenb.” – G-Hedwig/Schwägrichen!].

Hypnum varium (Hedw.) P. Beauv.

Stereodon varius (Hedw.) Mitt.

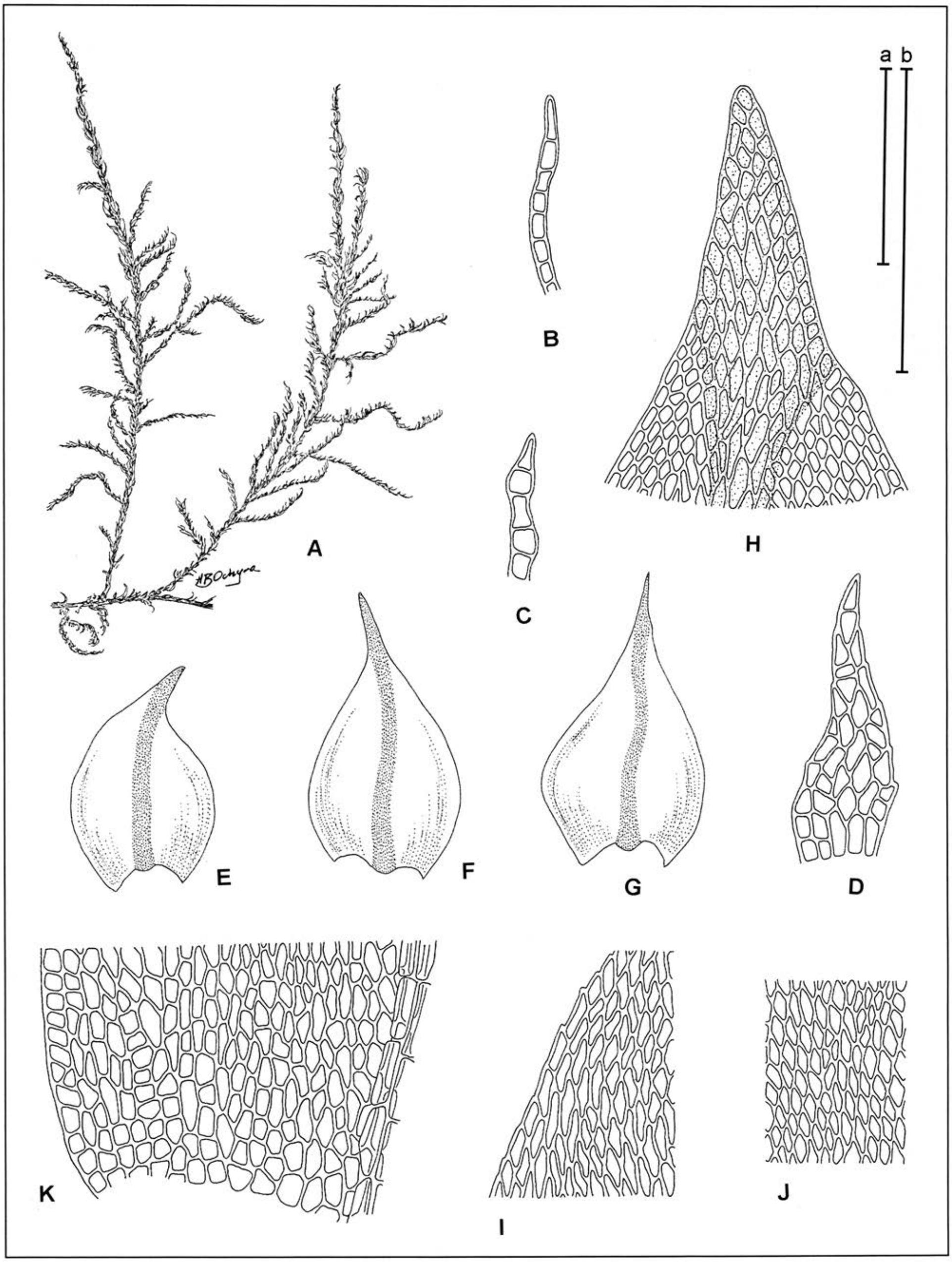


FIGURE 148. *Orthotheciella varia* (Hedw.) Ochyra. — **A**. Habit. — **B**–**C**. Paraphyllia. — **D**. Pseudoparaphyllium. — **E**–**G**. Leaves. — **H**. Leaf apex. — **I**. Upper leaf cells at margin. — **J**. Mid-leaf cells. — **K**. Basal leaf cells (A, E & I–J from *Longton & Lewis-Smith 832*; B–C from *Lewis-Smith 466*; F–G from *Racovitza 231a*, lectotype of *Pseudoleskea antarctica*, PC; H & K from *Lewis-Smith 651*; all in KRAM unless otherwise stated). Scale bars: a – 0.5 mm (A) and 100 µm (B–D, H–K); b – 1 mm (E–G).

Hypnum serpens Hedw. var. *varium* (Hedw.) Müll. Hal.
Amblystegium varium (Hedw.) Lindb.
Rigodium varium (Hedw.) Kindb.
Hygroamblystegium varium (Hedw.) Loeske
Amblystegium chilense Lor.
Pseudoleskea chilensis (Lor.) Ochyra
P. antarctica Card.
Hygroamblystegium antarcticum (Card.) Reim.
Pseudoleskea calochroa Card.
Hygroamblystegium calochroum (Card.) Reim.
Amblystegium subvarium Broth. *in* Dryg.

Plants small to medium-sized, loosely or densely caespitose, yellow-brown to brown, rather stiff, dull or lustrous. Stems filiform, prostrate to ascending, to 5 cm or more long; pseudoparaphyllia foliose to filamentous; paraphyllia infrequent to many on the surface of the stems and stronger branches, sometimes missing on slender and delicate plants, filiform. Leaves erect to erect-spreading, straight to secund, often subimbricate, non-decurrent, ovate-lanceolate, gradually long acuminate, 0.7–1.8 mm long, 0.3–0.8 mm wide; margins plane, serrulate or crenulate all round, sometimes subentire to entire; costa single, strong, percurrent to shortly excurrent, often curved above, terete; upper and median laminal cells smooth, rhomboidal or oblong-rhomboidal, firm- to thick-walled, becoming slightly longer and rectangular juxtacostally; basal angular cells subquadrate to short-rectangular, with thick and often yellow walls. Sterile.

Remark. — This species is exceedingly protean and the specific epithet introduced by Hedwig (1801) perfectly describes its plasticity resulting in an enormous number of different phenotypes, many of which have been given taxonomic recognition. The variation in this moss is undoubtedly environmentally induced and species inflation reached a high level in its case. *Orthotheciella varia* has been reported from the Antarctic under at least three names which are here reduced to synonymy with it. They are *Pseudoleskea chilensis* (for typification of this name see Ochyra 1987b), *P. antarctica* [Lectotype (*nov.*): "Danco Coast, Gerlache Strait, Beneden Head, 1.ii.1898 leg. Racovitza 231a" – PC-Card!; isolectotypes: BR!, S!], *P. calochroa* [Holotype: "South Georgia, Cumberland Bay, May Harbour, leg. Skottsberg 403" – PC-Card!; isotype: S!] and *Amblystegium subvarium* [Holotype: Kerguelen, Tal zwischen Station und Mittelberg, leg. Urbansky – H-Broth!].

Ecology. — Growing on an andesite rock ledge in a relatively moist situation.

Phytogeography. — **Bipolar** – In the Northern Hemisphere pan-temperate with maximum occurrence in eastern North America and Europe, widely scattered in Asia, very rare in the Arctic. In the tropics widely distributed in Central and South America along the Andean chain south to Bolivia and south-eastern Brazil; Southern Africa; Madagascar. Common in the temperate and cold zones of the Southern Hemisphere; southern South America; West Patagonia; Magellanian Channels; Tierra del Fuego; Falkland Islands; South Georgia; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to lat. 65°30′S; Tristan da Cunha; Marion I.; Îles Kerguelen; Heard I.; SE Australia; New Zealand.

Distribution on King George Island. — A rare species, known from a single locality in the Admiralty Bay area (Fig. 126).

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Admiralty Bay, Creeping Slopes, 60 m, *4846/79*. FILDES PENINSULA. Ardley Island, *Kühnemann 84* (AAS, KRAM).

Literature report. — Admiralty Bay (Ochyra, 1983 as *Cratoneuropsis relaxa*; Myrcha *et al.*, 1991 as *C. relaxa* subsp. *minor*).

SANIONIA

Sanionia Loeske, Verh. Bot. Ver. Prov. Brandenburg 49: 63. 1907.

Sanionia is one of several segregates of the large and all-encompassing genus *Drepanocladus* which is separated from allied genera by the combination of such characters as the distinctly dentate exostome teeth, the plicate stem leaves, the presence of a perfect ring of hyalodermis in the stem, as well as the 1–8-celled axillary hairs and shape of the alar cells. The genus consists of four species, widespread throughout the Holarctic. Two of them are bipolar in distribution and are common in the maritime Antarctic. They are very easily distinguished from all other pleurocarps in this region by their falcate, unicostate leaves. The genus has been monographed for north-western Europe (Hedenäs, 1989) and this treatment is also useful for Antarctic material.

KEY TO THE KING GEORGE ISLAND SPECIES OF *SANIONIA*

1. Alar cells forming a ± isodiametric group gradually passing into the rectangular to long rectangular, mostly echlorophyllose supra-alar cells, and forming together a longitudinally ovate alar region extending along the basal leaf margin; inner perichaetial leaves abruptly narrowed to an acute or short-acuminate apex with strongly denticulate to denticulate margins above . . . . *S. georgico-uncinata*
1. Alar cells forming an inflated transversely triangular group, abruptly passing into the quadrate to rectangular and mostly chlorophyllose supra-alar cells; inner perichaetial leaves gradually long acuminate with margins finely denticulate above . . . . *S. uncinata*

Sanionia georgico-uncinata (Müll. Hal.) Ochyra & Hedenäs, *comb. nov.* FIG. 149

Hypnum georgico-uncinatum Müll. Hal. *in* Neum., Deutsch. Exp. Int. Polarforsch. 2: 321. 1890. – *Drepanocladus uncinatus* (Hedw.) Warnst. fo. *georgico-uncinatus* (Müll. Hal. *in* Neum.) Card. *in* Card. & Broth., K. Svensk. Vet. Ak. Handl. **63**(10): 64. 1923. – Type: Austro-Georgia, Köppenberg, Sumpf auf der Westseite, 18.I.1883 [Lectotype (*nov.*): “No. 43. C. Müller. Hypnum georgico-uncinatum C. Müller Fundort: Köppenberg. Sumpf auf der W-Seite. Süd-Georgien 18/I 83 Will” – M!; isotype: PC-Card!].

Hypnum uncinatum Hedw. fo. *polare* Ren. *ex* Card.

Sanionia nivalis Hedenäs

Plants medium-sized to relatively large, forming soft, loose, yellow-green or brownish mats; stems creeping or ascending, 2.0–7.5 cm long, irregularly to subpinnately branched. Leaves

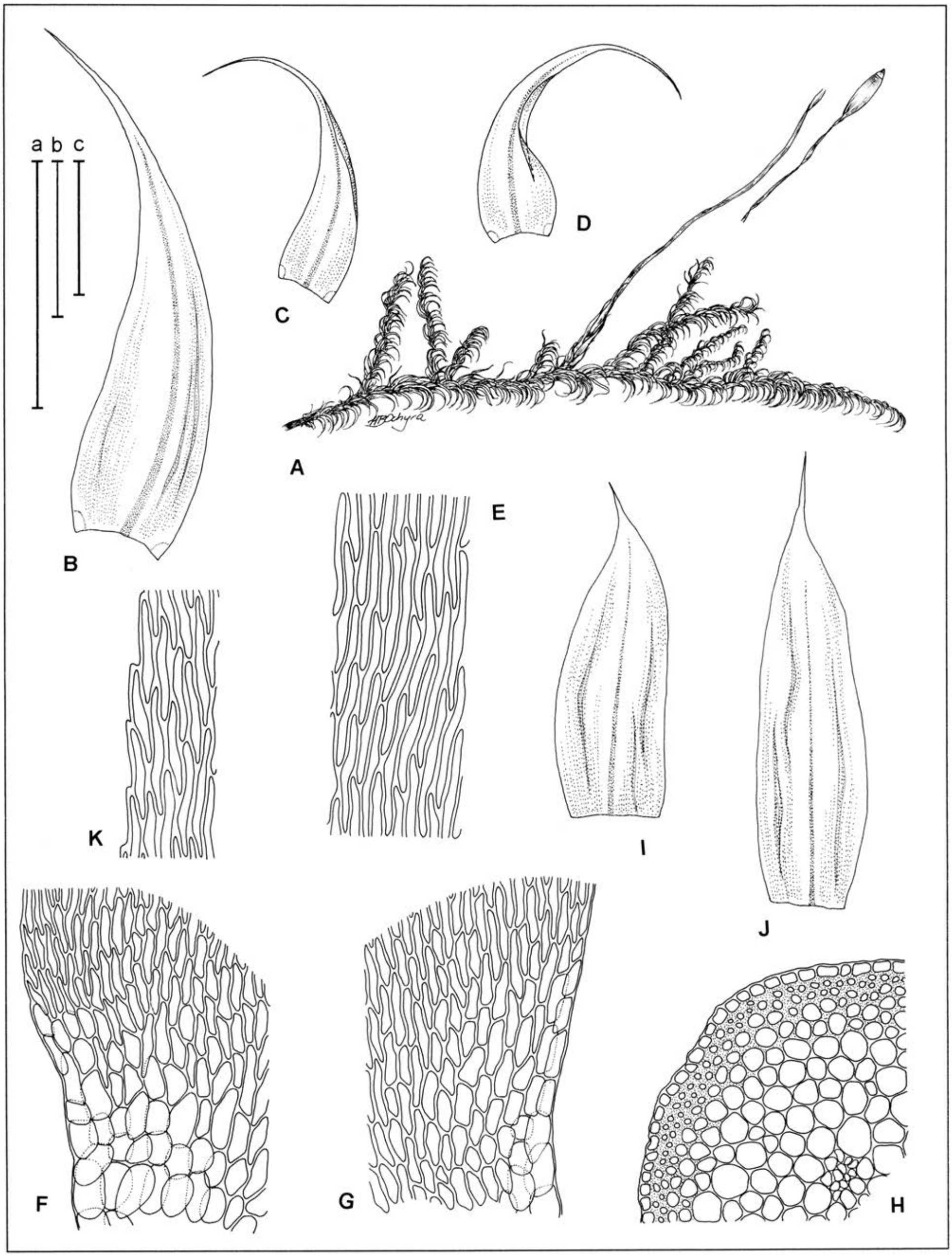


FIGURE 149. *Sanionia georgico-uncinata* (Müll. Hal. *in* Neum.) Ochyra & Hedenäs. — **A**. Habit. — **B–D**. Leaves. — **E**. Mid-leaf cells. — **F–G**. Angular cells. — **H**. cross-section of stem. — **I–J**. Inner perichaetial leaves. — **K**. Margin of the perichaetial leaf in the upper third (A, C, F, H–J from *Schulz 113*; B, D from *Ochyra 5120/79*; E, G from *Ochyra 1283/80*; all in KRAM). Scale bars: a – 100 μm (E–H, J); b – 0.5 cm (A); c – 1 mm (B–D); d – 1 mm (I).

strongly falcato-secund to almost straight, lanceolate from a broadly ovate to ovate-triangular base, 2.0–3.5 mm long, 0.5–1.2 mm wide, concave, smooth to weakly plicate; margins serrulate, becoming almost entire below; costa single, ceasing in the acumen, situated in a shallow, wide-angled furrow; laminal cells linear to linear-flexuose, 25–100 µm long, 5–10 µm wide, thin-walled; basal cells shorter and wider, with more incrassate and pitted walls; alar cells hyaline, thin-walled, forming with the rectangular and thin-walled supra-alar cells a large, ovate basal marginal group. Autoecious. Inner perichaetial leaves ovate-lanceolate, 2.5–5.5 mm long, abruptly acute to short-acuminate, strongly denticulate on the upper margins. Setae elongate, 2.0–3.5 mm long, smooth, red to reddish-brown; capsules short-cylindrical, 1.5–2.5 mm long, straight or slightly curved, erect to slightly inclined; peristome double. Remaining details unknown for Antarctic material.

Remark. — Careful examination of the type material of *Hypnum georgico-uncinatum*, a forgotten and poorly known species described from South Georgia (Müller, 1890) and comparison with *Sanionia nivalis*, a northern species recently described from Fennoscandia (Hedenäs, 1989) showed the two species to be indistinguishable. Both have alar cells of exactly the same shape, which, in the absence of sporophytes, are the safest gametophyte feature for recognizing this species. Accordingly, the South Georgian species is named under *Sanionia* and is established as a bipolar species. In fact F. Renauld was the first to call attention to the dissimilarity between many Antarctic plants and typical phenotypes of *S. uncinata*, and recognized them as a separate form, *Hypnum uncinatum* Hedw. fo. *polare* (Cardot, 1901, 1906b, 1907a). This form, too, is identical to *S. georgico-uncinata.*

Ecology. — The species grows in a wide range of habitats, frequently near late snow patches, in melt-water runnels, in small brooks and streams, in pools, but also on soil or humus on rock ledges and outcrops, on stony ground, both in sheltered and open habitats. It is a common constituent of all moss communities, especially those of the moss carpet and moss turf subformations and is also a common associate of the associations formed by the two native vascular plants.

Phytogeography. — **Bipolar** – The Northern Hemisphere distribution of the species is still imperfectly known. It is probably widely distributed in the arctic-boreal zone, especially in Fennoscandia, but is known also from North America and Asia. In the Southern Hemisphere it is recorded from South Georgia and the maritime Antarctic, extending to Marguerite Bay.

Distribution on King George Island. — One of the commonest moss species, widely distributed in all coastal areas (Fig. 150), extending from sea level up to 330 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Red Hill, 100 m, *1103/80*; Patelnia, 12 m, *1132/80*; Bastion, 250 m, *1000/80* and 280 m, *898/80*; Uchatka Point, 12 m, *1061/80*; Demay Point, 40 m, *1384/80* (BAE-170 as *S. uncinata*), 50 m, *1325/80* and *VK-388, 408, 416, 422, 423 & 447 105*; Creeping Slopes, 100 m, *1258/80*. ***Ecology Glacier***: Siodło, 130 m, *759/80*; Agat Point, 15 m, *379/80 105*; Zamek, 330 m, *24/80*; Błaszyk Moraine, 5 m, *2630* (BAE-19 as *S. uncinata*); Sphinx Hill, 100 m, *220/80*; Rescuers Hills, 35 m, *4880/79* (BAE-195 as *S. uncinata*); Llano Point, 10 m, *4851/79 & 4880/79*. ***Point Thomas***: Rakusa Point, 8 m, *303/80*; Penguin Ridge, 45 m, *1443/80*; Ornithologists Creek, 5 m, *704/80*; Jasnorzewski Gardens, 4 m, *1488/80 & 1525/80*; north-east branch of Panorama Ridge, 4 m, *1729/80*; Ambona, 85 m, *1636/80*; Ubocz, 85 m, *4964/79*; Jersak Hills, 200 m, *5114/79*; small stream west of Jersak Hills, 120 m, *646/80* (BAE-70 as *S. uncinata*); unnamed hill between Jersak Hills and Krokiew, 170 m, *127/80*. ***Ezcurra Inlet***: Jardine Peak, 275 m, *5167/79*; Kasprowy Hill, 190 m, *70/80*; Cytadela, 20 m, *956/80*; Belweder, 120 m, *1598/80*; Emerald Point,

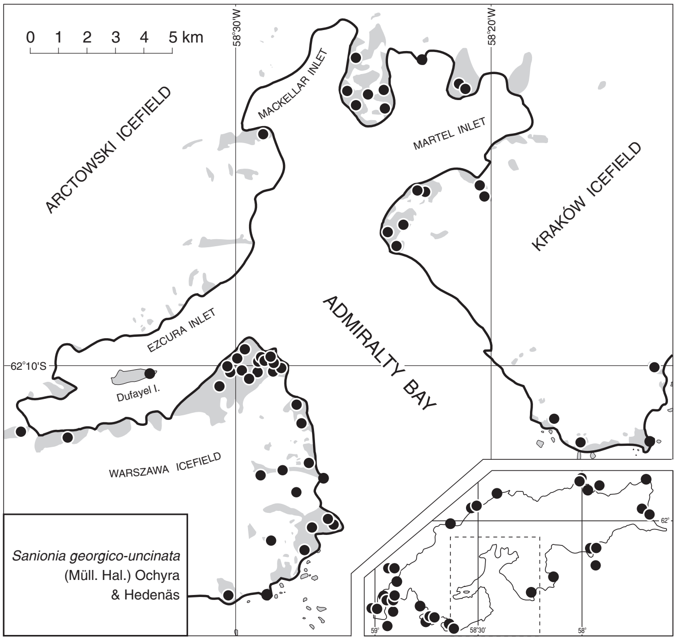


FIGURE 150. Distribution map for *Sanionia georgico-uncinata* (Müll. Hal. *in* Neum.) Ochyra & Hedenäs in the Admiralty Bay area. Inset: distribution of the species on King George Island.

3 m, *858/80*. ***Dufayel Island***: Gdynia Point, 4 m, *1767/80*. ***MacKellar Inlet***: Crépin Point, 20 m, *2038/80*. ***Keller Peninsula***: without specific locality, *VK-297, 359, 565, 529, 678 & 947*; Ore Point, 7 m, *518/80* and 30 m, *522/80*; Speil Point, 4 m, *549/80*; Harpoon Point, 3 m, *551/80*; British Point, 3 m, *454/80*; Moraine Point, 20 m, *463/80* and 25 m, *484/80*; Mount Flagstaff, 140 m, *422/80*; E side of Keller Peninsula, without specific locality, *Schuster 69-964a* (US). ***Martel Inlet***: Stenhouse Bluff, 30 m, *2583/80* (BAE-169); Ullman Spur, 2 m, *571/80* and 90 m, *561/80*; Warkocz, *2552/80*, 280 m, *2545/80* and 300 m, *2540/80*; Smok, 4 m, *2084/80* and 20 m, *2050/80* (BAE-196); Point Hennequin, 15 m, *Lindsay 847B* (AAS, KRAM); Mount Wawel, 40 m, *2131/80* (BAE-121); Basalt Point, 10 m, *2234/80*. ***Viéville Glacier***: Vauréal Peak, 35 m, *5246/79* (BAE-45); Cape Syrezol, 15 m, *1850/80*; Martins Head, 20 m, *1872/80*. **LEGRU BAY**. Low Head, *BJ-82*. **KING GEORGE BAY**. Lions Rump, *BJ-92*; Turret Point, *BJ-126*; Penguin Island, *BJ-64 & BJ-68*. **SHERRATT BAY**. Three Sisters Point, *BJ-116*. **DESTRUCTION BAY**. Wrona Buttress, *BJ-175*; Jenny Buttress, *BJ-168*. **VENUS BAY**. North Foreland, *BJ-100*. **DRAKE PASSAGE**. Pyrites Island, *BJ-35*; Gam Point, *BJ-11*; False Round, *Lindsay 665* (AAS, KRAM) and *BJ-75*; Ridley Island, *BJ-28*; Pottinger Point, 10 m, *BJ-31*; Tartar Point, 10 m, *BJ-6*; Davey Point, 60 m, *BJ-47*; Cieślak Point, *BJ-14*; Bell Island, *BJ-3*; Atherton Island, *BJ-112*. **FILDES PENINSULA**. North Foreland, 20 m, *Lindsay 656* (AAS, KRAM); Gemmel Peaks, 15 m, *2471/80*; Flat Top Peninsula,

John & Sudgen 15C & 16C (AAS, KRAM); Horatio Stump, 285 m, *Johm & Sudgen 39A* (AAS, KRAM); Two Summit Island, *Li S1* (AAS); Ardley Island, 5 m, *2482/80*, *Kühnemann 19, 59, 64, 65, 85 & 254* (AAS, KRAM), *VK-562* and *Li AN19* (AAS); Bellingshausen Station, 15 m, *2402 & 2417/*80; Nebles Point, *BJ-52*; Green Point, *BJ-17 & BJ-39*. MARIAN COVE. North Spit, *BJ-144*. BARTON PENINSULA. Narębski Point, *BJ-178*; Noel Hill, *BJ-197*; Winship Point, *BJ-181*. POTTER PENINSULA. Three Brothers Hill, *BJ-161A*; Stranger Point, *BJ-105*.

Literature records. — Most records from the Admiralty Bay area (Furmańczyk & Ochyra, 1982; Kuta *et al.*, 1982; Ochyra, 1984b; Ochyra *et al.*, 1986; Ochi & Ochyra, 1986; Kanda, 1987b; Myrcha *et al.*, 1991; Okada & Kanda, 1994) should be referred to this species.

Sanionia uncinata (Hedw.) Loeske, Hedwigia 47: 195. 1908. FIG. 151

Hypnum uncinatum Hedw.
Stereodon uncinatus (Hedw.) Brid.
Amblystegium uncinatum (Hedw.) De Not.
Drepanocladus uncinatus (Hedw.) Warnst.

Plants small to medium-sized, forming green, yellowish- to brownish-green mats. Stems creeping to ascending, 2.0–6.5 cm long, usually ± pinnately branched, with a perfectly developed hyalodermis. Leaves lanceolate, gradually narrowed from a rounded-triangular to ovate base to a long, strongly falcato-secund to circinate, sometimes almost straight, acumen, 2–4 mm long, plicate to almost smooth; margins denticulate to finely serrulate throughout, plane; costa often situated in a deep furrow; upper laminal cells linear to linear-flexuose, eporose; basal cells shorter and wider with more incrassate and porose walls; alar cells hyaline, thin-walled, quadrate to rectangular forming a transversely triangular, inflated group; supra-alar cells wider and shorter, often slightly pitted, chlorophyllose, forming a smaller group sharply contrasting with the alar cells. Autoecious. Inner perichaetial leaves lanceolate, gradually long acuminate, 3.5–7.5 mm long, plicate, with margins denticulate distally and a single costa ending in the acumen. Setae elongate, 1.5–3.0 mm long, smooth; capsules cylindrical, 1.5–2.5 mm long, curved to symmetric, inclined to horizontal or erect; exostome teeth yellowish-brown, cross-striolate below and papillose and dentate above; endostome teeth pale brownish to yellowish, with a high basal membrane giving rise to entire or narrowly perforated processes and 1–3 nodose cilia. Spores spherical, 13–15 µm wide, finely papillose.

Ecology. — Like the preceding, this species has a very wide ecological amplitude and is found almost everywhere, generally preferring drier habitats, although it can grow vigorously also in wet or moist situations. It is especially frequent in various communities of the fruticose lichen and moss cushion subformation, growing on rock faces, ledges and outcrops, in fissures and under overhangs, but often it is found in open and exposed habitats.

Phytogeography. — **Bipolar** – Very common and widespread throughout the Northern Hemisphere, high montane in the tropics in Central, East and Southern Africa and in South America. In the Southern Hemisphere common in temperate and cold regions: New Zealand, SE Australia, Auckland I.; Campbell I.; Macquarie I.; Heard I.; Îles Kerguelen; Îles Crozet; Marion I.; Prince Edward I.; Tristan da Cunha; South Georgia; West Patagonia; Magellanian Channels; Tierra del Fuego;

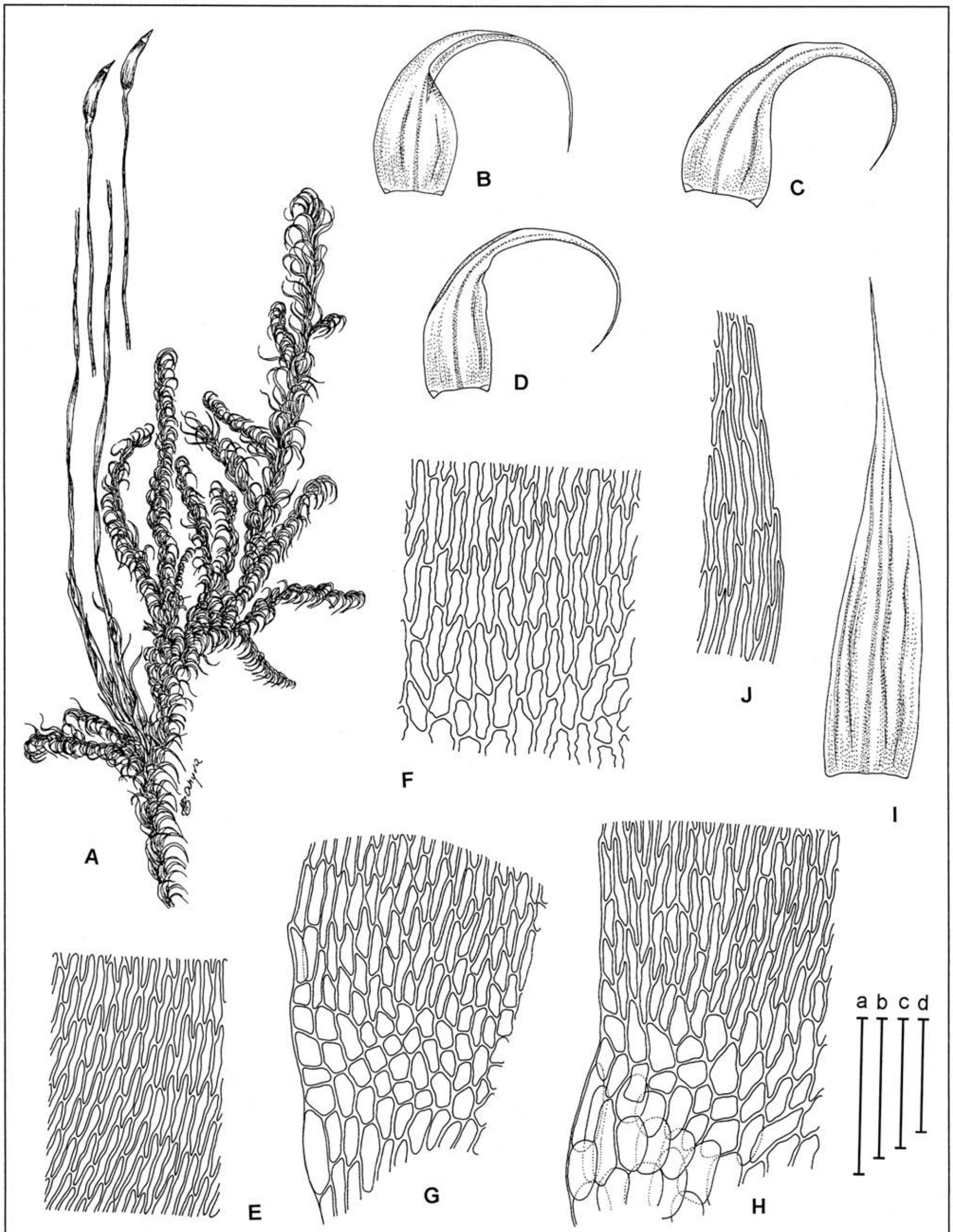


FIGURE 151. *Sanionia uncinata* (Hedw.) Loeske. — **A**. Habit. — **B–D**. Leaves. — **E**. Mid-leaf cells. — **F**. Basal cells. **G–H**. Angular cells. — **I**. Inner perichaetial leaf. — **J**. Margin of the perichaetial leaf in the upper third (A, C–D, F, I–K from *Ochyra 2630/80*; B, E. H from *Ochyra 646/80*; G from *Ochyra 2633/80*; all in KRAM). Scale bars: a – 100 µm (E, K); b – 0.5 cm (A); c – 1 mm (B–D, I–J) and 100 µm (F–H).

Falkland Is.; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Marguerite Bay.

Distribution on King George Island. — Widely distributed but scattered and less frequent (?undercollected) than the preceding species, known mostly from the Admiralty Bay area and south-western coast (Fig. 152), usually occurring at higher elevations above 100 m, and only occasionally found near sea level.

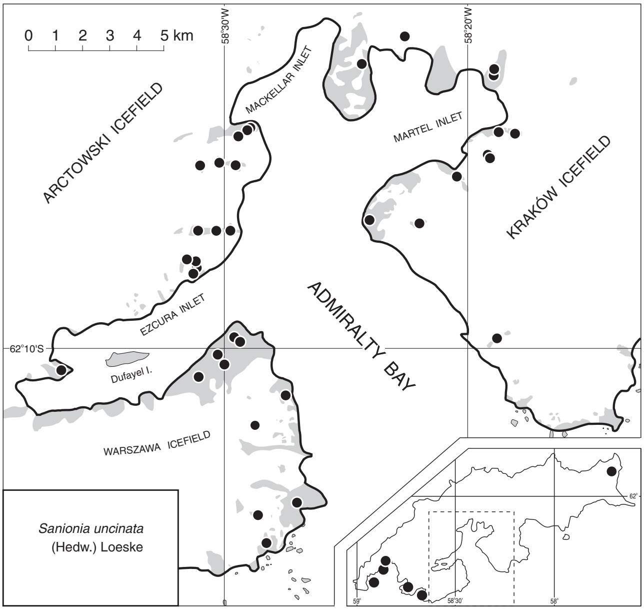


FIGURE 152. Distribution map for *Sanionia uncinata* (Hedw.) Loeske in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. Without specific locality, *Gain 298* (PC). ***Bransfield Strait***: Blue Dyke, 130 m, *1176/80*; The Tower, 330 m, *1029/80* and 340 m, *816/80*; Creeping Slopes, 130 m, *1283/80*. ***Ecology Glacier***: Czajkowski Needle, 240 m, *676/80*. ***Point Thomas***: Hala, 30 m, *5207/79*; Upłaz, 60 m, *2355/80*; Jersak Hills, 125 m, *5061/79* and 200 m, *5120/79* (BAE-95). ***Ezcurra Inlet***: Italia Valley, 100 m, *96/80*; Pond Hill, 90 m, *875/80*; Urbanek Crag, 100 m, *2320/80*, 110 m, *2322/*80, 130 m, *2315/80*, 140 m, *2316/80*, 150 m, *2334/80*, 160 m, *2330/80* and 180 m, *2326/80*. ***MacKellar Inlet***: Klekowski Crag, 200 m, *2272/80*, 220 m, *2266/80 & 2269/80* and 250 m, *2268/80*; Misty Nunatak, 250 m, *2030/80*; Admiralen Peak, 306 m, *2017/80*; Komandor Peak, 230 m, *1975/80*; Crépin Point, 5 m, *2044/80* and 20 m, *2038/80*; Kapitan Peak, 210 m, *1909/80*; ***Keller Peninsula***: E side of Keller Peninsula, without closer specification of locality, *RMS 69-950, 69-953 & 69-964* (US); Yellow Point, 40 m, *495/80*. ***Martel Inlet***: Shark Fin, 140 m, *2633/80*; Precious Peaks, 100 m, *2661/80* and 140 m, *2657/80*; Szafer Ridge, 230 m, *2560/80* and 245 m, *2564/80*; Tern Nunatak, 260 m, *2523/80* and 266 m, *2519/80*; Warkocz, 200 m, *2531/80*; Point Hennequin, 10 m, *2244/80*; Basalt Point, 25 m, *2198/80*; Bell Zygmunt, 300 m, *2671/80 & 2678/80*. ***Viéville Glacier***: Rembiszewski Nunataks, 150 m, *2722/80*. DESTRUCTION BAY. Faraway Nunataks, *BJ-170*. FILDES PENINSULA. Ardley Island, *Kühnemann 56, 58, 83 & 133* (AAS, KRAM), *Booth RILS-5293, 5295A, 5296A & 5298B* (AAS, KRAM), *VK-278 & 552* and *Li AN11* (AAS); Durant Point, *VK-*

579; Suffield Point, *2453/80*. **BARTON PENINSULA**. Noel Hill, 10 m, *Lindsay 769* (AAS, KRAM). **POTTER PENINSULA**. Without specific locality, *Schmitt 73(1)-63* (US); Three Brothers Hill, *BJ-161 & 161A*.

Literature records. — Reported in almost all papers dealing with the flora and vegetation of the island but many specimens should be referred to *Sanionia georgico-uncinata*.

WARNSTORFIA

Warnstorfia Loeske, Hedwigia 46: 310. 1907.

A small genus segregated from the large and catch-all *Drepanocladus* consisting of 9–10 species which are mostly Holarctic in distribution. They are considerably diversified gametophytically, making it difficult to give a clear-cut circumscription. The serrulate leaf margins, the triangular, ovate to lanceolate, acuminate to rounded-apiculate leaves, the prominent alar cells and the frequent presence of a red coloration in the plants are the most distinctive characters of *Warnstorfia*. In the present treatment the concept of the genus as outlined by Hedenäs (1993) is accepted, thereby including *W. sarmentosa*, which in the past has been placed either in the genus *Calliergon* or in the monotypic *Sarmentypnum*. In the Antarctic *Warnstorfia* is represented by two species which are widespread and locally abundant in the Antarctic Peninsula region.

KEY TO THE KING GEORGE ISLAND SPECIES OF *WARNSTORFIA*

1. Leaves broadly ovate to ovate-lanceolate, gradually acuminate; leaf apex acute; alar cells chlorophyllose forming indistinct, non-decurrent groups not sharply delimited from the laminal cells . . . . *W. laculosa*
1. Leaves elongate-ovate to oblong-lanceolate; leaf apex rounded, normally shortly apiculate and cucullate; alar cells hyaline or reddish-tinged forming sharply delimited, ovate to transversely triangular, decurrent groups . . . . *W. sarmentosa*

Warnstorfia laculosa (Müll. Hal.) Ochyra & Matteri, Fragm. Flor. Geobot. 42(1): 181. 1997. FIG. 153

Hypnum laculosum Müll. Hal.

H. austrostramineum Müll. Hal. *in* Neum.

H. fluitans Hedw. var. *laculosum* (Müll. Hal.) Par.

H. austrostramineum Müll. Hal. *in* Neum. var. *minus* Card.

Brachythecium turquetii Card.

Drepanocladus austrostramineus (Müll. Hal. *in* Neum.) Broth. *ex* Par.

D. laculosus (Müll. Hal.) Broth. *in* Card. & Broth.

Calliergidium austrostramineum (Müll. Hal. *in* Neum.) Bartr.

Brachythecium austrostramineum (Müll. Hal. *in* Neum.) Ochyra *in* Ochyra, Vitt & D. G. Horton

Warnstorfia austrostraminea (Müll. Hal. *in* Neum.) Ochyra

W. austrostraminea (Müll. Hal. *in* Neum.) Ochyra var. *minor* (Card.) Ochyra

Plants of moderate size to large and robust, in soft, loose or dense, somewhat lustrous, green, yellowish, brownish-yellow to brownish mats. Stems to 10 cm long, prostrate or ascending to suberect, flexible, irregularly to regularly subpinnately branched. Leaves distant and spreading to crowded, concave, not plicate, 2.5–3.5 mm long, 0.3–0.9 mm wide, ovate to ovate-lanceolate, gradually tapering to a broad and sometimes obtuse or rounded or acute tip, sometimes rather abruptly short-acuminate, not or hardly decurrent; margins plane, bluntly serrulate above, sometimes only at the tip, remotely and indistinctly so below; costa usually single but sometimes branched, slender, extending 1/2–3/4 of the way up the leaf; laminal cells narrowly linear-flexuose, straight to fusiform, thin-walled with 1–3 rhombic, hyaline nematogen cells at the apex; basal cells enlarged, short and rectangular, hyaline and thin-walled, becoming brownish-tinged and rather thicker-walled and porose with age, forming flat or weakly inflated alars, gradually merging into the laminal cells, forming indistinct, non-decurrent auricles reaching the costa. Sterile.

Remark. — The taxonomic position of this moss puzzled bryologists since its description until it was definitely placed in *Warnstorfia* (Ochyra, 1996f; Ochyra & Matteri, 1997). It exhibits considerable polymorphism resulting in numerous habitat expressions which, in the past, were often given taxonomic recognition, but these names have all been reduced to synonymy with *W. laculosa* (Ochyra, 1996f, 1998c; Ochyra & Matteri, 1997).

Ecology. — A wetland moss growing in a wide range of permanently moist to wet habitats, ranging from aquatic to wholly terrestrial, frequently on the banks of streams, melt-water channels and rills in wet hollows with late snow patches, on dripping rocks, sometimes floating and submerged in pools and local depressions. It is one of the major components of some associations of the moss carpet subformation.

Phytogeography. — **Circumsubantarctic** – New Zealand; Îles Kerguelen; South Georgia; Magellanian Channels; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Marguerite Bay.

Distribution on King George Island. — A rather infrequent although locally abundant species, found mainly on the eastern shore of Admiralty Bay and on Ardley Island and reported from the Barton and Potter Peninsulas (Fig. 154), occurring at lower elevations from sea level to 50 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 40 m, *1193/80* (BAE-69 as *Brachythecium austrostramineum*). ***Ecology Glacier***: Agat Point, 12 m, *375/80* (BAE-172 as *Brachythecium austrostramineum*) *& 376/80* (BAE-197 as *Brachythecium austrostramineum*); Rescuers Hills, 30 m, *4818/79* (BAE-198 as *Braxchythecium austrostramineum*); Llano Point, 55 m, *4917/79* and 60 m, *179/80*. Point Thomas: without specific locality, 20 m, *Lindsay 695* (AAS, KRAM); Penguin Ridge, 20 m, *1411/80*, 30 m, *1444/80*, 40 m, *1440/80* and 50 m, *1408/80 & 1428/80* (BAE-171 as *Brachythecium austrostramineum*); Ornithologists Creek, 4 m, *1418/80* (BAE-44 as *Brachythecium austrostramineum*), 8 m, *702/80* (BAE-94 as *Brachythecium austrostramineum*) and 15 m, *720/80*; Jasnorzewski Gardens, 4 m, *1483/80, 1484/80* (BAE-120 as *Brachythecium austrostramineum*), *1487/80 & 1493/80*. KING GEORGE BAY. Turret Point, 30 m, *Lindsay 818* (AAS, KRAM). DRAKE PASSAGE. Pyrites Island, *BJ-38*. FILDES PENINSULA. Ardley Island, 10 m, *2488/80* (BAE-143). BARTON PENINSULA. Noel Hill, 3 m, *Lindsay 757* (AAS, KRAM) and 8 m, *Lindsay 775* (AAS, KRAM). POTTER PENINSULA. Three Brothers Hill, 80 m, *Lindsay 866* (AAS, KRAM).

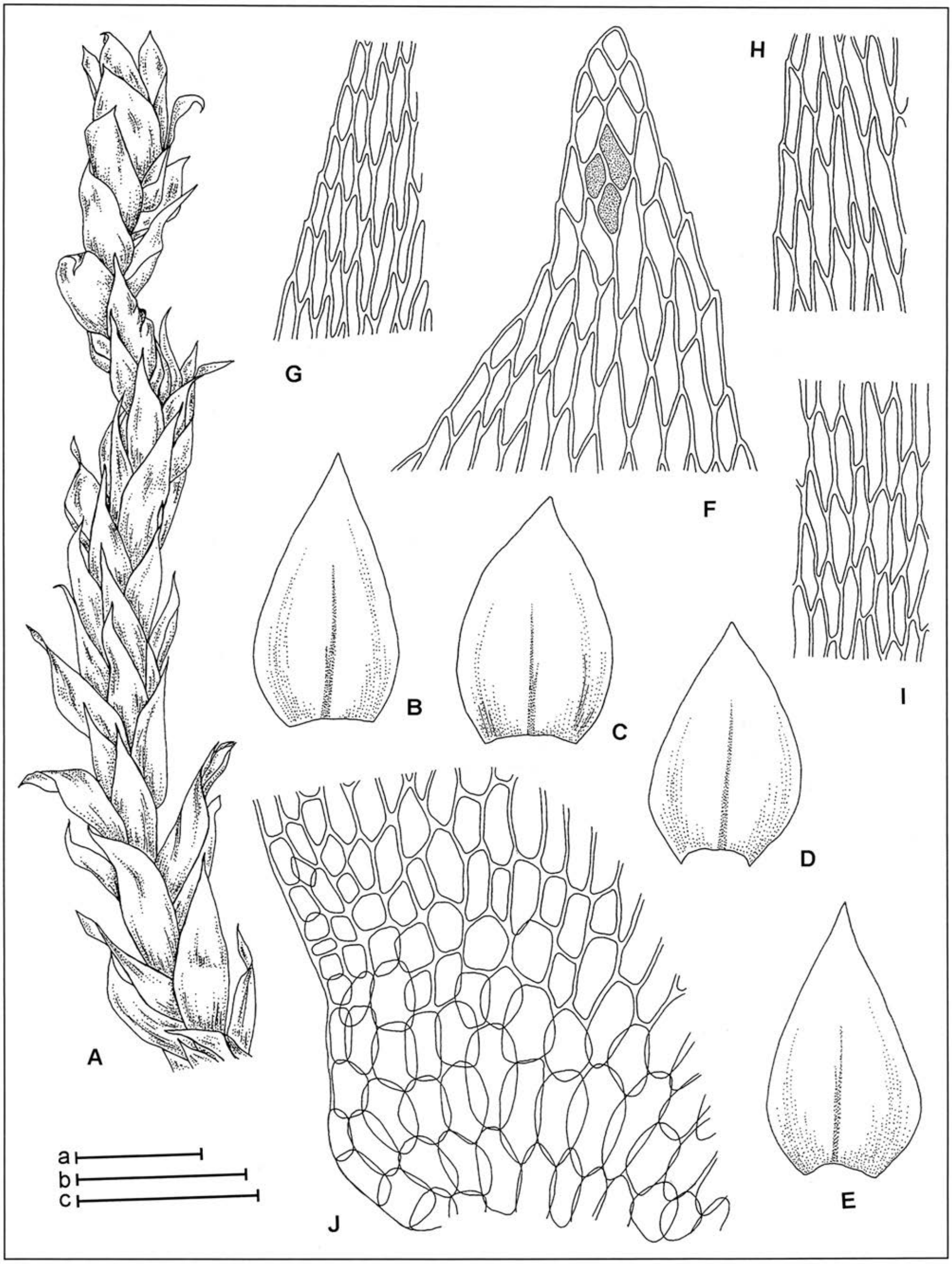


FIGURE 153. *Warnstorfia laculosa* (Müll. Hal.) Ochyra & Matteri. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Leaf apex. — **G**. Upper leaf cells at margin. — **H**. Mid-leaf cells at margin. — **I**. Mid-leaf cells. — **J**. Alar cells (A from *Ochyra 702/80*; B & G from *Ochyra 2488/80*; C from *Ochyra 1418/80*; D from *Ochyra 4818/79*; E–F & I from *Ochyra 1483/80*; H from *Will 41*, lectotype of *Hypnum austrostramineum*, HBG; J from *Komárková 1196*; all in KRAM unless otherwise stated. Scale bars: a – 1 mm (A); b – 1 mm (B–E); c – 100 µm (F–J).

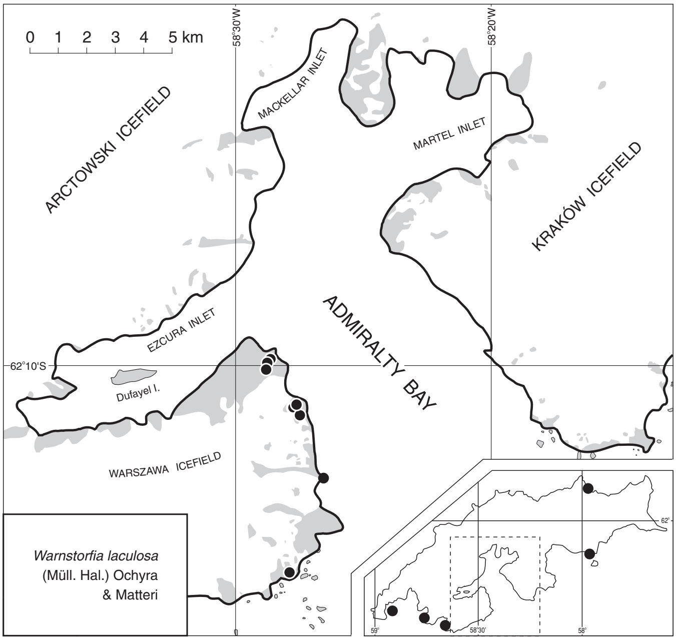


FIGURE 154. Distribution map for *Warnstorfia laculosa* (Müll. Hal.) Ochyra. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Literature records. — Fildes Peninsula (Ochyra, 1984b; Ochyra *et al.*, 1986; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Barton Peninsula (Chen *et al.*, 1995); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Furmańczyk & Ochyra, 1982; Kuta *et al.*, 1982; Ochyra, 1984b; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Gumińska *et al.*, 1994; Okada & Kanda, 1994).

Warnstorfia sarmentosa (Wahlenb.) Hedenäs, J. Bryol. 17(3): 470. 1993.
FIG. 155

Hypnum sarmentosum Wahlenb.
Amblystegium sarmentosum (Wahlenb.) De Not.
Calliergon sarmentosum (Wahlenb.) Kindb.
Acrocladium sarmentosum (Wahlenb.) Rich. & Wall.
Sarmentypnum sarmentosum (Wahlenb.) Tuom. & T. Kop

Plants medium-sized to rather large, growing in dense, yellow-green, dark brown to purplish-red, lustrous mats. Stems 4–7 cm or more long, erect or procumbent, terete, flexible, simple or sparingly branched. Leaves erect-spreading to loosely imbricate or closely appressed and imbricate, resulting in a cuspidate appearance of the stem and branch tips, concave, oblong to oblong-lanceolate, 1.5–2.5 mm long, 0.8–1.0 mm wide, rounded and cucullate at the apex, usually with a short apiculus; margins plane, entire; costa single, yellow- to red-brown, extending 3/4 or more of the way up the leaf; laminal cells elongate-linear, flexuose, often porose, becoming shorter towards the apex, often with 2–3 functionless, hyaline, short, quadrate or rhombic nematogen cells adjacent to the apex; basal cells shorter and wider, usually with porose and strongly

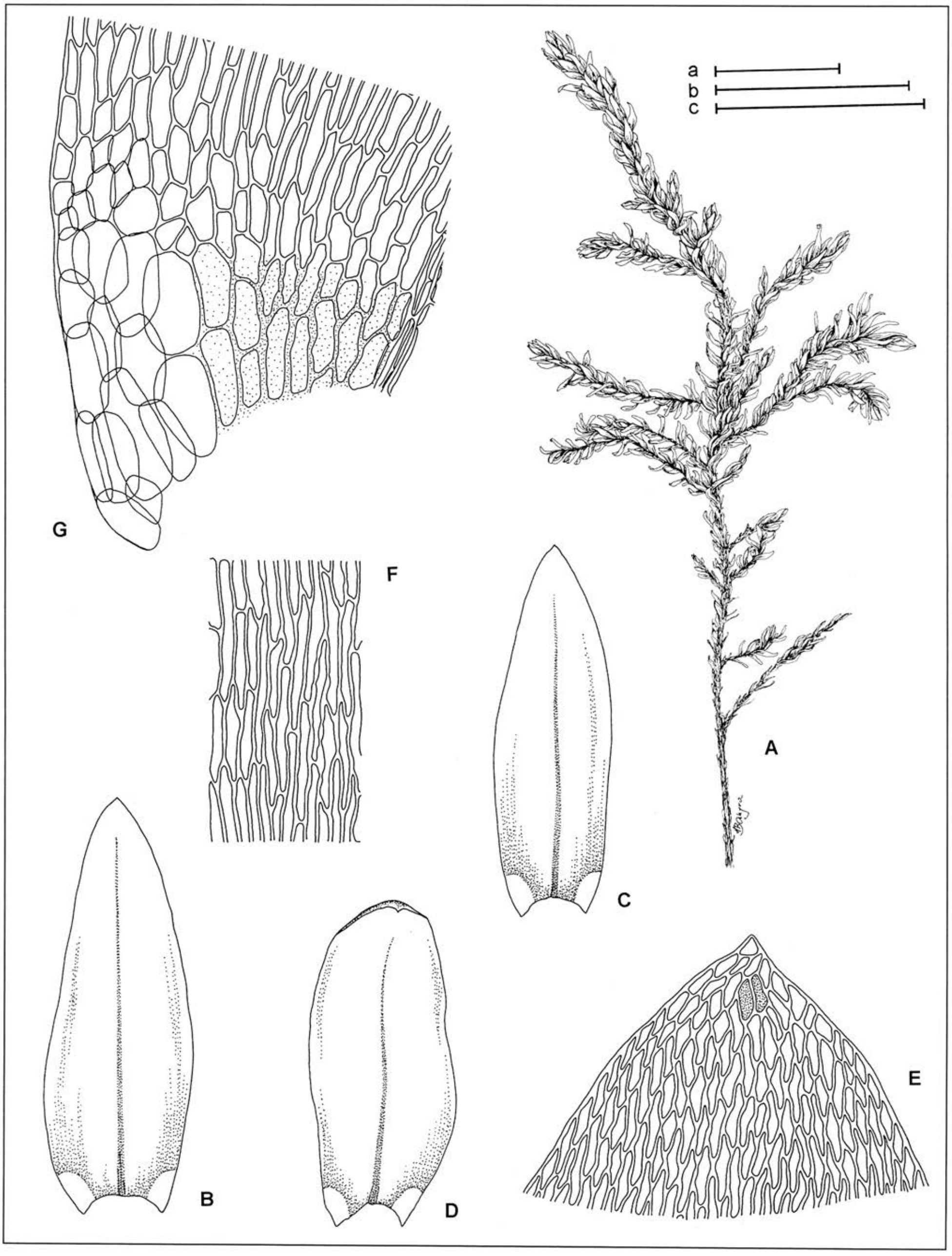


FIGURE 155. *Warnstorfia sarmentosa* (Wahlenb.) Hedenäs. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Mid-leaf cells. — **G**. Alar cells (A from *Ochyra 2365/80*; B–C & F from *Ochyra 1492/80*; D from *Ochyra 1185/80*; E & G from *Ochyra 2186/80*; all in KRAM). Scale bars: a – 1 mm (A); b – 100 μm (E–G); c – 1 mm (B–D).

incrassate walls; angular cells short, short-rectangular, thin-walled, large, forming inflated, elongate-elliptic decurrencies, sharply demarcated from the adjacent basal cells. Sterile.

Ecology. — A hydrophilous moss growing in a wide range of wet habitats including stream banks, slopes with seepage, melt-water runnels, also in streams and lakes, often submerged and on wet rock faces and boulders. It is one of the principal components of some associations within the moss carpet subformation.

Phytogeography. — **Bipolar** – Circumpolar arctic-boreal-alpine in the Northern Hemisphere, scattered in the tropics at high elevations in East Africa (Ochyra, 1990b), New Guinea (Ochyra *et al.*, 1991) and in the Northern Andes (Churchill *et al.*, 1995). In the Southern Hemisphere locally frequent in temperate and cool zones: New Zealand; SE Australia; West Patagonia; Tierra del Fuego; Magellanian Channels; Falkland Is.; South Orkney Is.; South Shetland Is.; Trinity Peninsula (Fig. 41).

Distribution on King George Island. — A frequent and locally abundant species in the Admiralty Bay area, especially in wet places in the vicinity of Point Thomas, and along the south-western coast, particularly on the Fildes Peninsula (Fig. 156), growing mostly at lower elevations, but occasionally found in wet habitats on the summits of nunataks as high as 275 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 40 m, *1185/80* (BAE-142); Bastion, 240 m, *1012/80*; Uchatka Point, 20 m, *1047/80*; Demay Point, 65 m, *1373/80*; Creeping Slopes, 100 m, *1253/80*. ***Ecology Glacier***: Rescuers Hills, 3 m, *4918/79*. Point Thomas: Jasnorzewski Gardens, 4 m, *1492/80* (BAE-93); Upłaz,

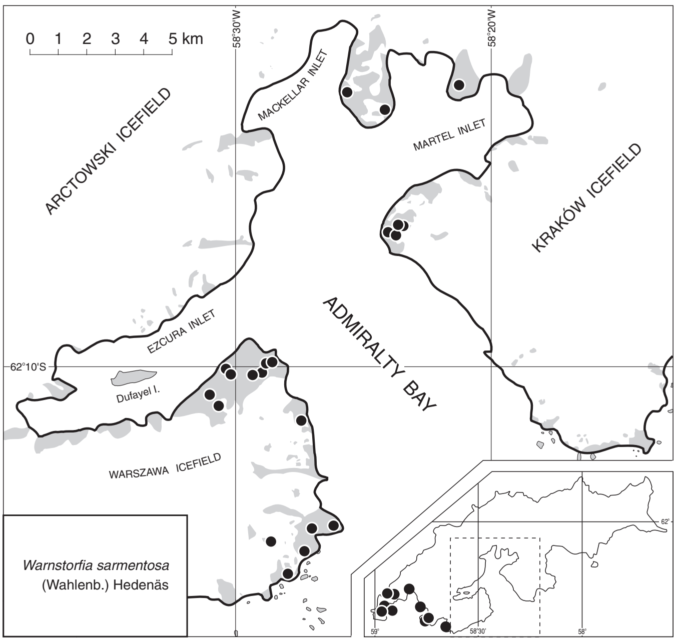


FIGURE 156. Distribution map for *Warnstorfia sarmentosa* (Wahlenb.) Hedenäs in the Admiralty Bay area. Inset: distribution of the species on King George Island.

80 m, *4965/79*; Petrified Forest Creek, 180 m, *4837/79*; Ubocz, 95 m, *4993/79* and 125 m, *2365/80*; Jersak Hills, 170 m, *5104/79* (BAE-194). ***Ezcurra Inlet***: Jardine Peak, 275 m, *5165/79*; Italia Valley, 70 m, *58/80* and 100 m, *90/80*. ***Keller Peninsula***: Speil Point, 6 m, *527/80* (BAE-43); British Point, 3 m, *456/80* (BAE-119). ***Martel Inlet***: Ullman Spur, 50 m, *572/80*; Point Hennequin, 5 m, *2240/80* and 10 m, *2248/80*; Mount Wawel, 20 m, *2186/80* and 25 m, *2190/80*. FILDES PENINSULA. Gemmel Peaks, 15 m, *2464/80 & 2479/80* (BAE-17); Horatio Stump, 185 m, *John & Sudgen 39B* (AAS); Ardley Island, 15 m, *2489/80*, *Kühnemann 86, 93, 142 & 144* (AAS, KRAM) and *Li AS16* (AAS); Marsh Base, *Wei 8308* (KRAM); Lake Kitezh, ca. 15 m, *2462/80 & 2465/80*; Suffield Point, 40 m, *2437/80*; Nebles Point, 5 m, *BJ-59*. MARIAN COVE. North Spit, *BJ-152*. BARTON PENINSULA. Without specific locality, *Li K12* (AAS); Narębski Point, 3 m, *Lindsay 712* (AAS, KRAM). POTTER PENINSULA. Three Brothers Hill, 80 m, *Lindsay 865* (AAS, KRAM).

Literature records. — Fildes Peninsula (Ochyra, 1984b; Ochyra *et al.*, 1986; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Barton Peninsula (Chen *et al.*, 1995); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Furmańczyk & Ochyra, 1982; Czeczuga *et al.*, 1982; Kuta *et al.*, 1982; Ochyra, 1984b; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Ochyra & Ochi, 1986; Putzke & Pereira, 1990; Okada & Kanda, 1994).

AMBLYSTEGIACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Cratoneuropsis relaxa (Hook. f. & Wils.) Fleisch. *in* Broth. subsp. **minor** (Hook. f. & Wils.) Myrcha, Ochyra & Tatur *in* Klek. & Opal., First Pol.-Sov. Ant. Symp.: 163. 1991, *comb. inval. basion. non citat.*

This name was provisionally used for the material which is currently named *Orthotheciella varia* (Myrcha *et al.*, 1991).

Drepanocladus aduncus (Hedw.) Warnst.

This species was reported from the Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998). Examination of two specimens (*Li S1 & AN19*, AAS) showed that they represent small but otherwise typical expressions of *Sanionia georgico-uncinata* of the type frequently encountered in Antarctica. The almost entire leaf margins and lax basal cells might indeed suggest *Drepanocladus aduncus*, but the stems have a perfect hyalodermis and the angular cells form elongate groups along the proximal margins.

Straminergon stramineum (Brid.) Hedenäs

This species was reported as *Calliergon stramineum* (Brid.) Kindb. from the Fildes Peninsula (Wu and Hu, 1990; Chen *et al.* 1993, 1995; Li *et al.*, 1998). The voucher specimens (*Wei 8308*, KRAM and *Li K12 & AS16*, AAS) represent very typical expressions of *Warnstorfia sarmentosa* with some reddish coloration and apiculate leaf apices.

Warnstorfia exannulata (Schimp. *in* B., S. & G.) Loeske *in* Nitardy

Chen *et al.* (1993, 1995) and Li *et al*. (1998) reported this species from Ardley Island near the Fildes Peninsula. The specimen examined (*Li AN11*, AAS) revealed it to be a typical orthophyllous plant of *Sanionia uncinata*. It differs from *Warnstorfia exannulata* in having a perfect hyalodermis in the stem and transversely rectangular alar cells not reaching the costa.

BRACHYTHECIACEAE

This large, cosmopolitan family is characterized generally by the unicostate and often plicate leaves with elongate and smooth laminal cells, the relatively short capsules with reddish exostome teeth and the invariably non-plicate inner perichaetial leaves. It consists of about 30 genera, although the limits between some of them are often obscure and not clear-cut. In the Antarctic the family is represented only by the genus *Brachythecium.*

BRACHYTHECIUM

Brachythecium Schimp. *in* B., S. & G., Bryol. Eur. 6: 5. 1853 [Fasc. 52–54 Mon. 1].

With about 230 species *Brachythecium* is one of the largest moss genera. In general terms, it is characterized mostly by sporophytic characters including short, asymmetric capsules, reddish-brown exostome teeth, frequently roughened setae and unicostate leaves. Regrettably, the plants are often sterile, a condition mainly responsible for the commonly held view that *Brachythecium* is one of the most difficult of all moss genera and differences between species are often difficult to describe. In the local Antarctic flora five species are known to occur which can be named reasonably well. Two of them are recorded in the study area. The treatment of *Brachythecium* for South Georgia (Newton, 1979a, 1979b) is relevant to the Antarctic biome, and the monograph of the genus by McFarland (1988), covering Central and South America and Antarctica, is also valuable.

KEY TO THE KING GEORGE ISLAND SPECIES OF *BRACHYTHECIUM*

1. Leaves broadly decurrent; margin broadly recurved below .... *B. glaciale*
1. Leaves not or scarcely decurrent; margin plane or narrowly recurved below .... *B. austrosalebrosum*

Brachythecium austrosalebrosum (Müll. Hal.) Kindb., Enum. Bryin. Exot. Suppl. 2: 97. 1891. FIG. 157

Hypnum austrosalebrosum Müll. Hal.
Brachythecium antarcticum Card.
B. antarcticum Card. var. *cavifolium* Card.

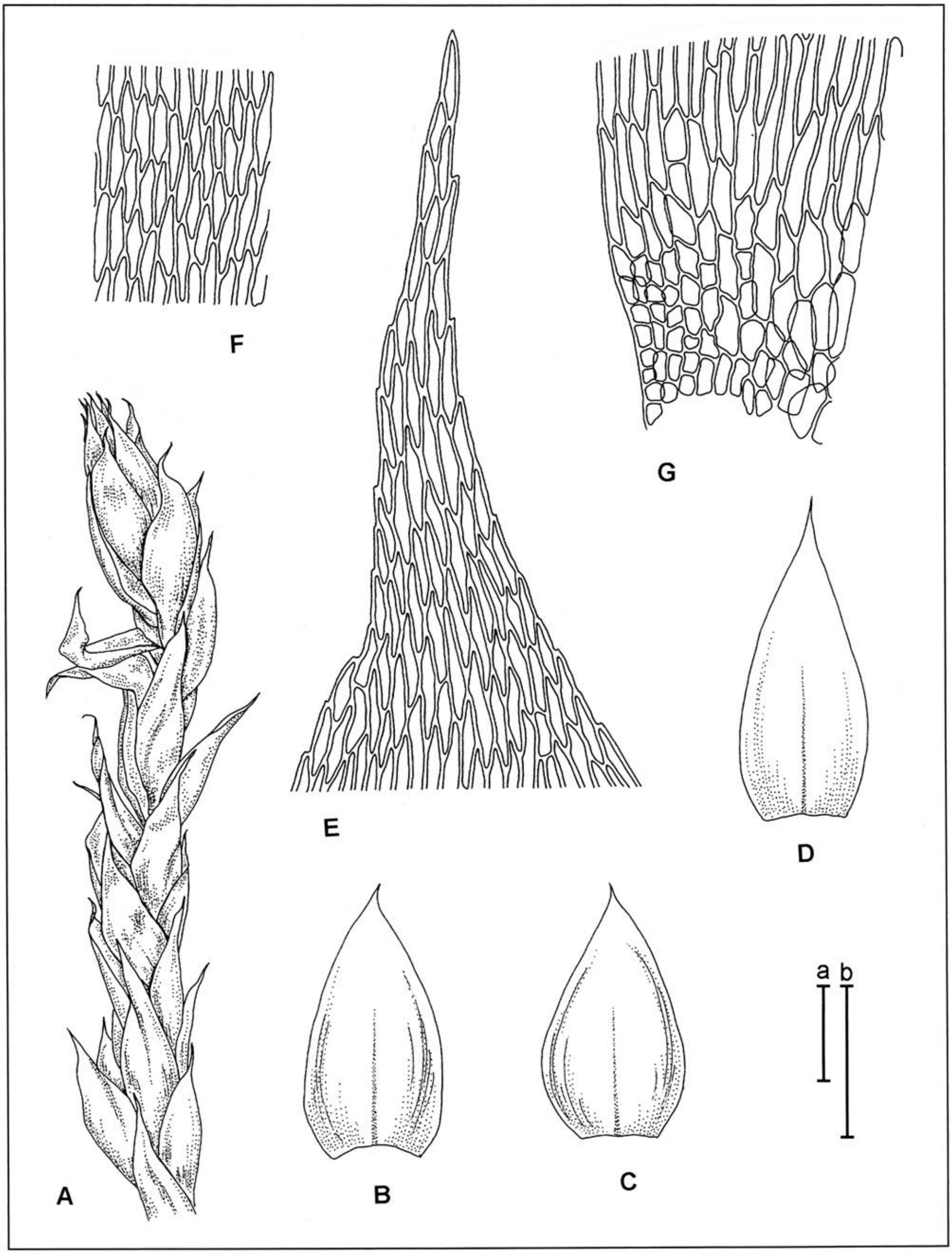


FIGURE 157. *Brachythecium austrosalebrosum* (Müll. Hal.) Kindb. — **A**. Habit. — **B–D**. Leaves. — **E**. Leaf apex. — **F.** Mid-leaf cells. — **G.** Alar cells (A & C from *Ochyra 4916/79*, KRAM; B & E from *Racovitza 232a*, lectotype of *Brachythecium antarcticum*, BR; D & G from *Naumann s.n.*, 1874, lectotype of *Hypnum austrosalebrosum*, LE; F from *Ochyra 1382/80*, KRAM). Scale bars: a – 1 mm (A–D); b – 100 µm (E–G).

Plants medium-sized to large, 2–10 cm tall, pale yellow-green to light green, forming dense, erect tufts. Stems prostrate to erect or ascending, julaceous, densely foliate in the younger parts, branches erect, julaceous, tapering at tips. Leaves erect to erecto-patent when moist, tightly appressed to spreading when dry, mostly strongly concave, 2.3–3.4 mm long, 1.0–1.7 mm wide, non-decurrent, plicate when dry, broadly ovate to ovate-lanceolate, abruptly or gradually short-acuminate; margins narrowly reflexed at base, plane above, entire to serrulate in the upper part; costa broad at base, gradually tapering upwards, ending somewhat above mid-leaf; laminal cells linear-flexuose, elongate-rhomboidal to fusiform, becoming shorter towards the apex; basal cells lax, rectangular, with thickened and porose walls; alar cells numerous, lax but not inflated, quadrate to rectangular. Sterile.

Ecology. — On rocks and stony ground in wet or moist places along melt-water runnels and streams, on wet sloping rocks, in low lying flushed areas and below rock outcrops. It forms a separate association within the moss hummock subformation.

Phytogeography. — **Pan-South-Temperate** – Macquarie I.; Îles Kerguelen; Marion I.; South Georgia; Magellanian Channels; Tierra del Fuego; Bouvetøya; South Sandwich Is.; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Marguerite Bay; Charcot I. Once recorded from a high elevation in the Andes of Peru (Allen, 1988).

Distribution on King George Island. — A locally common and abundant species, especially on the western shore of Admiralty Bay, less frequent elsewhere (Fig. 158), occurring predominantly at lower elevations, often near sea level, and only occasionally found as high as 200 m.

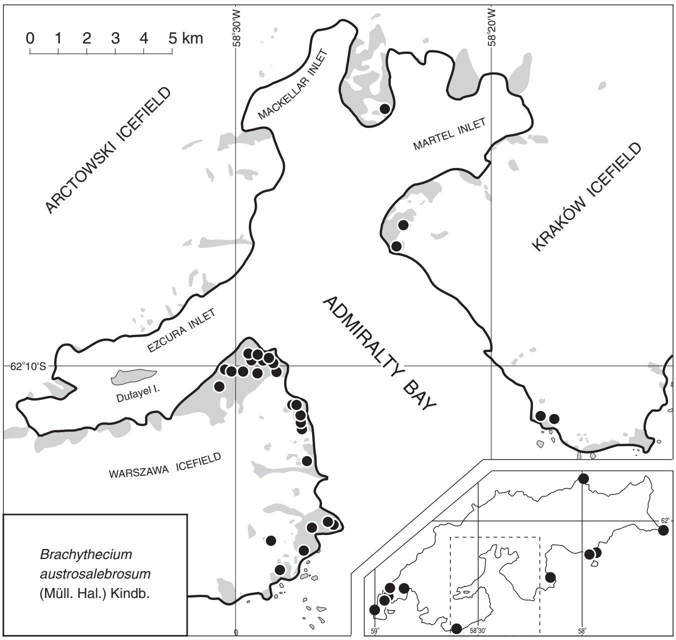


FIGURE 158. Distribution map for *Brachythecium austrosalebrosum* (Müll. Hal.) Kindb. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 10 m, *1202/80*; Bastion, 240 m, *1008/80*; Uchatka Point, 20 m, *1053/80* (BAE-71); Demay Point, 40 m, *1382/80* (BAE-122) and 50 m, *1331/80*; Creeping Slopes, 60 m, *1293/80 & 1295/80*. ***Ecology Glacier***: Sphinx Hill, 70 m, *Lindsay 851* (AAS, KRAM); Rescuers Hills, 20 m, *4919/79*, 25 m, *4965/79 & 4968/79* and 35 m, *4881/79* (BAE-173); Llano Point, 15 m, *4916/79* (BAE-199) and 30 m, *4882/79*. ***Point Thomas***: moraines by the northern edge of Ecology Glacier, 20 m, *718/80 & 910/80*; Rakusa Point, 8 m, *319/80* and 10 m, *291/80*; Penguin Ridge, 45 m, *1432/80* (BAE-144); Jasnorzewski Gardens, 3 m, *1494/80*; Hala, 18 m, *5214/79*; Upłaz, 50 m, *2356/80*; Ambona, 85 m, *1646/80*; Ubocz, 90 m, *4959/79*, 95 m, *4954/79*, 96 m, *4991/89* and 110 m, *4838/79*; upper part of Ornithologists Creek, 120 m, *644/80* (BAE-96); Jersak Hills, 180 m, *5107/79*. ***Ezcurra Inlet***: Jardine Peak, 230 m, *5195/79* (BAE-46); Kasprowy Hill, 190 m, *67/80* and 200 m, *72/80*. ***Keller Peninsula***: British Point, 5 m, *460/80*. ***Martel Inlet***: Basalt Point, 10 m, *2237/80*; Mount Wawel, 20 m, *2193/80*. ***Viéville Glacier***. Vauréal Peak, 30 m, *5257/79*; Cape Vauréal, 35 m, *5256/79*. KING GEORGE BAY. Lions Rump, *BJ-98*; Turret Point, 30 m, *Lindsay 817* (AAS, KRAM) and *BJ-130*. SHERRATT BAY. Three Sisters Point, *BJ-122*. DESTRUCTION BAY. Cape Melville, *BJ-81*. DRAKE PASSAGE. Ridley Island, *BJ-29*. FILDES PENINSULA. North Foreland, 12 Feb 1980, *Petrov s.n.* (KRAM); Flat Top Peninsula, 10 m, *John & Sudgen 16A* (AAS, KRAM); Bellingshausen Station, 15 m, *2423/80*; Lake Kitezh, 16 m, *2460/80*; Suffield Point, 4 m, *2441/80*. POTTER PENINSULA. Stranger Point, 17 m, *Lindsay 852* (AAS, KRAM).

Literature records. — Fildes Peninsula (Bonner & Lewis-Smith, 1985; Chen *et al.*, 1993, 1995; Li *et al.*, 1998); Potter Peninsula (Kanda, 1987b); Admiralty Bay (Kuta *et al.*, 1982; Ochyra, 1984b; Bonner & Lewis-Smith, 1985; Ochyra *et al.*, 1986; Kanda, 1987b; Putzke & Pereira, 1990; Myrcha *et al.*, 1991; Okada & Kanda, 1994).

Brachythecium glaciale Schimp. *in* B., S. & G., Bryol. Eur. 6: 15, *pl. 542*. 1853 [Fasc. 52–54 Mon. 11, *pl. 8*]. FIG. 159

Plants medium-sized, in extensive mats, rarely in tufts, bright green, brownish or sometimes yellowish-green above, brown below. Stems prostrate or ascending, 1–5 cm long, irregularly or subpinnately branched. Stem leaves appressed or erecto-patent, little changed on drying, straight or slightly falcate, 1–2 mm long, 0.5–1.0 mm wide, ovate, gradually narrowed to a long fine acumen, concave, non-plicate, deeply and broadly decurrent; margins recurved and entire below the widest point of the leaf, plane and serrulate to serrate above; branch leaves similar to stem leaves, only somewhat smaller; costa well-defined, extending to mid-leaf; upper laminal cells elongate-rhomboidal or elongate-hexagonal or slightly fusiform; basal cells shorter and broader, with incrassate and porose walls; alar cells numerous, compact, quadrate to short-rectangular, becoming thin-walled and rectangular in the decurrent part. Sterile.

Ecology. — On rocks and stony ground, on scree and rock outcrops, in rock crevices, on gravelly soil, detritus, generally in moist situations.

Phytogeography. — **Bipolar** – A widely distributed, but scattered and disjunct, arctic-boreal-montane species in the Northern Hemisphere with maximum occurrence in Greenland and northern Europe, extending south to Central China; rare in the Southern Hemisphere (Magellanian Channels, Tierra del Fuego, South Georgia, South Shetland Is., Danco Coast).

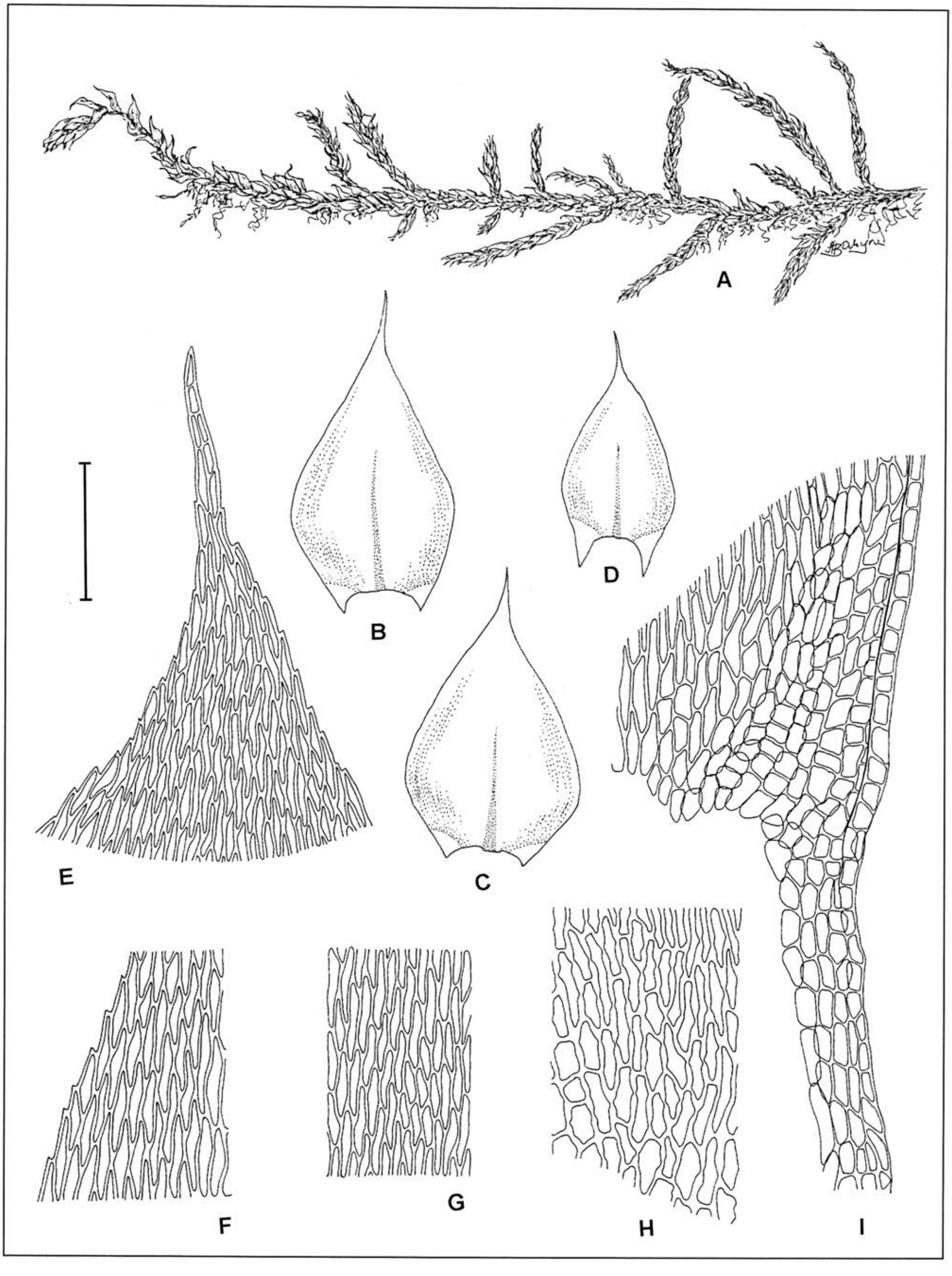


FIGURE 159. *Brachythecium glaciale* Schimp. *in* B., S. & G. — **A**. Habit. — **B**–**D**. Leaves. — **E**. Leaf apex. — **F**. Upper leaf cells at margin. — **G**. Mid-leaf cells. — **H**. Basal leaf cells. — **I**. Alar cells (A–C from *Ochyra 1533/80*; D–E & I from *Ochyra 636/80*; F from *Recio 1916*; G–H from *Ochyra 1725/80*; all in KRAM). Scale bar: 1 mm (A–D) and 100 μm (E–I).

Distribution on King George Island. — An occasional species, distributed mainly in the Point Thomas region of the Admiralty Bay area (Fig. 160), occurring at lower elevations up to 100 m.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Demay Point, 80 m, *1309/80*. ***Point Thomas***: Upłaz, 45 m, *1546/80* and 100 m, *1533/80*; north-east branch of Panorama Ridge, 4 m, *1725/80* (BAE-72); Skua Cliff, 80 m, *161/80 & 636/80* (BAE-145). ***Ezcurra Inlet***: Italia Valley, 8 m, *5078/79*. ***Keller Peninsula***: Moraine Point, 15 m, *478/80* (BAE-97).

Literature records. — Admiralty Bay (Ochyra, 1984b as *B. subpilosum*; Ochyra *et al.*, 1986 as *B. subpilosum*; Kanda, 1987b as *B. subpilosum*; Lightowlers, 1987; Myrcha *et al.*, 1991 as *B. subpilosum*).

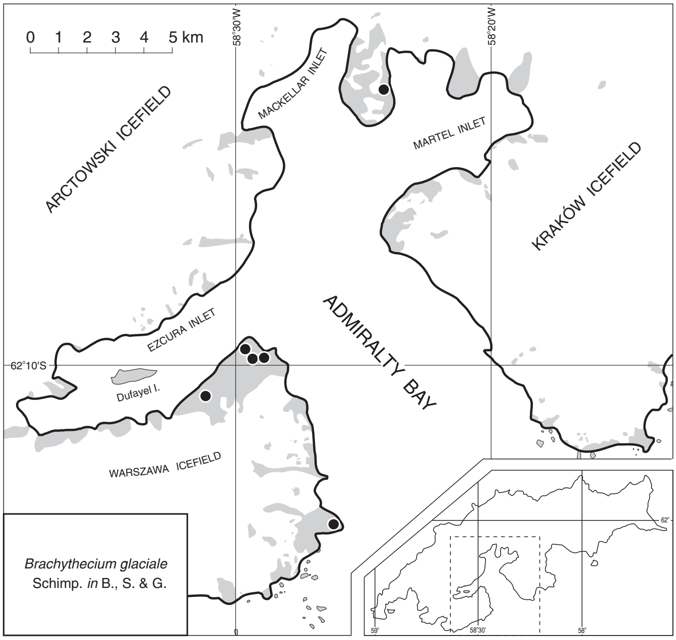


FIGURE 160. Distribution map for *Brachythecium glaciale* Schimp. *in* B., S. & G. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

BRACHYTHECIACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Brachythecium subpilosum (Hook. f. & Wils.) Jaeg.

The specimens distributed by Ochyra (1984b) in *Bryophyta Antarctica Exsiccata* as Nos 72, 97, 145 and 174 (cf. also Ochyra *et al.*, 1986) actually represent *Brachythecium glaciale* (Lightowlers, 1987). I also examined one of several collections purported to represent this species (*Li AN1*) reported from the Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998) and it a typical expression of *B. austrosalebrosum*, so other records would also seem to be rather doubtful. *B. sub-*

pilosum is an amphiatlantic temperate species, very common in South Georgia and Tierra del Fuego but only once recorded from the Davis Coast on the West Antarctic Peninsula (Cardot, 1906a, 1908).

Brachythecium subplicatum (Hampe) Jaeg.

This species has been recorded in several localities on the Fildes Peninsula. Two specimens examined during the course of the present study (*Li FW8* & *NN5*, AAS) in fact represent large and turgid plants of *Brachythecium austrosalebrosum*. *B. subplicatum* is a pan-south-temperate species having its nearest stations on South Georgia.

PLAGIOTHECIACEAE

This family is represented by two species in the Antarctic, *Plagiothecium ovalifolium* Card. and *P. georgico-antarcticum* (Müll. Hal.) Kindb., which have scattered and localized distributions and do not occur on King George Island at all (Bednarek-Ochyra *et al.*, 1999). Campos *et al.* (1978) reported *P. simonovii* L. I. Savicz & Smirnova from Lake Kitezh on the Fildes Peninsula, a species described from the Schirmacher Oasis in Queen Maud Land on the continent (Savicz-Lyubitskaya & Smirnova, 1964), but which is now considered to be conspecific with *P. georgico-antarcticum.* The material reported from King George Island (*Mahu 20553*, KRAM) actually represents *Campylium polygamum.*

HYPNACEAE

As with many other families of pleurocarpous mosses, the Hypnaceae are difficult to define in general terms. The family can essentially be recognized by having a perfect hypnaceous peristome with bordered, markedly transversely striolate exostome teeth, and endostome consisting of a high basal membrane and keeled segments alternating with cilia. In addition, the leaves are often homomallous or decidedly secund, with a short and double or no costa. The Hypnaceae are variously interpreted by bryologists and certainly does not constitute a phylogenetically uniform group; their recognition is really a matter of convenience. In Antarctica the family comprises three species in seperate genera so in the local flora the species should not be too troublesome to identify.

KEY TO THE KING GEORGE ISLAND GENERA OF THE HYPNACEAE

1. Plants larger; leaves falcato-secund, more than 0.5 mm long; alar cells well differentiated, small and subquadrate . . . . *Hypnum*
1. Plants very small, filiform; leaves minute, up to 0.4 mm; alar cells scarcely differentiated . . . . *Platydictya*

Hypnum

Hypnum Hedw., Spec. Musc. Frond.: 236. 1801, *nom. cons.*

This large and worldwide genus is primarily characterized by pinnate branching, more or less differentiated stem and branch leaves that are usually falcato-secund, and inclined, asymmetric, cylindrical capsules with perfect hypnoid peristome. Of the 150 or so species now included in *Hypnum*, one is known to occur in the Antarctic (Ando, 1973).

Hypnum revolutum (Mitt.) Lindb., Oefv. K. Vet. Ak. Foerh. 23: 542. 1867.
Fig. 161

Stereodon revolutus Mitt.

Plants small to medium-sized, brownish to yellow-green, in thin to dense mats. Stems crowded and ascending or looser and prostrate, 2–5 cm long, irregularly to evenly pinnate. Stem leaves moderately falcato-secund, concave, strongly plicate when dry, 1.2–2.0 mm long, 0.4–0.6 mm wide, oblong-lanceolate and gradually acuminate to broadly ovate and abruptly short-acuminate; margins strongly revolute in the lower half, or often plane throughout, entire or sinuate-serrulate near the apex; costa double, slender, short, often with one branch extending about 1/3 of the way up the leaf; laminal cells linear-rhomboidal to oblong-rhomboidal, somewhat thicker-walled and porose near the insertion; angular cells small, quadrate and obscure in a rather extensive, narrowly triangular alar group; branch leaves shorter and more distinctly serrulate at the apex. Sterile.

Ecology. — On rocks, stony ground and humus on rock ledges and outcrops, usually in open and exposed, dry to slightly moist habitats.

Phytogeography. — **Bipolar** – A circumpolar, disjunct, arctic-boreal-montane species in the Northern Hemisphere, extending south to Mexico and the Himalayas; rare in the Southern Hemisphere: Patagonia (Ando & Matteri, 1982; Matteri, 1985b); South Orkney Is.; South Shetland Is.; West Antarctic Peninsula south to Marguerite Bay; Alexander I.; East Antarctic Peninsula James Ross I.).

Distribution on King George Island. — An infrequently recorded species, known mostly from the Admiralty Bay area and the Fildes Peninsula (Fig. 162), occurring at higher elevations up to 280 m on the summits of nunataks and the tops of high cliffs; only occasionally recorded from near sea level.

Specimens examined from King George Island. — ADMIRALTY BAY. ***Bransfield Strait***: Blue Dyke, 130 m, *1148/80* (BAE-98); Brama, 200 m, *791/80* and 210 m, *802/80*. ***Ezcurra Inlet***: Breccia Crag, 140 m, *920/80*. ***MacKellar Inlet***. Klekowski Crag, 220 m, *2267/80* and 250 m, *2284/80* (BAE-146). ***Keller Peninsula***: without specific locality, *Schuster 69-941 & 69-956* (AAS); Ore Point, 90 m, *448/80* (BAE-123); Tyrrell Ridge, 220 m, *430/80*; Mount Birkenmajer, 280, *442/80* (BAE-73). ***Martel Inlet***: Stenhouse Bluff, 30 m, *2584/80* (BAE-147); Szafer Ridge, 250 m, *2578/80 & 2268/80*; Tern Nunatak, 266 m, *2518/80*; Smok, 40 m, *2090/80 & 2091/80*; Mount Wawel, 80 m, *2171/80*. FILDES PENINSULA. Two Summit I., *Li S2* (AAS); Great Wall Station, *Li DTN2* (AAS); Green Point, *BJ-214*.

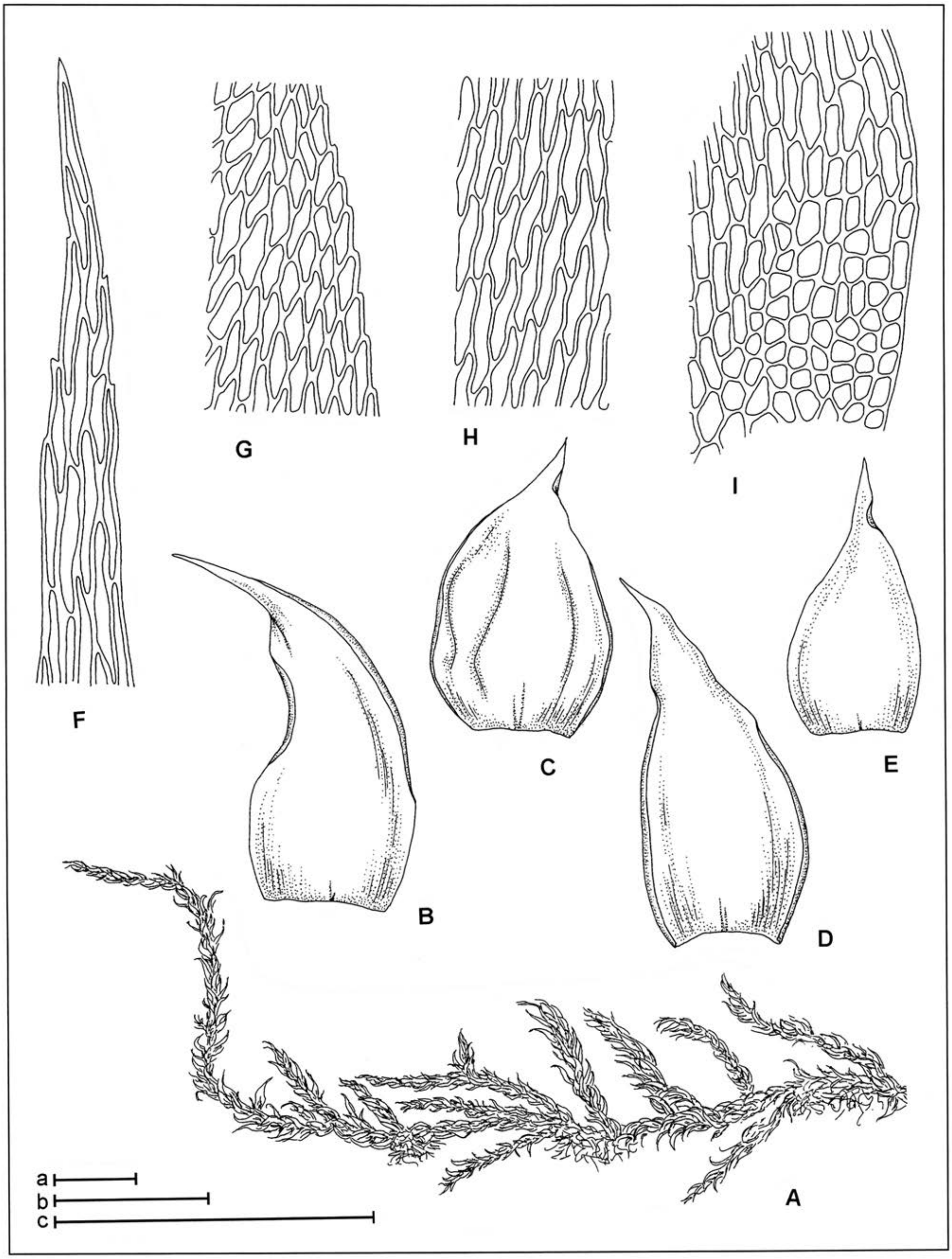


FIGURE 161. *Hypnum revolutum* (Mitt.) Lindb. — **A**. Habit. — **B**–**E**. Leaves. — **F**. Leaf apex. — **G**. Upper laminal cells at margin. — **H**. Mid-leaf cells. — **I**. Alar cells (A from *Ochyra 2090/80*; B & H–I from *Ochyra 2284/80*; C & G from *Ochyra 448/80*; D from *Ochyra 2584/80*; E from *Ochyra 2171/80*; F from *Ochyra 430/80*. Scale bars: a – 1 mm (A); b – 50 μm (F–I); c – 1 mm (B–E).

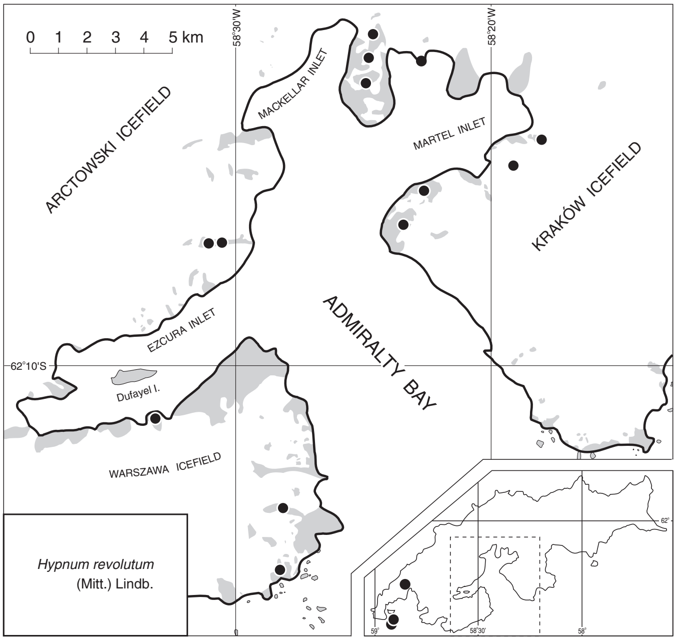


FIGURE 162. Distribution map for *Hypnum revolutum* (Mitt.) Lindb. in the Admiralty Bay area. Inset: distribution of the species on King George Island.

Literature records. — Fildes Peninsula (Chen *et al.*, 1993, 1995; Li *et al.*, 1998 as *Hypnum recurvatum*); Admiralty Bay (Robinson, 1972; Ochyra, 1984b; Ochyra *et al.*, 1986; Kanda, 1987b; Myrcha *et al.*, 1991).

PLATYDICTYA

Platydictya Berk., Handb. Brit. Moss.: 145. 1863.

A small bitypic genus, very distinct and easily recognized by the minute, filiform nature of the plants, tiny, mostly ecostate leaves no more than 0.5 mm in length, with serrulate margins and granular-papillose, purple-brown, axillary rhizoids. It is represented in the Antarctic by the single species *Platydictya jungermannioides*, whose taxonomy, ecology and geographical distribution in this region are discussed by Ochyra (1999b).

Platydictya jungermannioides (Brid.) Crum, Mich. Bot. 3: 60. 1964 FIG. 163

Hypnum jungermannioides Brid.
Amblystegiella jungermannioides (Brid.) Giac.
Amblystegium densissimum Card.
Amblystegiella densissimum (Card.) Broth. *in* Engl. & Prantl
Platydictya densissima (Card.) H. Robinson *in* Llano

Plants in very dense, soft, silky mats, green to yellow-brown. Stems fragile, 5–7 mm long,

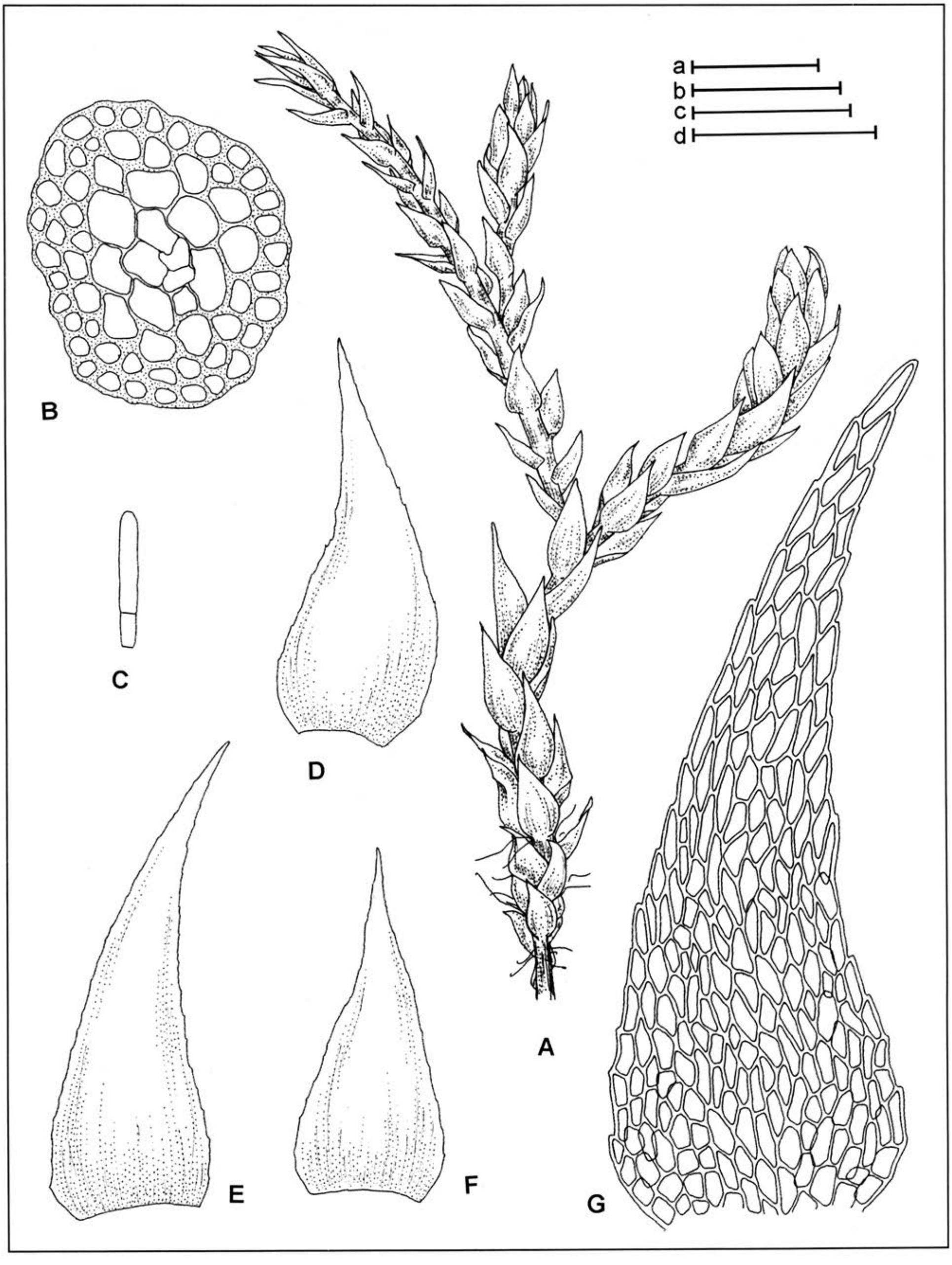


FIGURE 163. *Platydictya jungermannioides* (Brid.) Crum. — **A**. Habit. — **B**. Cross-section of stem. — **C**. Axillary hair. — **D**–**F**. Leaves. — **G**. Leaf areolation (A from *Killingbeck 146*; B, D–E & G from *Ochyra 926/80*; C & F from *Racovitza 205e*, lectotype of *Amblystegium densissimum*, BR; all in KRAM unless otherwise stated). Scale bars: a – 25 μm (C, G); b – 100 μm (D–F); c – 0.5 mm (A); d – 50 μm (B).

creeping or ascending, subjulaceous, sparingly branched, branches erect or erecto-patent. Leaves densely set, subimbricate to erect-spreading, sometimes subsecund, 0.15–0.3 mm long, 0.05–0.1 mm wide, lanceolate or ovate-lanceolate, narrowly acute, somewhat constricted at the insertion; margins serrulate, plane; costa lacking or short, single or double, indistinct; upper laminal cells oblong-rhomboidal, 3–4 times as long as wide, thick-walled; alar cells subquadrate in small, inconspicuous groups. Sterile.

Ecology. — A saxicolous moss growing in damp situations in sheltered rock crevices or fissures and under overhanging rocks.

Phytogeography. — **Bipolar** – A circumpolar, disjunct arctic-boreal-montane species in the Northern Hemisphere, very rare and scattered in the Southern Hemisphere: Tierra del Fuego; South Georgia; South Orkney Is.; South Shetland Is.; West Antarctic Peninsula from Anvers to Adelaide Is.; Alexander I. (Ochyra, 1999b) (Fig. 40).

Distribution on King George Island. — An exceedingly rare species, recorded only once in the Admiralty Bay area (Fig. 129).

Specimen examined from King George Island. — ADMIRALTY BAY. ***Ezcurra Inlet***: Breccia Crag, 140 m, *926/80*.

HYPNACEAE SPECIES EXCLUDED FROM KING GEORGE ISLAND

Hypnum recurvatum (Lindb. & Arn.) Kindb.

This species was reported from the Fildes Peninsula by Chen *et al.* (1993, 1995) and Li *et al.* (1998), its first record from the Southern Hemisphere. The records are based upon misidentifications and re-examination of the two specimens (*Li S2 &* DTN2, AAS) has shown that they actually represent *Hypnum revolutum* in the habitat expression which Ando (1973) called fo. *pumilum*. This resembles *H. revolutum* in leaf shape and areolation, but differs in the very small alar group, consisting of only a few subquadrate cells in a marginal row.

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INDEX TO SCIENTIFIC NAMES

Names of recognized taxa are in roman type; names in *italics* indicate illegitimate or synonymous names, while those in **boldface** are new. A page number in **boldface** indicates a primary reference; a page number with an asterisk (*) indicates a map or illustration.

About the Author

RYSZARD OCHYRA

Ryszard Ochyra was born in Rozbórz in Rzeszów Province in south-eastern Poland on 10 September 1949. He attended the Jagiellonian University in Cracow in 1967 and graduated in 1972. He continued his studies as a postgraduate student at the same university and received his PhD in 1976 on the basis of a doctoral thesis on the vegetation in karst swallow holes in the Małopolska Upland. He began work in the Institute of Botany of the Polish Academy of Sciences in Cracow immediately after receiving his PhD and from 1976–1990 he was Curator of Bryophytes in KRAM and is currently head of the Laboratory of Bryology there. When completing a revision of *Sciaromium* in 1988 he took the position of docent and in 1993 became extraordinary and in 1996 ordinary professor of natural sciences. From 1991–1996 he was editor of *Fragmenta Floristica et Geobotanica*, in 1994–1996 editor of *Fragmenta Floristica et Geobotanica Series Polonica* and since 1983 he is editor of *Atlas of the geographical distribution of mosses in Poland*. His main research interests are floristics, phytogeography and the systematics of mosses on a world scale. He has done fieldwork in Antarctica, Tierra del Fuego, on the Falkland Islands and in Tanzania. The results of his studies he presented in over 550 publications. (Photograph by Ryszard Halba, February 1980, King George Island, Antarctica.)