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Studies in Austral Bryaceae (Bryopsida).

IV. New records from the Falkland Islands (Islas Malvinas), with a phytogeographic analysis of the family

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ABSTRACT

Based on collections made by R. S. Tangney from the National Museum of Wales, eight taxa of the moss family Bryaceae Rchb. are newly recorded for the Falkland Islands, including *Bryum funkii* Schwägr., *Bryum microimbricatum* Ochi, *Bryum platyphyllum* Schwägr., *Bryum barnesii* J.B.Wood ex Schimp., *Imbriobryum clavatum* (Schimp.) J.R.Spence & H.P.Ramsay, *Ptychostomum gayanum* (Mont. ex Müll.Hal.) Ochyra & Bedn.-Ochyra, *Rhodobryum* cf. *roseodens* (Müll.Hal. ex Geh.) Paris, and *Rosulabryum flaccidum* (Brid.) J.R.Spence. These additions increase the Bryaceae flora of the archipelago to 28 species. The northern hemisphere species, *B. barnesii*, is also new to the southern hemisphere. Phytogeographic analyses reveal that the Bryaceae of the Falkland Islands have strongest affinities with southern South America, followed by southern New Zealand, Tasmania and the subantarctic islands including the Prince Edward Islands, Macquarie Island and Îles Kerguelen. A key to the species is included.

KEY WORDS

Falkland Islands,
Bryophyta,
mosses,
phytogeography,
new records.

RÉSUMÉ

Étude des Bryaceae australes (Bryopsida). IV. Nouveaux signalements pour les îles Malouines (Islas Malvinas), avec une analyse phytogéographique de la famille.

Sur la base des récoltes réalisées par R. S. Tangney du National Museum of Wales, huit taxons de la famille des Bryaceae Rchb. sont nouvellement enregistrés pour les îles Falkland, à savoir *Bryum funkii* Schwägr., *Bryum microimbricatum* Ochi, *Bryum platyphyllum* Schwägr., *Bryum barnesii* J.B.Wood ex Schimp., *Imbriobryum clavatum* (Schimp.) J.R.Spence & H.P.Ramsay, *Ptychostomum gayanum* (Mont. ex Müll.Hal.) Ochyra & Bedn.-Ochyra, *Rhodobryum* cf. *roseodens* (Müll.Hal. ex Geh.) Paris, et *Rosulabryum flaccidum* (Brid.) J.R.Spence. Ces ajouts portent la flore des Bryaceae de l'archipel à 28 espèces. L'espèce de l'hémisphère nord, *B. barnesii*, est également nouvelle dans l'hémisphère sud. Les analyses phytogéographiques révèlent que les Bryaceae des îles Malouines ont les affinités les plus fortes avec le sud de l'Amérique du Sud, suivi du sud de la Nouvelle-Zélande, de la Tasmanie et des îles subantarctiques, notamment les îles du Prince-Édouard, l'île Macquarie et les îles Kerguelen. Une clé des espèces est incluse.

MOTS CLÉS
Îles Malouines,
Bryophyta,
mousses,
phytogéographie,
signalements nouveaux.

INTRODUCTION

The Falkland Islands (Islas Malvinas) are an archipelago 500 km east of Argentine Patagonia. There are two main islands, known as East and West Falkland, along with over 500 smaller islands and islets, with a combined surface area of *c.* 12 200 km² (Heller *et al.* 2019). The climate is cold-temperate and oceanic, with elevations reaching 715 m. Evidence indicates that the islands were never extensively glaciated during the Pleistocene (McDowell 2005). Geologically, the islands share stratigraphic relationships with South Africa, although there was significant southwestern tectonic displacement towards southern South America that ended in the Cretaceous. There are no surviving floristic traces of this South African connection (McDowell 2005). The strongest affinities of the vascular and bryophyte flora of the Falkland Islands are with southern South America, including Patagonia and Tierra del Fuego (Greene 1986; McDowell 2005; Heller *et al.* 2019).

The most recent checklist of the moss flora included 141 species, while recent collecting has added more species, with the total currently at 185 species (Matteri 1986, 2003; Ochyra *et al.* 2015; Larraín *et al.* 2016; Ellis *et al.* 2017a, b). The Bryaceae were represented by 22 species. Among these species five endemics were reported. Two of these have been considered conspecific with other species (see results), for a total of 20 recognized species in the flora prior to this study.

The ongoing Darwin Initiative Project to document the bryoflora of the Falkland Islands more fully is being conducted by R. S. Tangney, M. von Konrat and J. Larraín of the Herbarium of the National Museum of Wales, the Field Museum of Natural History, Chicago, and the Universidad Católica de Guayaquil, Santiago, Chile respectively. As part of this project, *c.* 120 collections of Bryaceae Rchb. were made available to the author for study. Here the results of this work are reported. The history of collecting up to the 1980's on the islands was reviewed by Matteri (1986).

MATERIAL AND METHODS

Collections made in the Falkland Islands between 2011 and 2015 from the National Museum of Wales were made available for study. All collection numbers cited are those of R. S. Tangney. A list of cold climate Bryaceae of the southern hemisphere was assembled to explore the relationships of the family in the Falkland Islands with other regions. Cold climates are defined in this study as those regions with cold temperate, subantarctic, Antarctic, and montane climates, where mean temperatures are typically below 5°C at least part of the year with periods of freezing conditions, and with the potential for snow. Primary sources for Bryaceae species records as well as phytogeographic analyses include Zanten (1971), Ochi (1972, 1980, 1982), Vitt (1979), Greene (1986), Matteri (1986, 2003), Rooy & Magill (1987), Engel (1990), Ochyra & Hertel (1990), Selkirk *et al.* (1990), Bergstrom & Selkirk (1997), Ochyra (1998), Bednarek-Ochyra

et al. (2000), Ochyra *et al.* (2002, 2008a, b), Seppelt (2004), Spence & Ramsay (2006, 2019), Ochyra & Singh (2008), Müller (2009), and Fife (2015). The southern hemisphere was regionalized into six areas for analysis, Tasmania (some species extend to southeast Australia), the South Island of New Zealand (including Stewart Island and the Auckland and Campbell Islands), South Africa (primarily the Drakensberg Mountains), southern South America below *c.* 45°S, the Subantarctic (Macquarie Island, Îles Kerguelen, Îles Crozet, Prince Edward Islands, Heard Island, South Georgia) and the Falkland Islands. Due to the small size of the Bryaceae floras on individual subantarctic islands, they were combined into a single category for analyses, recognizing that they share roughly similar climates, although the islands differ significantly in age and geology.

Phytogeographic elements consisted of two main categories based on geography and ecology in the southern hemisphere as well as the world. The geographic grouping was based on the above areas, and world level ecological categories were derived from the broad classification of Matteri (1986) and Ochyra *et al.* (2008b). This element included widespread (cosmopolitan) species found throughout the world, bipolar species including true disjuncts as well as species appearing in transitional mountain areas, and southern hemisphere species. For the southern hemisphere geographic element, the classification of Ochyra *et al.* (2008b) was adopted. The distributions of the Bryaceae within regions in southern South America (e.g. Valdivian, Magellanic, Patagonian, etc.) remain poorly understood and are not categorized in this study (cf. Engel 1990).

Sorenson's coefficient of similarity was selected to analyze floristic relationships among the six regions. This coefficient is less sensitive to rare and endemic species than others such as Jaccard's (McCune & Grace 2002). The statistical package PC-ORD was used to conduct the analyses (McCune & Grace 2002).

The generic classification used is that of Spence (2014), with one exception. Due to the lack of clarity over the taxonomic status of *Gemmabryum* J.R.Spence & H.P.Ramsay and its poorly understood relationships with *Bryum* Hedw. and *Imbricabryum* N.Pedersen, it is not recognized in this study, with all species assigned to either *Bryum* or *Imbricabryum*.

RESULTS

Below each species known from the Falkland Islands is listed alphabetically by genus and species, including eight newly recorded species marked with an asterisk and with specimen data. For each species, previous names used in studies on the Falkland Islands are included, and its geographic range is listed, with its world-level distribution first, followed by its distribution in the southern hemisphere. Following the species list a preliminary key to the 28 species known from the Falkland Islands is presented. The various habitats on the islands have been previously documented by Matteri (1986), Engel (1990) and Heller *et al.* (2019).

Family BRYACEAE Rchb.
Genus *Bryum* Hedw.

Bryum argenteum Hedw.

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum argenteum* var. *subamblyolepis* Cardot & Broth.

NOTES

A common species throughout the world and found in all regions of the southern hemisphere. The Falkland Islands endemic variety, *Bryum argenteum* var. *subamblyolepis*, is likely to be a form of *B. argenteum* var. *muticum* Brid. based on the description. Most material of this species in the islands is the var. *muticum*. A cosmopolitan/southern pantemperate species.

Bryum badium (Brid.) Bruch ex Milde

NOTES

Reported by Matteri (1986), this species is related to *Bryum caespiticiu*m Hedw. and is generally not recognized by most northern hemisphere workers (but see Spence 2014). It is characterized by a very long costa, often as long as the lamina and commonly denticulate. It has been reported in earlier studies from the region by Greene (1986). A disjunct bipolar/South American species restricted to southern South American.

**Bryum barnesii* J.B. Wood ex Schimp.

SPECIMEN EXAMINED. — **Falkland Islands**. East Falkland, North Arm Farm, 52°7'26.4"S, 59°21'50.4"W, rock cliffs opposite settlement, 2 m a.s.l., 12.I.2015, 15/806 (MNH).

NOTES

New to the southern hemisphere. The collection closely matches northern hemisphere material (Spence 2014). This species along with *Bryum dichotomum* Hedw. tend to be more widespread than other species in the complex, most of which prefer Mediterranean-type climates. The bulbils are smaller than those in *B. dichotomum*, and generally there are 2-5 per leaf axil. The species has also recently been found in Magallanes Province of Chile in Tierra del Fuego (pers. comm.). Possibly introduced. A strict bipolar/South American species restricted to southern South America.

*Bryum caespiticiu*m Hedw.

NOTES

This species is relatively widespread in both hemispheres, and in the south is known from South America, New Zealand, and Tasmania. It has not been reported from the subantarctic islands. A transitional bipolar/southern amphipacific temperate species.

Bryum dichotomum Hedw.

NOTES

One of the most widespread species in the southern hemisphere, found throughout the region except for South Georgia. Since it is found in Antarctica (Ochyra *et al.* 2008b) it is likely also on South Georgia. In the northern hemisphere the species is most common in temperate and Mediterranean climate regions. A strict bipolar/southern pantemperate species.

**Bryum funkii* Schwägr.

SPECIMEN EXAMINED. — **Falkland Islands**. East Falkland, Stanley area, Moody Brook, 51°41'6"S, 57°55'19.2"W, at and above weir, on soil over concrete, stream bed and banks, 10 m a.s.l., 22.I.2011, 11-495 (MNH).

NOTES

A common species on beaches in the eastern drier regions of Tierra del Fuego and recently found in New Zealand (Fife 2015). This is a Eurasian species related to *Bryum caespiticiu*m Hedw. A strict bipolar/southern amphipacific temperate species.

Bryum gilliesii Hook.

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum litoris* Cardot.

NOTES

This species has gone under the name of *Bryum litoris* and was considered a Falkland Islands endemic, but Ochi (1982) reports that it is identical to *B. gilliesii*. See also additional comments under *B. platyphyllum*. A southern hemisphere/South American temperate species.

**Bryum microimbricatum* Ochi

SPECIMENS EXAMINED. — **Falkland Islands**. East Falkland, Port Harriet, Bertha's Beach, east of carpark, 51°53'31.2"S, 58°42'28"W, on ground in dry pool on ship timber, 4 m a.s.l., 25.I.2011, 11/563 (MNH); 11/568 (MNH); West Falkland, upper branch of Chartres River, Patricia Luxton Nature Reserve, 51°43'33.6"S, 59°59'6"W, on rock, 13 m a.s.l., 30.I.2015, 15/348 (MNH).

NOTES

Previously known from Tierra del Fuego (Ochi 1982), this is a small species similar to *Bryum argenteum* but with bright green leaves. It is very similar to the Australasian *B. harriotii* R.Br.bis (Spence & Ramsay 2019) and future studies may show them to be the same species. Sporophytes have not yet been documented. A southern hemisphere/South American cold-temperate species.

Bryum miserum Cardot

NOTES

A Falkland Islands endemic. This species is closely related to *Bryum dichotomum*, but differs in the somewhat broader ovate leaves, elongate rectangular cells in the alar region, and unusual large bulbils that are morphologically distinct from those in *B. dichotomum*, as noted in the key.

Bryum pabstianum Müll.Hal.

NOTES

A common widespread South American species characterized by its synoicous sexuality and small orange pyriform tubers. A southern hemisphere/South American montane-temperate species.

**Bryum platyphyllum* Müll.Hal.

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum uvidum* Cardot & Broth.?

SPECIMEN EXAMINED. — **Falkland Islands**. West Falkland, Crooked Inlet, Herbert Stream, Bailey Bridge, 51°31'15.6"S, 60°19'40.8"W, on rock in stream, 11 m a.s.l., 17.I.2011, 11/294 (MNH).

NOTES

This species is related to others transferred to the genus *Plagiobryoides* J.R.Spence. Although reported as new to the Falkland Islands it may have been previously reported as the endemic *Bryum uvidum*. However, the poor quality of the material comprising the type could not be confidentially assigned to this species, as Ochi (1982) indicates that it may be either *B. platyphyllum* or *Imbribryum clavatum*. Molecular and morphological studies are in progress on the status of *Plagiobryoides* and other related species including *B. gilliesii* from southern South America (Toren, Spence, Shevock, Larraín pers. comm.). A southern hemisphere/South American temperate species.

Bryum rhizoblastum Cardot & Broth.

NOTES

A poorly known Falkland Islands endemic characterized by *Bryum*-type laminal areolation, lanceolate leaves and a weak costa. The epithet suggests a similarity to juvenile innovations that arise early from rhizoids, which in many species show differences from leaves developed later. The species is most similar to *Bryum pabstianum* but is tentatively accepted pending further work.

Bryum sabuletorum Cardot & Broth.

NOTES

A distinctive Falklands Islands endemic characterized by broadly ovate to suborbicular concave leaves, a weak costa, and dis-

tinct unistratose limbidium. The presence of *Rhodobryum*-like laminal areolation and inflated red-pink subalar cells on some leaves suggests an affinity with *Ptychostomum* subg. *Cladodium*.

Genus *Imbribryum* N.Pedersen

**Imbribryum clavatum*

(Schimp.) J.R.Spence & H.P.Ramsay

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum uvidum* Cardot & Broth.?

SPECIMEN EXAMINED. — **Falkland Islands**. West Falkland, upper branch of Chartres River, Patricia Luxton Nature Reserve, 51°43'33.6"S, 59°59'6"W, on rock, 13 m a.s.l., 24.XI.2015, 15/634 (MNH).

NOTES

This species is known from New Zealand, Tasmania, Macquarie Island, and southern South America. Often associated with calcareous springs and seeps (Spence & Ramsay 2019). See comments under *Bryum platyphyllum* about the confusion regarding *B. uvidum*. A southern hemisphere/southern amphipacific temperate species.

Imbribryum laevigatum

(Hook.f. & Wilson) J.R.Spence & H.P.Ramsay

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum laevigatum* Hook.f. & Wilson.

NOTES

One of the most common southern hemisphere species, found throughout the region except for South Africa and some subantarctic islands. To date it has not been reported from Îles Crozet, Heard Island and South Georgia. Primarily an alpine to subantarctic cold-climate species, it also extends north in the Andes to Columbia. In the Falklands and southern South America, it reaches sea level so is categorized as primarily a temperate species. A southern hemisphere/southern pantemperate species.

Imbribryum subapiculatum

(Hampe) D.Bell & Holyoak

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum subapiculatum* Hampe.

NOTES

A common northern hemisphere species that also occurs in Tasmania, New Zealand, and South Africa. The species is absent from the subantarctic islands. *Imbribryum subapiculatum* includes significant morphological variation in the southern hemisphere. The New Zealand species *Bryum duriusculum* Hook.f. & Wilson may be the same as *I. subapiculatum*, and

has priority, but more work is needed (cf. Fife 2015). A transitional bipolar/southern pantemperate species.

Genus *Plagiobryoides* J.R.Spence

Plagiobryoides orbiculatifolia
(Cardot & Broth.) Ochyra & Bedn.-Ochyra

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum orbiculatifolium* Cardot & Broth.

NOTES

This species was previously recorded by Larraín *et al.* (2016), and has an unusual distribution, found in southern South America, South Georgia, Heard Island, Antarctica, and Tristan da Cunha. A south temperate/South America species, occasionally penetrating to subantarctic South Georgia (Ochyra *et al.* 2002) and the maritime Antarctic where it occurs on volcanic islands in the South Sandwich Islands and on Deception Island in the South Shetland Islands archipelagoes and only once recorded in the continental Antarctic in the Schirmacher Oasis (Ochyra & Singh 2008; Ochyra *et al.* 2008a, b). A southern hemisphere/southern amphiatlantic temperate species.

Genus *Ptychostomum* Hornsch.

Ptychostomum compactum Hornsch.

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum algovicum* Sendtn. ex Müll.Hal.

NOTES

Holyoak (2021) has recently confirmed the correct name of this species as *Ptychostomum compactum*. It is a rare species in the southern hemisphere known from a few records from New Zealand, Îles Kerguelen and South America. A transitional bipolar/southern amphipacific temperate species.

**Ptychostomum gayanum*
(Mont. ex Müll.Hal.) Ochyra & Bedn.-Ochyra

SPECIMENS EXAMINED. — **Falkland Islands.** West Falkland, Crooked Inlet, Roy Cove, 51°32'56.4"S, 60°23'6"W, in pasture with gorse, 15 m a.s.l., 17.I.2011, 11/281 (MNH); East Falkland, Mt. Kent, east of gate at summit, 51°40'26.4"S, 58°6'25.2"W, on ground in flush, 432 m a.s.l., 20.I.2015, 15/54 (MNH).

NOTES

Common in Tierra del Fuego and on Îles Kerguelen but also extending north to south-central Chile (Müller 2009). It is an autoicous species related to *Ptychostomum pseudotriquetrum* (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen, but with a reduced peristome and larger spores. A southern hemisphere/South American temperate-subantarctic (Îles Kerguelen only) species.

Ptychostomum inclinatum Hornsch.

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum amblyodon* Müll.Hal.

NOTES

A common species found primarily in alpine tundra climates in the northern and southern hemispheres, but also reaching sea level in Tierra del Fuego and the Falkland Islands. The species is found in New Zealand, South America and some subantarctic islands and extends to Antarctica. A transitional bipolar/southern amphipacific temperate species largely restricted to cold climates.

Ptychostomum pallescens
(Schleich. ex Schwägr.) J.R.Spence

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum pallescens* Schleich. ex Schwägr.

NOTES

A widespread northern hemisphere species that is disjunct to many areas in the southern hemisphere, including Tasmania, New Zealand, and South America. The species has not been reported from South Africa. *Ptychostomum pallescens* extends to Antarctica but is inexplicably absent from the subantarctic islands. It is likely to be found as more field work is conducted on these remote islands. A transitional bipolar/southern amphipacific temperate species.

Ptychostomum pseudotriquetrum
(Hedw.) J.R.Spence & H.P.Ramsay
ex Holyoak & N.Pedersen

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum pseudotriquetrum* (Hedw.) P.Gaertn., B.Meyer & Scherb.

NOTES

One of the most common bipolar species, *Ptychostomum pseudotriquetrum* is common throughout temperate regions of the southern hemisphere and extends to most subantarctic islands and Antarctica. A transitional bipolar/southern pantemperate species.

Genus *Rhodobryum* (Schimp.) Limpr.

**Rhodobryum* cf. *roseodens* (Müll.Hal. ex Geh.) Paris

SPECIMENS EXAMINED. — **Falkland Islands.** East Falkland, San Carlo Water, stream at head of inlet, 51°36'18"S, 59°0'50.4"W, wet earth in streambed, 5 m a.s.l., 14.I.2011, 11/233 (MNH); West Falkland, Fox Bay, head of South Arm, 51°57'54"S, 60°6'43.2"W, wet rocks, stream edge, 3 m a.s.l., 27.I.2015, 15/259 (MNH).

NOTES

A robust species with stolons, distinct from other southern South American species in its elongate evenly foliate stems.

The material keys out to the northern Andean species *Bryum* (*Rhodobryum*) *roseodens* (Ochi 1980), but further work is needed as this represents a gap of several thousand km. Much of the Andean Mountain region has not been extensively collected so the distribution of this species may change with more field work. The only other species of *Rhodobryum* (Schimp.) Limpr. from Chile and Argentina include three species that are distinctly rosulate: *Bryum rubromarginatum* Ochi (synonym: *Rhodobryum chilense* Thér.) from central Chile (Ochi 1982), *R. beyrichianum* (Hornsch.) Müll.Hal. and *R. subverticillatum* Broth. from northern Argentina (Koponen & Fuertes 2010). Koponen & Fuertes (2010) indicate that the species known as *R. platense* (Müll.Hal.) Paris from Argentina is likely a *Bryum*, excluding it from their treatment of the genus. The description indicates it is also strongly rosulate. The Falkland Islands species has also been found in similar habitats in the Magallanes Province of Chile in Tierra del Fuego (Spence, unpublished data). A southern hemisphere/South American temperate species.

Genus *Rosulabryum* J.R.Spence

Rosulabryum billardierei (Schwägr.) J.R.Spence

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum billardierei* Schwägr.

NOTES

One of the most common species in temperate regions of the southern hemisphere, found in New Zealand, Tasmania, South America and extending to Macquarie Island in the Subantarctic, but uncommon on the Falkland Islands and absent from South Africa. A south temperate/southern amphipacific temperate species.

Rosulabryum capillare (Hedw.) J.R.Spence

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum capillare* Hedw.

NOTES

Although widespread in many parts of the world outside the tropics, *Rosulabryum capillare* is relatively uncommon on the Falkland Islands. It is more common in temperate regions of southern South America. The species is found in South America, Tasmania, New Zealand including the Auckland Islands, and South Africa, but is absent from the subantarctic islands. A cosmopolitan/southern pantemperate species.

**Rosulabryum flaccidum* (Brid.) J.R.Spence

SPECIMEN EXAMINED. — **Falkland Islands.** East Falkland, road to North Arm, Bodie Creek culvert, 51°50'9.6"S, 59°7'8.4"W, cliff at shore, 5 m a.s.l., 12.I.2015, 15/779 (MNH).

NOTES

A small species in the *Rosulabryum capillare* (Hedw.) J.R.Spence complex characterized by evenly foliate stems, a weak costa, and numerous filiform leaf axil gemmae, found in temperate climates of North America and the Caribbean (Spence 2014). Possibly introduced, but old reports from South America exist (summarized in Greene 1986). See Spence (2014) for confusion on the correct name for this species. The type does not match the species known as *R. andicola* (Hook.) Ochyra (cf. Haji Mohamed 1979), and more work is needed to resolve the issue. A disjunct bipolar/South American temperate species.

Rosulabryum macrophyllum

(Cardot & Broth.) Ochyra

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum macrophyllum* Cardot & Broth.

NOTES

One of the most common species on the Falkland Islands. Although originally considered as endemic, it has been found in temperate regions of Chile (Müller 2009; Spence 2021). A southern hemisphere/South American temperate species.

Rosulabryum perlimbatum (Cardot) Ochyra

RECORDED ON THE FALKLAND ISLANDS AS. — *Bryum perlimbatum* Cardot.

NOTES

A widespread species occurring in southern South America and in New Zealand, extending to Stewart Island and the Auckland Islands south of the South Island of this insular country. This is the common large rosulate species in the southern Patagonian regions of Argentina and Chile, but it is less common on the Falkland Islands. The type, however, is from the Falkland Islands. The species was reported from South Africa (Haji Mohamed 1979; Rooy & Magill 1987), but it was based upon the wrong interpretation of the locality name "Port-Natal" which actually refers to the city of "Puerto Natales" in Magallanes Province of Chile (Ochyra 1989). Accordingly, *Rosulabryum perlimbatum* has to be considered as a southern hemisphere/southern amphipacific temperate species occurring in New Zealand and southern South America.

PHYTOGEOGRAPHIC ANALYSIS

Phytogeographic affinities of the Falkland Islands Bryaceae flora to other southern hemisphere cold-climate regions were analyzed to determine if the family showed patterns similar to those found in other taxa from the islands. The list includes 66 species (see Appendix 1) from southern South America, New Zealand, Australia (specifically Tasmania), South Africa, and the subantarctic islands.

At the world distribution level, 39% of the Bryaceae on the Falkland Islands are bipolar disjuncts, with another 53%

KEY TO BRYACEAE RCHB. OF THE FALKLAND ISLANDS

1. Plants very small, stems to 1 cm, strongly julaceous, leaves mostly < 1 mm long, costa weak, not reaching apex, leaf tip rounded-obtuse, with or without short apiculus, proximal laminal cells quadrate 2
- Plant sizes from small to large, stems 1-10 cm, not or weakly julaceous, leaves mostly (1.5-)2-8 mm, costa variable, from not reaching apex to percurrent or excurrent in short to long awn, tips obtuse to acuminate, apiculus lacking, if plants small and julaceous, proximal laminal cells elongate rectangular across leaf base or in alar region 3
2. Plants silver-green, distal lamina cells elongate, length 3-5:1, apiculus sometimes present; leafy bulbils sometimes present in leaf axils *Bryum argenteum* Hedw.
- Plants bright green, distal lamina cells short and wide, 2-3:1, apiculus and bulbils absent *Bryum microimbricatum* Ochi
3. Plants robust, stems long, to 10 cm, evenly foliate, leaves ovate, to 8 mm long, limbidium present, distal leaf margins sharply dentate, stolons sometimes present *Rhodobryum* cf. *roseodens* (Müll.Hal. ex Geh.) Paris
- Plants mostly smaller, stems short or to 4-6 cm long, leaves mostly < 5 mm, limbidium present or absent, distal leaf margins smooth to serrate, stolons absent 4
4. Plants distinctly rosulate, rarely two or more interrupted rosettes present, leaves flaring in rosette when wet, strong limbidium present, distal lamina margins serrulate to serrate, rhizoidal tubers often present 5
- Plants evenly foliate, gemmiform to short-comose with leaves mostly erect spreading when wet, limbidium present or absent, distal leaf margins smooth or serrulate, rhizoidal tubers sometimes present 8
5. Leaves 2-3 mm long, spirally twisted around stem when dry, costa excurrent in long awn *Rosulabryum capillare* (Hedw.) J.R.Spence
- Leaves 3-5 mm long, somewhat imbricate to irregularly contorted when dry, costa excurrent in short awn .. 6
6. Leaf limbidium very strong, 4-6 rows wide, whitish, stems sometimes in two or more interrupted rosettes *Rosulabryum perlimbatum* (Cardot) Ochyra
- Leaf limbidium narrow, 2-3 rows wide, same color as lamina, stems usually in single rosettes 7
7. Leaves sometimes appressed-imbricate when dry, ovate, distal lamina margins serrulate *Rosulabryum macrophyllum* (Cardot & Broth.) Ochyra
- Leaves contorted and twisted when dry, not imbricate, obovate to spatulate, distal lamina margins sharply serrate *Rosulabryum billardiarei* (Schwägr.) J.R.Spence
8. Plants small, stems to 2 cm, leaves mostly < 2 mm long, costa not reaching apex to short-excurrent in awn, bulbils present in leaf axils of sterile stems 9
- Plant sizes various, stems to 6 cm, leaves often > 2 mm long, costa variable, not reaching apex to excurrent in long awn, bulbils absent 11
9. Bulbils small, ovate, 200-450 µm long, typically (2-)3-5 or more per leaf axil, costa variable, percurrent to short excurrent, some leaves with longer excurrent awn sometimes present ... *Bryum barnesii* J.B.Wood ex Schimp.
- Bulbils large, to 1 mm, typically 1(-3) present in leaf axils, costa not reaching apex to short excurrent in short awn 10
10. Leaves ovate, costa weak, not reaching apex to percurrent, lamina cells in alar regions elongate-rectangular, bulbils long and narrow, to 1 mm, often 2 or 3 present, club-shaped, leafy primordia restricted mostly to top of bulbil, often flaring out in rosette *Bryum miserum* Cardot
- Leaves ovate to ovate-lanceolate, costa mostly percurrent to short-excurrent in awn, lamina cells in alar region quadrate, bulbils broadly ovate to pyriform, to 750 µm, mostly single, leafy primordia not restricted to apex of bulbil, often arising from mid-bulbil or lower *Bryum dichotomum* Hedw.
11. Rhizoidal tubers commonly present in sterile collections, mostly on rhizoids arising at base of stem and in soil 12
- Rhizoidal tubers absent 14
12. Leaves slender, ovate to ovate-lanceolate, much longer than wide, apex acute to acuminate, costa distinctly excurrent in short to medium-length awn, distal lamina cells longer than proximal cells, tubers pyriform to spherical, orange to red, mostly < 300 µm in widest dimension 13
- Leaves broadly ovate, not much longer than wide, apex broadly rounded, costa not reaching apex, distal lamina cells short and wide, proximal cells much longer, rhizoidal tubers irregularly spherical to sometimes flattened and lobed, brown to red-brown *Bryum gilliesii* Hook. (in part)

13. Sexuality synoicous, rhizoidal tubers small, pyriform, orange, < 100 µm in longest axis *Bryum pabstianum* Müll.Hal.
 — Sexuality dioicous, rhizoidal tubers larger, spherical, red, to 300 µm wide *Imbricbryum subapiculatum* Cardot & Broth.
14. Costa strong, excurrent in medium to distinctly long awn, plants mostly small, in compact tufts, stems gemmiform to short-comose (leaves enlarged towards stem tip but not flaring in rosette), mostly < 2 cm long 15
 — Costa not reaching apex, percurrent or very short-excurrent in short awn, plants evenly foliate, weakly julaceous, to comose, stems often longer than 2 cm 19
15. Sexuality dioicous, awns very long, often > ½ lamina length, sometimes denticulate, limbidium weak or absent, spores mostly < 15 µm 16
 — Sexuality autoicous or synoicous, awns medium length to long, mostly < ½ lamina length, limbidium present, narrow to wide ; spores mostly >15 µm 17
16. Leaves with very long awns, ½-1/1 length of lamina, denticulate, distal lamina cells 3-4:1, short fragile innovations in leaf axils absent *Bryum badium* Bruch ex Brid.
 — Leaves awns shorter, mostly ½ lamina length, smooth, distal lamina cells long, 4-6:1, fragile innovations with rudimentary leaves common in leaf axils *Bryum caespiticium* Hedw.
17. Sexuality autoicous, leaves 2-3 mm long, ovate-lanceolate to lingulate, stems short-comose, somewhat enlarged towards stem tip, peristome well developed, cilia present, spores 14-20 µm, capsules long pyriform to clavate *Ptychostomum pallescens* (Schleich. ex Schwägr.) J.R.Spence
 — Sexuality synoicous, leaves mostly < 2 mm long, ovate-lanceolate, stems short and compact, usually somewhat gemmiform, peristome reduced, cilia absent or short, spores >20 µm, capsules pyriform 18
18. Endostome often adherent to exostome at base, exostome teeth with chambered look of patchy cells with cross-walls, cilia absent or very short, spores 22-35 µm, variable in size but often > 30 µm *Ptychostomum compactum* Hornsch.
 — Endostome and exostome free, teeth not chambered or patchy, cilia short, sometimes 1-2 longer ones present, spores 22-26 µm *Ptychostomum inclinatum* Hornsch.
19. Plants consisting mostly of masses of slender brown to red-green innovations, leaves ovate, concave, limbidium weak to absent, brown to red-brown filiform gemmae present in leaf axils *Rosulabryum flaccidum* (Brid.) J.R.Spence
 — Plants not or rarely dominated by innovations, leaves lanceolate, ovate, ovate-lanceolate or suborbicular, concave or flat, limbidium present or absent, filiform gemmae absent 20
20. Plants large, stems to 4 cm, often matted with rhizoids, leaves 3-4 mm long, ovate, distinctly strongly decurrent, apex acute, limbidium distinct *Ptychostomum pseudotriquetrum* (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen
 — Plants mostly smaller, stems rarely to 3 cm, leaves 1-3(-4) mm, lanceolate, ovate, or suborbicular, not or weakly decurrent, apex rounded obtuse to acute or rarely acuminate, limbidium present or absent 21
21. Plants small, leaves mostly < 1(-2) mm, narrowly lanceolate, costa weak, not reaching apex, limbidium absent *Bryum rhizoblastum* Cardot & Broth.
 — Plants small to large, leaves 2-3 mm, ovate to suborbicular, costa variable, not reaching apex, percurrent to short excurrent, limbidium present or absent 22
22. Stems gemmiform, forming pale whitish-green to yellow-green budlike shoots, leaves strongly concave, ovate, limbidium weak or absent, costa short excurrent as stout awn, basal lamina cells shorter than distal cells, often forming small pale quadrate group in alar region *Bryum funkii* Schwägr.
 — Stems elongate, evenly foliate to julaceous, or sometimes comose, not bud-like, leaves flat or concave, ovate to suborbicular, limbidium present or absent, costa not reaching apex to short excurrent, basal lamina cells longer or shorter than distal cells, alar region not distinct 23
23. Stems evenly foliate to somewhat comose, distal lamina cells shorter and often wider than proximal cells, rhomboidal, proximal cells more or less rectangular, limbidium present 24
 — Stems more or less julaceous or evenly foliate, distal lamina cells longer than proximal cells, often oblique to costa, proximal cells mostly quadrate to short-rectangular, limbidium absent or weak 25

24. Stems elongate and evenly foliate, leaves ovate, not decurrent, flat or weakly concave, costa excurrent in short awn, sexuality autoicous, peristome reduced, endostome adherent to exostome, cilia lacking, spores 22–26 µm *Ptychostomum gayanum* (Mont. ex Müll.Hal.) Ochyra & Bedn.-Ochyra
 — Stems short, somewhat comose, leaves broadly ovate to suborbicular, somewhat decurrent, distinctly concave, costa mostly not reaching apex or percurrent, sexuality unknown, capsules unknown *Bryum sabuletorum* Cardot & Broth.
25. Plants green to olive, julaceous, large, stems to 6 cm, leaves to 4 mm, obtuse to broadly acute, costa percurrent or sometimes weaker, distal lamina cells incrassate, somewhat vermicular, 3–4:1, oblique to costa c. 30–45° *Imbricbryum laevigatum* (Hook.f. & Wilson) J.R.Spence & H.P.Ramsay
 — Plants green, yellow-green, red or brown, smaller, stems < 3 cm, leaves 1–3 mm, acute to obtuse, costa not reaching apex, percurrent or short-excurrent in awn, distal lamina cells not or rarely oblique to costa, mostly thin-walled 26
26. Stems somewhat julaceous, leaves small, to 1 mm, brown-yellow to brown-green, leaf base red *Plagiobryoides orbiculatifolia* (Cardot & Broth.) Ochyra & Bedn.-Ochyra
 — Stems evenly foliate but not julaceous, leaves mostly somewhat shrunken-contorted when dry, yellow, yellow-green to red, leaf base same color as rest of lamina 27
27. Plants green to yellow-green, leaves more or less flat, ovate to sometimes lingulate, weak limbidium present to mid-leaf, costa percurrent to short-excurrent in awn, distal cells somewhat thick-walled but not incrassate, rarely oblique to costa, capsule long-clavate, to 5 mm, often curved, often purple when mature *Imbricbryum clavatum* (Schimp.) J.R.Spence & H.P.Ramsay
 — Plants green to red, leaves somewhat concave, ovate, limbidium absent, costa not reaching apex to short-excurrent, distal cells mostly thin-walled, not oblique to costa, capsules pyriform to long-necked with somewhat inflated urn, mostly < 3 mm, brown at maturity 28
28. Plants small, stems short, mostly < 1.5 cm, leaves mostly < 2 mm, often red-tinted, apex more or less rounded-obtuse, costa not reaching apex *Bryum gilliesii* Hook. (in part)
 — Plants larger, stems to 3 cm, leaves 2–3 mm, green to yellow-green, apex acute, costa percurrent to short-excurrent in awn *Bryum platyphyllum* Schwägr.

restricted to the southern hemisphere. Only 8% are cosmopolitan species. In the southern hemisphere, the family shows the greatest affinities with southern South America (23 species, 82%), followed by New Zealand (13 species, 46%) and the subantarctic islands (11 species, 39%). Affinities with South Africa and Tasmania are weaker. The three endemic species account for an endemism rate of c. 11% (Table 1).

Sorenson's coefficients support these patterns, with the strongest floristic connections with South America (77%), followed by New Zealand (75%). Because Sorenson's coefficient is influenced by the number of endemic species within a region, Tasmania with only two endemics shows a slightly higher similarity (59%) to the Falkland Islands compared with the subantarctic islands (54%) with four endemics. Again, the weakest ties are with the depauperate cold-temperate flora of South Africa (Table 2; Appendix 1).

DISCUSSION

The Bryaceae flora of the Falkland Islands is very diverse, representing c. 15% of the currently known moss flora. Among cold-climate regions of the southern hemisphere, it is more diverse than those of Tasmania, New Zealand and South Africa. Only southern South America supports more species, due to its large size, connections to the Andes with extensive high elevation habitats as well as the Patagonian (including Magellanic) region at the southern tip of the continent. The

addition of eight species new to the islands suggests that more discoveries are likely with additional field work.

In his analysis of the relationships of various plant and animal taxa on the Falkland Islands, McDowell (2005) pointed out that virtually all groups were strongly influenced by proximity to South America, which lies to the west and upwind of the prevailing westerlies. Thus, it is probable that the Falkland Islands acquired most of their moss flora as the islands rafted southwest into colder latitudes and closer to South America. The presence of the bipolar taxa may also result from dispersal from South America, although direct dispersal from the northern hemisphere cannot be ruled in the absence of species population-level molecular analyses. McDowell's earlier analysis of the moss flora (based on Matteri 1986) indicated that 80% of the species are also found in South America. The full moss flora also has strong connections with New Zealand (30%), South Georgia (26%) and Antarctica (15%). This study provides further evidence in the Bryaceae for a strong South American connection.

The three endemic species include two that seem to be relatively distinct, *Bryum miserum* and *B. sabuletorum*. The third species, *B. rhizoblastum*, appears to be a weak segregate possibly conspecific with *B. pabstianum*. Based on morphology, *B. miserum* and *B. sabuletorum* do not provide evidence of relationships with other southern hemisphere species, although the former is closely related to *B. dichotomum*. Of the three, *B. sabuletorum* is the most distinctive and its affinities are not known at this time. Future work using molecular methods would be useful to determine the origin of these endemics.

TABLE 1. — Summary phytogeographic results of the world and southern hemisphere geographic categories for the moss family Bryaceae of the Falkland Islands. ¹, pantemperate subelement of Ochyra *et al.* (2008b), including subantarctic and Antarctic regions, as well as Australasia and South Africa.

World geographic element	Number of species	Southern geographic element	Number of species
Cosmopolitan	2	Pantemperate ¹	6
Bipolar	—	South America	9
Transitional	7	(Temperate)	(6)
Strict	4	(Cold-temperate)	(1)
Southern Hemisphere	15	(Temperate-Subantarctic)	(1)
—	—	(Montane-Temperate)	(1)
—	—	Amphipacific Temperate	9
—	—	(South America-Australasia)	(4)
—	—	(South America-New Zealand)	(4)
—	—	(Pantemperate-Montane-Subantarctic)	(1)
—	—	Amphiatlantic Temperate	1
—	—	Falkland Islands Endemic	3
Total	28		28

TABLE 2. — Sorenson's coefficient of similarity among six regions in the southern hemisphere for the moss family Bryaceae. The larger the percent similarity the more similar floras are to each other. Abbreviations: **FI**, Falkland Islands; **NZ**, South Island and offshore islands of New Zealand with some extensions to the North Island; **SA**, South Africa; **SAM**, southern South America; **SI**, subantarctic islands; **TAS**, Tasmania, with extensions to southeast Australia.

	SAM	FI	NZ	TAS	SA	SI
SAM	100	77.4	64	51	41	54.4
FI	—	100	75	58.7	38.3	54
NZ	—	—	100	92.5	40.8	75
TAS	—	—	—	100	55.6	68.1
SA	—	—	—	—	100	38.8
SI	—	—	—	—	—	100

In contrast, the native vascular plant flora of the Falkland Islands (Heller *et al.* 2019) shows, as expected, a more insular and much stronger southern hemisphere pattern. Of the 180 known species on the islands, the strongest connections are also with South America (89%), but the relationships with Australasia (9%) are much weaker than in the mosses including the Bryaceae. The cosmopolitan and bipolar elements represent *c.* 12% in the vascular flora, compared with 47% for the Bryaceae and *c.* 28% for the overall moss flora (Matteri 1986). The subantarctic connection is also much stronger for the Bryaceae (39%) compared to the vascular flora (13%) as well as the moss flora (*c.* 24%; Matteri 1986). Interestingly, the Falkland Islands Bryaceae show much weaker connections to South Georgia (3 species, 11%) compared with the more distant Antarctica (6 species, 21%). The liverwort flora (Engel 1990) also shows strong affinities with South America, less so with Australasia and the subantarctic islands. Taxonomic work is ongoing in other cryptogamic groups including lichens as well as recent collections of liverworts, and it will be interesting to see what patterns emerge when these groups are better known. A preliminary analysis of the macrolichens of the Falkland Islands (Galloway 1988) showed that virtually all known species also occurred in South America, with strong extensions to South Georgia.

Most of the connections in the Falkland Islands Bryaceae with South America are among more temperate and widespread species such as *Bryum gilliesii*, *B. pabstianum* and *B. platyphylum*, supporting the concept that the islands should be classified as cold temperate rather than subantarctic (see Engel 1990). There is a large endemic component to the extreme

cold-temperate-alpine regions of southern South America that is absent from the Falkland Islands. There are at least 11 endemic Bryaceae species reported from the region including southern Chile and Argentinian Patagonia south to Tierra del Fuego, mostly in the genus *Ptychostomum* (Spence 2020, 2021). The absence of these species in the Falkland Islands is noteworthy and may be due to its isolation as well as potential differences in climate, habitats and geology. However, the islands are relatively large with many remote high elevation areas that have not yet been thoroughly explored, thus some of these species may eventually be found.

Although the Falkland Islands occur at similar latitudes as the subantarctic islands, they support no strictly subantarctic island species in the Bryaceae. Matteri (1986) also pointed out that for the full moss flora this subantarctic element was very small, although recent field work on the island may add more species. This lack of shared subantarctic species in the Bryaceae occurs because most species are widespread on mainland areas as well as the northern hemisphere. For example, of the 22 species in the family reported from Macquarie Island, Prince Edward Islands, Îles Crozet, Heard Island and South Georgia, all but four (82%) are found in adjacent mainland regions of Australasia, South Africa and South America, while eight species (36%) extend to the northern hemisphere. All seven species that occur in Antarctica are also found in mainland areas (Ochyra *et al.* 2008b).

There is one significant exception to this pattern of mostly widespread species on the subantarctic islands. Three endemics, *Ptychostomum eatonii* (Mitt.) Ochyra & Bedn.-Ochyra, *P. kerguelense* (Mitt.) Ochyra & Bedn.-Ochyra and *Imbriobryum*

orthotheciellae (Müll.Hal.) Ochyra & Bedn.-Ochyra are restricted to the south Indian Ocean islands including Îles Kerguelen and the Prince Edward Islands, providing support for this area as a fairly distinct regional province, at least for mosses (cf. Ochyra *et al.* 2008b). A fourth poorly known species, *Bryum lamprocarpum* Müll.Hal., is endemic to South Georgia but it may not be a distinct species and requires further study.

Three species that reach the Falkland Islands show interesting distributions. *Plagiobryoides orbiculatifolia* is found in Antarctica, on South Georgia and Heard Islands, and southern South America, but also extends to the South Atlantic Ocean on Tristan da Cunha. The second, *Ptychostomum gayanum*, originally endemic to Îles Kerguelen, has also been reported from southern South America and is newly reported here from the Falkland Islands. These two species, along with potentially other mosses represent a small but distinct amphiatlantic element. The third species, the bipolar species *P. pallescens*, shows a distribution similar to other species in Antarctica (Ochyra *et al.* 2008b) where it occurs on the Falkland Islands, in all mainland areas and Antarctica but is apparently absent from the subantarctic islands. Although autoicous, this species is often sterile in more extreme environments, and may eventually be found on some of the subantarctic islands.

Among the bipolar species that reach the Falkland Islands, several may have been introduced. The islands have an extensive history of colonization by the British as well as cultural ties with Argentina. The introduction of agriculture and livestock may have also inadvertently introduced some predominantly northern hemisphere species such as *Bryum badium*, *B. barnesii*, *Imbriobryum subapiculatum* and *Rosulabryum flaccidum*. The origin of the last species is enigmatic, as it is a Caribbean-North American species. Molecular analysis may be of use in determining the source origins of these species.

The results of this study may change as more field exploration on the Falkland Islands as well as other remote regions of the southern hemisphere continue. In addition, taxonomic studies including molecular methods are needed to determine the status of some poorly known southern species. Of particular concern are the group of endemic species related to the bipolar *Ptychostomum compactum*-*P. inclinatum* complex. These include *P. altisetum* (Müll.Hal.) J.R.Spence & H.P.Ramsay in Australia, *Bryum* (*Ptychostomum*) *tenuidens* Dixon & Sainsbury in New Zealand, *P. kerguelense* and *P. donatii* (Thér.) Ochyra & Bedn.-Ochyra from southern South America. These species are all very similar morphologically to *P. compactum* and *P. inclinatum*, and their status is in urgent need of review.

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APPENDIX

APPENDIX 1. — List of Bryaceae species from the southern hemisphere used in the study. Although *Bryum chrysoneuron* Müll.Hal. is reported from the subantarctic Macquarie Island it is likely misidentified (R. Seppelt, pers. comm. 2021). Its removal from the analyses would not affect the results. *Bryum gilliesii* Hook. and *B. platyphyllum* Müll.Hal. are placed within *Plagiobryoides* J.R.Spence as they are likely members of that genus. *Bryum lamprocarpum* Müll.Hal. is placed within *Plagiobryum* Lindb. as it may be a member of that genus. Neither combination was made.

		Tierra del Fuego/						
Genus	Species	S. Patagonia	Falklands	New Zealand	Tasmania	South Africa	Sub Islands	Antarctica
Anomobryum	A. drakensbergense	–	–	–	–	1	–	–
	A. julaceum	1	–	–	–	1	1	–
Brachymenium	B. magellanicum	1	–	–	–	–	–	–
Bryum	B. argenteum	1	1	1	1	1	1	1
	B. badium	–	1	–	–	–	–	–
	B. barnesii	1	1	–	–	–	–	–
	B. caespiticium	1	1	1	1	1	–	–
	B. dichotomum	1	1	1	1	1	1	1
	B. funkii	1	1	1	–	–	–	–
	B. harriotii	–	–	1	1	–	1	–
	B. microimbricatum	1	1	–	–	–	–	–
	B. miserum	–	1	–	–	–	–	–
	B. pabstianum	1	1	–	–	–	–	–
	B. rhizoblastum	–	1	–	–	–	–	–
	B. sabuletorum	–	1	–	–	–	–	–
	B. sauteri	–	–	1	1	–	1	–
Imbricobryum	I. alpinum	–	–	–	–	1	–	–
	I. australe	1	–	1	1	–	–	–
	Bryum chrysoneuron	–	–	1	1	–	1	–
	I. clavatum	1	1	1	1	–	1	–
	I. crassinervium	1	–	–	–	–	–	–
	I. laevigatum	1	1	1	1	–	1	–
	I. subapiculatum	1	1	1	1	1	–	–
Ochiobryum	O. blandum	–	–	1	1	–	1	–
Plagiobryoides	Bryum gilliesii	–	1	–	–	–	–	–
	P. orbiculatifolia	1	1	–	–	–	1	1
Plagiobryum	Bryum platyphyllum	–	1	–	–	–	–	–
	Bryum lamprocarpum	–	–	–	–	–	1	–
	P. novae-seelandiae	–	–	1	–	–	–	–
Ptychostomum	P. zierii	–	–	–	–	1	–	–
	P. altisetum	–	–	–	1	–	–	–
	P. bimum	1	–	–	1	1	–	–
	P. chorizodontum	1	–	–	–	–	–	–
	P. cernuum	1	–	–	–	–	1	–
	P. compactum	1	1	1	–	–	1	–
	P. creberrimum	–	–	1	1	–	–	–
	P. dicarpum	1	–	–	–	–	–	–
	P. donatii	1	–	–	–	–	–	–
	P. eatonii	–	–	–	–	–	1	–
	P. gayanum	1	1	–	–	–	–	–
	P. inclinatum	1	1	1	–	–	1	1
	P. kerguelense	–	–	–	–	–	1	–
	P. lamprochaete	1	–	–	–	–	–	–
	P. mucronatum	1	–	1	–	–	1	–
	P. nivale	1	–	–	–	–	1	1
	P. orthothecium	1	–	–	–	–	–	–
	P. pallens	1	–	–	–	–	–	–
	P. pallescens	1	1	1	1	–	–	1
	P. pauperculum	1	–	–	–	–	–	–
	P. pseudotriquetrum	1	1	1	1	1	1	1
	P. tenuidens	–	–	1	–	–	–	–
	P. turbinatum	1	–	–	–	1	–	–
	P. vernicosum	1	–	–	–	–	–	–
	P. weigeli	–	–	–	–	–	1	–
P. zeballosicum	1	–	–	–	–	–	–	
Rhodobryum	R. cf. roseodens	1	1	–	–	–	–	–
Rosulabryum	R. billardieri	1	1	1	1	–	1	–
	R. capillare	1	1	1	1	1	–	–
	R. flaccidum	–	1	–	–	–	–	–
	R. macrophyllum	1	1	–	–	–	–	–
	R. microrhodon	–	–	1	1	–	–	–

APPENDIX 1. — Continuation.

		Tierra del Fuego/						
Genus	Species	S. Patagonia	Falklands	New Zealand	Tasmania	South Africa	Sub Islands	Antarctica
	<i>R. perlimbatum</i>	1	1	1	–	–	–	–
	<i>R. puconense</i>	1	–	–	–	–	–	–
	<i>R. rubens</i>	–	–	1	1	–	–	–
	<i>R. subtomentosum</i>	–	–	1	1	–	–	–
Species		38	28	26	21	11	22	7
Endemics		11	3	2	2	1	4	0