



The Mosses of Barton Peninsula, King George Island: New Records and an Updated Checklist

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ABSTRACT

This study was carried out to investigate the moss flora of Barton Peninsula on King George Island of Antarctica. The study presented here was based on field surveys of Barton Peninsula conducted by the author during the austral summer season in 2012/2013, 2013/2014, 2014/2015 and herbarium specimens from Hiroshima University. The result of the study showed that the moss flora Barton Peninsula consisted of a total of 35 species, with 11 families and 21 genera.

Keywords: Antarctica, Barton Peninsula, Bryophyta, King George Island, Moss

Introduction

The Barton Peninsula is a small peninsula separating Marian Cove and Potter Cove at the southwest end of King George Island in the South Shetland Islands, Antarctica. The Korean research station, King Sejong is located on the Barton Peninsula. Barton Peninsula is 4 km wide at its maximum and 3 km long, so the development is directed from the north-east to the south-west (Jeong & Yoon, 2001). There is an area of exposed outcrops in summer, which covers about 15 km². This area has a rugged topography with a wide and gentle slope in the central belt having elevations of 90-180 m above sea level, the slopes of sea side are steep (Chang *et al.*, 1990).

Previous studies on the mosses of Barton Peninsula were conducted and reported by an ornithologist during his short visit on this peninsula unlike other areas on King

George Island (Ochyra, 1998). Recently, Yu *et al.* (2014) reported 13 bryophyte belonging to five species from Barton Peninsula. Also, some moss species are continually being added to the flora of King George Island (Ellis *et al.*, 2012a). In sight of these, the moss flora of King George Island, including Barton Peninsula, is still incompletely known. This study aims to provide a supplemented species list of mosses growing on Barton Peninsula for the related phylogenetic and physiological studies with information of new moss records of the peninsula.

Materials and Methods

This study was done during the austral summer season of 2012-2013, 2013-2014 and 2014-2015. The study has been based on specimens collected from the field by the first author and herbarium specimens from Herbarium of Hiroshima University (HIRO). All the collected materials were processed into voucher specimens and are currently deposited at the Korea Polar Research Institute (KOPRI) Herbarium (KOPRI, Index Herbarium) and HIRO. To identify the taxa, we referred to all the literatures available (Noguchi, 1987; 1988; 1989; 1991; 1994; Ochyra, 1998; Ochyra *et al.* 2008) and observed the specimens carefully

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under the stereoscopic and optical microscopes.

Results and Discussion

Since Ochyra reported moss flora of King George Island consists of 61 species belonging to 33 genera and 15 families in 1998, the moss flora of King George Island had been increased with four species. *Schistidium lewis-smithii* Ochyra and *S. leptoneurum* Ochyra were described as new to science from Admiralty Bay in the Island. These two unique species are new Antarctic endemics (Ochyra *et al.*, 2008). *Drepanocladus longifolius* (Mitt.) Paris was recorded for the first for the time from the southern part of Fildes Peninsula in King George Island (Li *et al.*, 2009), and *Bryoerythrophyllum recurvirostrum* (Hedw.) P. C. Chen was also recorded from north-western side of Marian Cove near the Weaver Peninsula by Kurbatova and Ochyra (Ellis *et al.*, 2012a).

Currently, the moss flora of King George Island currently consists of 65 species belonging to 35 genera and 15 families (Ellis *et al.*, 2012b).

Here we reported on a collection from Barton Peninsula in King George Island (Fig. 1). Through this study on the moss diversity of Barton Peninsula, a total of 35 species were identified as belonging to 21 genera and 11 families. This number corresponds to 54% of total number of mosses (65 taxa) currently recognized from King George Island (Ellis *et al.*, 2012a). Among the species, 19 species are the first records from the Barton peninsula.

Both Admiralty Bay and Fildes Peninsula are located near the study area. Admiralty Bay has the richest moss flora on the King George Island. It has been reported to have 58 species of mosses, and the number corresponds to 89% of total number currently recognized from King

George Island. On the other hand, the Fildes Peninsula has 41 species, which represents 63% of total number of mosses on King George Island. Because of the good climatic condition and wide range of habitats suitable for colonization by mosses, Admiralty Bay is known for its rich moss flora and has much more favorable habitats for moss diversity than the Fildes Peninsula and Barton Peninsula (Ellis *et al.*, 2012a; Ochyra, 1998).

Below, we provide some information of the species identified above as new moss records for Barton Peninsula (Table 1).

List of newly reported species in Barton Peninsula

Andreaea depressinervis Cardot

Andreaea depressinervis is an Antarctic species, and widely distributed in maritime Antarctic. The species is easily recognized in the Antarctic, by the single costa extending into an acumen (Ochyra *et al.*, 2008). It grows mostly on rocks or soil, stony and gravelly ground, sometimes on patches of moss peat in Barton Peninsula. The collections were without sporophytes.

Specimens examined: Barton Peninsula, Jeonjaegyu Hill, soil, 62°13'31.18"S, 58°46'42.54"W, 84 m, 9 January 2013 Y.-J. Yoon KG-1017; Barton Peninsula, Narebski point, rocks, 62°14'03.9"S, 58°46'20.0"W, 127 m, 2 February 2015 Y.-J. Yoon KG-1892; Barton Peninsula, along the seacoast, 62°13'20"S, 58°46'49"W, 5 m, 30 January 2006 T. Yamaguchi 26425.

Andreaea gainii Cardot

This is an amphipacific subantarctic-Antarctic species, and widely distributed in the maritime Antarctic (Ellis *et al.*, 2011). *Andreaea gainii* differs from other species of

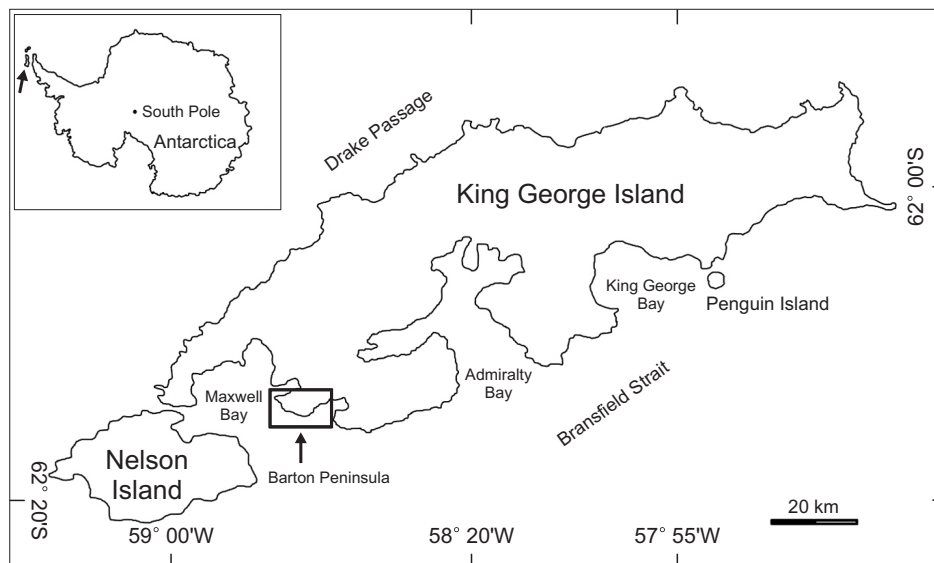


Fig. 1. Study area on Barton Peninsula in King George Island, Antarctica.

Table 1. Updated checklist of Barton Peninsula

Species	Information source		This research	
	OCHYRA	YU	HIRO	KOPRI
<i>Andreaea depressinervis</i> Cardot*	-	-	○	○
<i>Andreaea gainii</i> Cardot*	-	-	○	○
<i>Andreaea regularis</i> Müll.Hal.	○	-	○	○
<i>Bartramia patens</i> Brid.	○	-	○	○
<i>Bryum archangelicum</i> Bruch & Schimp.*	-	-	○	○
<i>Bryum argenteum</i> Hedw.*	-	-	○	-
<i>Bryum pseudotriquetrum</i> (Hedw.) P.Gaertn., B.Mey. & Scherb.	○	-	○	○
<i>Bucklandiella sudeticum</i> (Funck) Bendnarek-Ochyra & Ochyra*	-	-	○	○
<i>Ceratodon purpureus</i> (Hedw.) Brid.	○	-	○	○
<i>Chorisodontium aciphyllum</i> (Hook.f. & Wils.) Broth.	○	○	○	○
<i>Ditrichum hyalinocuspdatum</i> Cardot	○	-	○	○
<i>Ditrichum hyalinum</i> (Mitt.) Kuntze	○	-	○	○
<i>Encalypta rhaptocarpa</i> Schwägr.*	-	-	-	○
<i>Hennediella antarctica</i> (Ångstr.) Ochyra & Matteri*	-	-	○	○
<i>Hennediella heimii</i> (Hedw.) R.H.Zander*	-	-	○	-
<i>Hymenoloma antarcticum</i> (Müll.Hal.) Ochyra	○	-	○	○
<i>Hymenoloma crispulum</i> (Hedw.) Ochyra	○	-	○	-
<i>Kiaeria pumila</i> (Mitt.) Ochyra*	-	-	○	-
<i>Meesia uliginosa</i> Hedw.*	-	-	○	○
<i>Notoligotrichum trichodon</i> (Hook.f. & Wils.) G.L.Sm.*	-	-	○	○
<i>Pohlia cruda</i> (Hedw.) Lindb	○	-	-	○
<i>Pohlia drummondii</i> (Müll.Hal.) A.L.Andrews*	-	-	○	-
<i>Pohlia nutans</i> (Hedw.) Lindb.	○	-	○	○
<i>Pohlia wahlenbergii</i> (F.Weber & D.Mohr) A.L.Andrews*	-	-	○	-
<i>Polytrichastrum alpinum</i> (Hedw.) G.L.Sm.*	-	○	○	○
<i>Polytrichum strictum</i> Brid.*	-	○	○	○
<i>Sanionia georgicouncinata</i> (Müll.Hal.) Ochyra & Hedenäs	○	-	○	-
<i>Sanionia uncinata</i> (Hedw.) Loeske*	-	○	○	○
<i>Schistidium antarctici</i> (Cardot) L.I.Savicz & Smirnova	○	-	○	○
<i>Stegonia latifolia</i> (schwägr.) Venturi ex Broth.*	-	-	-	○
<i>Syntrichia filaris</i> (Müll.Hal.) R.H.Zander	○	-	○	○
<i>Syntrichia magellanica</i> (Mont.) R.H.Zander*	-	-	○	○
<i>Syntrichia saxicola</i> (Cardot) R.H.Zander	○	-	○	○
<i>Warnstorfia fontinaliopsis</i> (Müll.Hal.) Ochyra*	-	-	○	○
<i>Warnstorfia sarmentosa</i> (Wahlend.) Hedenäs	-	○	○	○

OCHYRA, Ochyra *et al.* (2008); YU, Yu *et al.* (2014); HIRO, Herbarium of Hiroshima University; KOPRI, Korea Polar Research Institute.

*New records to Barton Peninsula.

the genus in Antarctica by leaves obovate-spathulate to panduriform and leaf margins crenate to dentate below. This species occurs mostly on exposed rocks or soil, stony

and gravelly ground, sometimes on patches of moss peat, shallow soil over rocks in Barton Peninsula. This is one of the most frequent producers of sporophytes seen in Bar-

ton peninsula.

Specimens examined: Barton Peninsula, Jeonjaegy Hill, soil, 62°13'31.18"S, 58°46'42.54"W, 84 m, 9 January 2013 Y.-J. Yoon KG-1023; Barton Peninsula, Kaya Hill, humus rocks, 62°13'48.5"S, 58°46'48.4"W, 99 m, 3 February 2015 Y.-J. Yoon KG-1902; Barton Peninsula, route from the station to Chottae-bawi, on soil in the shade of rock, 62.13.54S, 58.46.43W; 130 m, *T. Yamaguchi* 26391.

Bryum archangelicum Bruch & Schimp

Bryum is the largest and most widely distributed genus of mosses through the world. The genus consist of about 800 species in the world (Li *et al.*, 2007). About 8 taxa have been reported from Antarctica (Ochyra *et al.*, 2008). This is a bipolar species, and pioneer moss growing on bare soil or shallow soil over rocks in glacial retreated area of Barton Peninsula. Commonly with sporophytes.

Specimens examined: Barton Peninsula, glacial retreated area, soil, 62°13'48.90"S, 58°42'48.93"W, 7 m, 10 January 2014 Y.-J. Yoon KG-1425; 62°13'48.99"S, 58°42'38.04"W, 6 m, 15 January 2014 Y.-J. Yoon KG-1476; Barton Peninsula, along the seacoast, on soil, 62°13'08"S, 58°45'56"W, 3 m, 9 February 2006 *T. Yamaguchi* 26643; on soil among boulder, 62°13'47"S, 58°42'34"W, 1 m, 9 February 2006 *T. Yamaguchi* 26643.

Bryum argenteum Hedw

Bryum argenteum is a cosmopolitan species common to urban areas where it can be found between cracks on sidewalks, poor soil, and rocks. In South Shetland Islands, it has been known only to Admiralty Bay and Deception Island, but this study shows that it is distributed in summit of nunatak in Skua's nesting ground, Barton Peninsula (Ochyra *et al.*, 2008). This species was distributed in rock crevice and soil covered gravel in Barton Peninsula. Sterile in Antarctica.

Specimens examined: Barton Peninsula, along the seacoast, in rock crevice, 62°14'28"S, 58°44'25"W, 2 m, 2 February *T. Yamaguchi* 26560; Barton Peninsula, summit of nunatak in Skua nesting ground; on soil covered gravel, 62°14'03"S, 58°46'15"W, 130 m, 14 February *T. Yamaguchi* 26685.

Bucklandiella sudetica (Funck) Bednarek-Ochyra & Ochyra

Bucklandiella sudetica is a bipolar species and mostly common in the subantarctic South Georgia. To date, two localities are known also from King George Island (Ochyra *et al.*, 2008). However, this species was growing on rocks and humus rocks near the Kaya Hill around King SeJong Station. Sterile in Antarctica.

Specimens examined: Barton Peninsula, Kaya Hill, on humus rocks, 62°13'48.86"S, 58°46'55.62"W, 96 m, 13 January 2014 Y.-J. Yoon KG-1434; Barton Peninsula,

around the Korean Antarctic Station, 5 m, 27 January 2006 *T. Yamaguchi* 26357.

Encalypta rhaptocarpa Schwägr

This is a bipolar species, and widely distributed in the northern hemisphere. In King George Island, it was only known around Bransfield Strait and Admiralty bay (Ochyra *et al.*, 2008). *E. rhaptocarpa* differs from other species in the genus by large calyptra over the capsule, shape of peristome teeth and without propagules. Commonly with sporophytes.

Specimens examined: Barton Peninsula, glacial retreated area, on soil, 62°13'49.99"S, 58°42'38.04"W, 6 m, 15 January 2014 Y.-J. Yoon KG-1458.

Hennediella antarctica (Ångstr.) Ochyra & Matteri

This is an amphiatlantic subantarctic species which is known from four collection sites (Admiralty Bay, Bransfield Strait, Drake Passage, Potter Peninsula) in King George Island. Most populations of this species are from maritime locations of Antarctic, and they usually produce fully mature sporophytes (Ochyra *et al.*, 2008). *H. antarctica* was growing on rocks and soil among boulders near the glacial retreated area in Barton Peninsula.

Specimens examined: Barton Peninsula, glacial retreated area, on rocks, 62°14'18.8"S, 58°43'07.1"W, 2 m, 15 January 2014 Y.-J. Yoon KG-1237; Barton Peninsula, along the seacoast, on soil among boulders, 62°13'47"S, 58°42'34"W, 1 m, 9 February 2006 *T. Yamaguchi* 26630.

Hennediella heimii (Hedw.) R.H.Zander

This bipolar species is known from numerous area of South Shetland Islands (Ochyra *et al.*, 2008). It can be readily distinguished from other Antarctic species by size of upper laminal cells (16-35 µm), calyptra covering only half of the urn. It is sterile in our collections.

Specimens examined: Barton Peninsula, along the seacoast, in rock crevice, 62°14'28"S, 58°44'25"W, 2 m, 3 February 2006 *T. Yamaguchi* 26561.

Kiaeria pumila (Mitt.) Ochyra

This is a pan-south-temperate species which is known from two collection sites (Admiralty Bay, Fildes Peninsula) in King George Island (Ochyra *et al.*, 2008). It is distributed in around the Kingsejong station, Barton Peninsula. It is sterile in our collections.

Specimens examined: Barton Peninsula, around the Kingsejong station, in rock crevice, 5 m, 27 January 2006 *T. Yamaguchi* 26363; Barton Peninsula, around the Kingsejong station, on gravel, 30 m, 27 January 2006 *T. Yamaguchi* 26370.

Meesia uliginosa Hedw

This is a bipolar species which is known from several

area of South Shetland Islands in Antarctica. This species is distinguished by its stems erect, 0.5–1.5 cm long, oblong-lanceolate, shortly apiculate with broad costa (Ochyra *et al.*, 2008). It is sterile in our collections.

Specimens examined: Barton Peninsula, Nabi Hill, on rocks, 62°14'24.7"S, 58°45'37.8"W, 100 m, 17 January 2013 Y.-J. Yoon KG-1159-1; Barton Peninsula, on soil in shade of rock, 62°13'40"S, 58°46'49"W, 90 m, 20 February 2006 T. Yamaguchi 26743.

Notoligotrichum trichodon (Hook.f. & Wils.) G.L.Sm.

This is an amphiatlantic subantarctic species which was known only from the Potter Peninsula in King George Island. But, this species is the most abundantly and widely distributed on South Georgia (Ochyra *et al.*, 2008). It is common on around of Kaya Hill in Barton Peninsula. The sporophytes are very rare in Antarctica, and not seen in our collections.

Specimens examined: Barton Peninsula, Kaya Hill, on humus rocks, 62°13'48.86"S, 58°46'55.62"W, 96 m, 13 January 2014 Y.-J. Yoon KG-1439; Barton Peninsula, Kaya Hill, on humus, 62°13'46.1"S, 58°47'00.9"W, 96 m, 25 January 2015 Y.-J. Yoon KG-1856-1; Barton Peninsula, route from the station to Chottae-bawi, on gravel, 90 m, 28 January 2006 T. Yamaguchi 26373a; Barton Peninsula, on humus covered travel, 62°13'04"S, 58°46'45"W, 90 m, 4 February 2006 T. Yamaguchi 26691.

Pohlia drummondii (Müll.Hal.) A.L.Andrews

This is a bipolar species, and typically grows on sandy, glacial soil in wet places or under moist condition. Previously, the species has been found in Admiralty Bay in King George Island. This species can be identified from other congeneric species by its median laminal cells than 15 µm wide, leaves long-decurrent, axillary gemmae usually present (Ochyra *et al.*, 2008). It is sterile in our collections.

Specimens examined: Barton Peninsula, along the seacoast, 62°13'20"S, 58°46'49"W, 5 m, 30 January 2006 T. Yamaguchi 26440a; Barton Peninsula, along the seacoast, 62°13'20"S, 58°46'49"W, 5 m, 30 January 2006 T. Yamaguchi 26449.

Pohlia wahlenbergii (F.Weber & D.Mohr) A.L.Andrews

This is a bipolar species which is known from two collection sites (Admiralty Bay, Deception Island) in Antarctica. *Pohlia wahlenbergii* is one of the geographically widespread and common species of the genus *Pohlia*. The leaves are pale whitish, decurrent and thin-walled cells (Ochyra *et al.*, 2008). It is sterile in our collections.

Specimens examined: Barton Peninsula, route from the station to Chottae-bawi, on soil in the shade of rock, 62°13'54"S, 58°46'43"W, 130 m, 28 January 2006 T. Yamaguchi 26390; Barton Peninsula, along the seacoast, on

soil, 62°13'08"S, 58°45'56"W, 3 m, 30 January 2006 T. Yamaguchi 26477; Barton Peninsula, around the station, on moist soil in shade of rock, 62°13'35"S, 58°46'11"W, 140 m, 31 January 2006 T. Yamaguchi 26531.

Polytrichastrum alpinum (Hedw.) G.L.Sm.

This species was the first moss species reported from Antarctica. It is a bipolar species and one of the commonest species in South Shetland Islands (Ochyra *et al.*, 2008). The species is best distinguished by having papillose marginal cells of leaf lamellae. The sporophytes are not seen in our collections.

Specimens examined: Barton Peninsula, Jeonjaegyu Hill, on humus rocks, 62°13'50.2"S, 58°46'66.9"W, 91 m, 16 January 2013 Y.-J. Yoon KG-1107; Barton Peninsula, glacial retreated area, on rocks, 62°13'49.99"S, 58°42'38.04"W, 6 m, 15 January 2014 Y.-J. Yoon KG-1462; Barton Peninsula, around the Sejong Hill, 62°13'18.5"S, 58°45'46.6"W, 193 m, 9 February 2015 Y.-J. Yoon KG-1929; Barton Peninsula, along the seacoast, on soil, 62°13'20"S, 58°46'49"W, 5 m, 30 January 2006 T. Yamaguchi 26426b; Barton Peninsula, route from the station to Chottae-bawi, on soil, 62°13'54"S, 58°46'43"W, 130 m, 28 January 2006 T. Yamaguchi 26388.

Polytrichum strictum Brid.

This is a bipolar species which is known only from Ardley Island in King George Island (Ochyra *et al.*, 2008). It is common in Barton Peninsula, and sterile in our collections.

Specimens examined: Barton Peninsula, Jeonjaegyu Hill, on humus, 62°13'50.2"S, 58°46'66.9"W, 91 m, 16 January 2013 Y.-J. Yoon KG-1111; Barton Peninsula, around the Narebski point, on soil, 62°14'03.9"S, 58°46'20.0"W, 127 m, 2 February 2015 Y.-J. Yoon KG-1888; Barton Peninsula, around the station, on gravels, 62°13'30"S, 58°46'41"W, 80 m, 31 January T. Yamaguchi 26511; Barton Peninsula, near the Narebski point, 62°14'02"S, 58°46'17"W, 120 m, 18 February T. Yamaguchi 26726.

Sanionia uncinata (Hedw.) Loeske

This is a bipolar species and one of the common species in the Antarctic. This species is similar in appearance to *S. georgicouninata*, but it can be distinguished by having a different leaf alar structure (Ochyra *et al.*, 2008). The sporophytes are very rare in Antarctica, and not seen in our collections.

Specimens examined: Barton Peninsula, Jeonjaegyu Hill, soil, 62°13'31.18"S, 58°46'42.54"W, 84 m, 9 January 2013 Y.-J. Yoon KG-1027; Barton Peninsula, along the seacoast, on gravel, 62°14'15"S, 58°45'58"W, 2 m, 3 February 2006 T. Yamaguchi 26541, 26542, 26543, 26544, 26545.

Stegonia latifolia (Schwägr.) Venturi ex Broth

This is a rare bipolar species which was known only from three collection sites (Signy Island, Bransfield Strait and Marguerite Bay) in the Antarctic. We found this species in glacial retreated area near the Potter Cove. It has a sporophytes in our collections.

Specimens examined: Barton Peninsula, glacial retreated area, on soil, 62°13'49.99"S, 58°42'38.04"W, 6 m, 15 January 2014 Y.-J. Yoon KG-1451.

Syntrichia magellanica (Mont.) R.H.Zander

This is a pan-Antarctic species which is widely distributed in maritime sites of the Antarctic (Ochyra *et al.*, 2008). This species is clearly distinguished from other species of the genus by having a hyaline hair-point in the field. The sporophytes are not seen in our collections.

Specimens examined: Barton Peninsula, along the seacoast, on humus, 62°14'30.60"S, 58°44'20.55"W, 9 m, 9 January 2013 Y.-J. Yoon KG-1048; Barton Peninsula, glacial retreated area, on soil, 62°13'49.99"S, 58°42'38.04"W, 6 m, 15 January 2014 Y.-J. Yoon KG-1446; Barton Peninsula, glacial retreated area, on soil, 62°14'16.2"S, 58°43'15.9"W, 22 m, 19 January 2015 Y.-J. Yoon KG-1805; Barton Peninsula, along the seacoast, on gravel, 62°14'15"S, 58°45'58"W, 2 m, 3 February 2006 T. Yamaguchi 26540; Barton Peninsula, along the seacoast, on soil among boulders, 62°13'47"S, 58°42'34"W, 1 m, 3 February 2006 T. Yamaguchi 26633.

Warnstorfia fontinaliopsis (Müll.Hal.) Ochyra

Two species of *Warnstorfia* Loeske have been reported from Antarctica. *Warnstorfia fontinaliopsis* is a subantarctic species which was known from several area of maritime Antarctic (Ochyra *et al.*, 2008). It can be distinguished by leaves broadly ovate to ovate-lanceolate, gradually long acuminate, axillary hairs short, brown basal cells. The sporophytes are not seen in our collections.

Specimens examined: Barton Peninsula, flat top, on wet land, 62°14'20.41"S, 58°44'22.52"W, 93 m, 10 January 2014 Y.-J. Yoon KG-1418; Barton Peninsula, near the Narebski point, on wet land, 62°14'03.9"S, 58°46'20.0"W, 127 m, 2 February 2014 Y.-J. Yoon KG-1896; Barton Peninsula, around the station, on gravels, 62°13'30"S, 58°46'41"W, 80 m, 31 January 2006 T. Yamaguchi 26515; Barton Peninsula, on soil covered rock, 62°14'02"S, 58°46'17"W, 120 m, 31 January 2006 T. Yamaguchi 26727.

Conflict of Interest

The authors declare that they have no competing interests.

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