

MOSSES OF THE PRINCE OSCAR LAND (NORDAUSTLANDET, SVALBARD)
МХИ ЗЕМЛИ ПРИНЦА ОСКАРА (О. СЕВЕРО-ВОСТОЧНАЯ ЗЕМЛЯ, ШПИЦБЕРГЕН)

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Abstract

An annotated list of mosses for the Prince Oscar Land (polar desert zone) is compiled. It includes 78 species, 25 of which are new for Nordaustlandet and adjacent little islands. Three species (*Cnestrum schisti* (F. Weber & D. Mohr) I.Hagen., *Hygroamblystegium tenax* (Hedw.) Jenn., *Pohlia beringiensis* Shaw) are new for Svalbard.

Резюме

Приведены результаты изучения локальной флоры мхов Земли Принца Оскара, расположенной в зоне полярных пустынь. Аннотированный список включает 78 видов, из которых 25 – новые для района Северо-Восточной Земли, включая соседние мелкие острова. Три вида впервые приводятся для Шпицбергена (*Cnestrum schisti* (F. Weber & D. Mohr) I.Hagen., *Hygroamblystegium tenax* (Hedw.) Jenn., *Pohlia cf. beringiensis* Shaw).

KEYWORDS: flora, mosses, Svalbard, Prince Oscar Land

INTRODUCTION

Nordaustlandet is the second largest island in the Svalbard Archipelago. Its area is about 15000 km², with three-quarters covered by glaciers. The Prince Oscar Land is located in the north of Nordaustlandet (Fig. 1a), on a peninsula and adjacent territory northward of the Austfonna ice sheet. The peninsula is bounded by Rijpfjorden in the west and by Duvefjorden in the east. The northernmost point – Kapp Platen – has the coordinates 80°30'N and 22°30'E. The Prince Oscar Land is free from glaciers except for one little ice cap in the central part (Ahlmannfonna).

Climate of various parts of the island is quite different. The mean annual temperature is -7-8°C. The warmest months are July or August with mean daily temperature +2.3-+2.4°C, the coldest – February or March (-18-20°C). Yearly precipitation is about 250 mm. On Svalbard a polar day lasts 102-133 days, from April till August. An important environmental factor is wind, because of its adverse effect on plants in summer and blowing off the protective layer of snow in winter. Permafrost can be found at different depth anywhere within the Nordaustlandet (Neilson, 1968; Troitskiy *et al.*, 1975).

According to the Norwegian bedrock map (Dallmann *et al.*, 2002), the prevailing rocks on the northern part of the Prince Oscar Land are Neoproterozoic quartzite and shale. The largest area (center and south-west) is occupied by granite. In other parts Mezoproterozoic low-grade slate and phyllite with quartzite, marble tuffaceous intercalations, as well as a Mezoproterozoic Migmatite

complex – augen gneiss, schist, and amphibolite with granites are found. Krasil'shchikov (1965) wrote about the Heckla Hoek complex (low group) including gneisses, migmatites, quartzites, marbles, shales, amphibolites, on the northern part of the Prince Oscar Land and Caledonian granitoides in the south. In the studied area most of the cliffs and outcrops are composed of granite. Debris of other bedrocks can be found in stonefields where its pieces mix with each other. However, there aren't any specific complexes of mosses on them.

The relief is hilly and low mountainous. The altitudes of mountains are 280-350 m. There are numerous outcrops, cliffs and screes on their slopes. Vast areas of plains are covered by stonefields (Fig. 2). They are composed of various boulders, debris, and pebbles. Unnamed lakes (often with an ice layer in August), streams and rivers are widespread especially in the interior part of the peninsula. Numerous melting snow patches and fields supply water to many sites where mosses and liverworts form big dense carpets. Many bare-soil spots both on the first sea terrace and the interior plain are the results of frost actions. Some slopes are affected by sea bird colonies.

According to geobotanical zoning of the Arctic, most of the Nordaustlandet, including the Prince Oscar Land, belongs to the Polar desert zone (Alexandrova, 1977; Matveyeva, 1998), Arctic polar desert zone (Elvebakk, 1985, 1990), High Arctic tundra subzone (Yurtsev, 1994), subzone A (Walker *et al.*, 2005). Vegetation on the studied area is open, has poor vertical structure and species composition. Cryptogams (bryophytes and lichens) dom-

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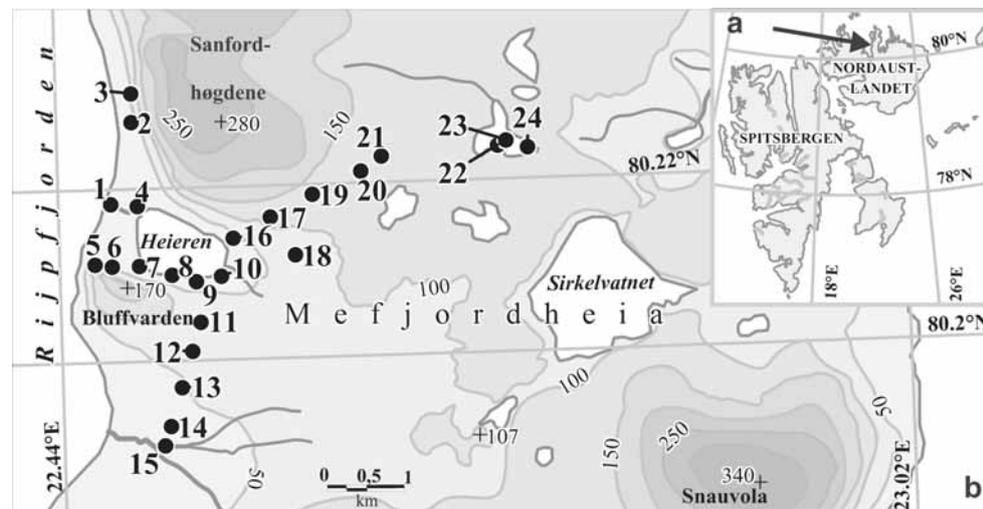


Fig. 1. Sampling points on the Prince Oscar Land; a – location of the the Prince Oscar Land within Nordaustlandet and in the Svalbard archipelago.

inate while vascular plants, represented mostly by herbaceous species, are scanty and scattered (*Luzula confusa* (Hartm.) Lindeb., *Saxifraga cernua* L., *S. cespitosa* L., *S. oppositifolia* L., *S. rivularis* L., *Cochlearia groenlandica* L., *Draba* spp.). In many communities vascular plants were not found at all. Mosses and liverworts form dense covers on favorable habitats: on moist and wet depressions in slopes and rock fields, on lake shores and stream banks, on seepage areas beneath snow patches and fields, as well as on sea bird nesting areas enriched with nitrogen. In damp or drier habitats, mosses (individuals or clones) grow separately from each other, without forming any close communities. Examples of such places are bare soil disturbed by frost actions or solifluction spots. Many species prefer sheltered sites beneath ledges, in crevices and in furrows along edges of polygons.

One of the first lists of Spitsbergen mosses was compiled by Lindberg (1867). It included also 60 species from Nordaustlandet and the neighboring islands (Sjuøyane and Lagøya). In 1875, Berggren published a list of mosses and liverworts collected during Swedish expeditions in Svalbard in 1864 and 1868. He noted 83 mosses from Nordaustlandet and adjacent little islands. The data from the previous Lindberg's list were also included.

The most complete annotated check-list of Svalbard bryophytes was presented by Frisvoll & Elvebakk (1996). It indicated 31 species for Nordaustlandet region, including small neighboring islands. Three of the species were found in Rippfjorden and Duvefjorden, but rather far from the area we camped in: *Polytrichum swartzii*, *Sanionia georgico-uncinata*, *Tetraplodon pallidus*. Frisvoll revised the Lindberg's and Berggren's collections and some samples were assigned to other species.

In last cited publications the name "Nordaustlandet" often means the territory of Nordaustlandet island with small neighboring islands Lågøya, Chermsideøya, and groups of little islands Sjuøyane, Castrénøyane. In our paper we use the name "Nordaustlandet region"

for a set of all these islands and the name "Nordaustlandet" for the Nordaustlandet island only (one big island).

MATERIALS AND METHODS

The mosses were gathered on August 3-8, 2006 in the central part of Prince Oscar Land in the surroundings of Sanfordhøgdene and Bluffvarden Mountains and on the Mefjordheia plain (Fig. 1). The studied area was 5×5 km². Samples were collected on coastal terraces, plain and lower parts of mountain slopes, because they are more interesting botanically. Upper parts of mountains are less rich in mosses and are often inaccessible because of moving screes or high steep cliffs.

About 200 specimens from 37 sampling points were collected by O. Belkina. We also identified mosses from 63 samples collected by N.A. Konstantinova for her study of liverworts. All specimens are kept in the Herbarium of Polar-Alpine Botanical Garden-Institute (KPABG).

LIST OF SPECIES

The annotated list of mosses includes information about 78 species. Short descriptions of sampling sites are arranged in Table 1. The nomenclature in the list follows Ignatov *et al.* (2006). After the name of each species, we specify the number of sampling points according to Table 1, habitats, accompanying mosses. The digit at the end of a paragraph denotes the frequency of the species on the whole archipelago. This digit was taken from the paper of Frisvoll & Elvebakk (1996) and means: 1 – the species is scattered or common on Svalbard, 2 – rare, 3 – very rare in archipelago. However, real frequency of mosses for the Prince Oscar Land often does not meet these values (see number of collection sites in the respective annotation). There is also the fourth category "uncertain". It means that information on frequency of species on the archipelago is absent in the Frisvoll & Elvebakk' list of mosses. The species new for Nordaustlandet are marked with one asterisk, for Nordaustlandet region (including also small neighboring islands) – with two asterisks. Mosses new for Svalbard have three asterisks.

Table 1. Description of sampling points

No	Latitude / Longitude	Altitude, m	Description of localities
1	80°13'6" N, 22°28,34" E	2	East coast of Rijpfjorden, first marine terrace, rock fields, lower part of the brook from Heieren Lake to Rijpfjorden.
2	80°13'40" N, 22°29'30" E	25	East coast of Rijpfjorden, first marine terrace, at the foot of the west facing slope of Sanfordhøgdene Mt. Group of boulders.
3	80°13'52" N, 22°29'31" E	36	The bottom of the west facing slope of the southern part of Sanfordhøgdene Mt.: a – benches of rock outcrops; b – gentle rocks and adjacent scree
4	80°13'5" N, 22°29'39" E	26	North-east bank of Heieren Lake and nearby sites: a – moist seepage area: stony ground with pools and patches of moss cover and scattered single vascular plants; b – damp depression in the rock field
5	80°12'41" N, 22°27'51" E	20-60	East coast of Rijpfjorden, NW facing slope of Bluffvarden Mt.: a – steep dry cliffs with a northerly aspect; b – vertical ranges of gentle and steep rocks along the seashore; c – <i>Carex-Luzula</i> meadow in hollows between rocks; d – rock debris at the bottom of the slope under and near the snow-bed, patches with moss and liverwort cover
6	80°12'40" N, 22°28'33" E	26-49	North-facing slope of Bluffvarden Mt. in its western part: a – scree debris at the bottom of the slope; b – cliffs under late snow patches; c – rock outcrops and strips of scree between them on the steep slope; d – cliffs under a sea birds colony; e – moist vertical rock cleft in the cliff
7	80°12'40" N, 22°29'40" E	40	North-facing slope of Bluffvarden Mt. in its western part, under cliffs with nesting of colonial sea birds
8	80°12'36" N, 22°31'00" E	30	Bottom of the north-facing slope of Bluffvarden Mt. in its eastern part. Melt stream bordered by moss and liverwort carpets
9	80°12'33" N, 22°31'59" E	17	South-east bank of Heieren Lake, sandy and fine earth beach with protruding stones
10	80°12'35" N, 22°33'1" E	20	East bank of Heieren Lake: a – dense cover of mosses and liverworts over moist sandy ground by streamside; b – boulder run near a stream
11	80°12'16" N, 22°32'7" E	66	Mefjordheia, near the foot of the south-east facing slope of Bluffvarden Mt., rock field with patches of soil disturbed by frostaction
12	80°12'4" N, 22°31'45" E	48	Mefjordheia, about 0.5 km southward of Bluffvarden Mt., mostly stony area with flowing water across a rock field
13	80°11'49" N, 22°31'17" E	39	Mefjordheia, about 1 km southward of Bluffvarden Mt. <i>Luzula</i> -bryophyte – community over stony ground on a rock field
14	80°11'33" N, 22°30'47" E	24	Mefjordheia, about 1.5 km southward of Bluffvarden Mt., a – Moist shore of a small lake of 15mx8 m with an extensive cover of bryophytes surrounded by rock field; b – depression in a slope of a river valley
15	80°11'25" N, 22°30'31"E	18	Mefjordheia, about 1.6 km southward of Bluffvarden Mt., an unnamed river between Bluffvarden Mt. and Brinkuten Mt., the place of confluence of three river-heads
16	80°12'52" N, 22°33'41" E	47 57	a – North-eastern shore of Heieren Lake at the bottom of the southern slope of Sanfordhøgdene Mt., stony <i>Luzula</i> -bryophytes-lichens community; b – depression in the south-facing slope of Sanfordhøgdene Mt. A patch of <i>Andreaea rupestris</i> - <i>Polytrichastrum alpinum</i> community with <i>Racomitrium lanuginosum</i> by edge
17	80°12'59" N, 22°35'6" E	114	The base of the south facing slope of Sanfordhøgdene Mt. near the north-east bank of Heieren Lake. Scree debris with flowing water between rocks
18	80°12'43" N, 22°36'5"E	75	Mefjordheia, 1 km eastward of Heieren Lake. Boulder field. A patch with bryophytes among stones
19	80°13'8" N 22°36'51" E	132	Mefjordheia, about 1.2 km north-eastward of Heieren Lake. Rock field with patches of mineral soil
20	80°13'17" N 22°38'52" E	113	Mefjordheia, about 2 km north-eastward of Heieren Lake: a – a patch of crustaceous liverworts over fine earth of a moist rock field; b – rock field
21	80°13'23" N, 22°39'44" E	112	Mefjordheia, about 2.3 km north-eastward of Heieren Lake. A stream 3-5 m wide and 0.2-0.3 m deep flowing across a rock field
22	80°13'26" N, 22°44'31" E	105	Mefjordheia, south-east bank of an interior unnamed “double lake”, about 1.5 km north-eastward of Sirkelvatnet Lake. North-east facing rock outcrops and scree debris
23	80°13'29"N, 22°44'52"E	105	Mefjordheia, about 1.5 km north-eastward of Sirkelvatnet Lake, channel between two lakes in the “double lake”, 10 m wide and 0.5 m deep, with big stones at the bottom.
24	80°13'25" N, 22°45'45" E	104-117	Mefjordheia, about 1.5 km north-eastward of Sirkelvatnet Lake, the north bank of the eastern lake in the “double lake”. South facing gentle rocks alternating with scree debris areas

- ***Amphidium lapponicum* (Hedw.) Schimp. – Collection site: 4a. On wet soil, with *Aulacomnium turgidum*, *Bryum* sp., *Conostomum tetragonum*, *Oncophorus wahlenbergii*, *Pohlia cruda*, *Polytrichastrum alpinum*, *Polytrichum swartzii*. 1.
- Andreaea blyttii* Bruch et al. – Collection sites: 3b, 6a, 10b, 18, 19, 22, 24. On non-calcareous boulders, especially on sheltered overhung surfaces, sometimes on even gentle rock outcrops or on fine earth between stones and boulders. Pure cushions, rarely mixed with *Kiaeria glacialis* or *Andreaea rupestris*. 2.
- ***A. obovata* Thed. – Collection sites: 16b, 18. On fine earth and soil among other bryophytes. Pure cushions and mixed with *Arctoa fulvella*, *Conostomum tetragonum*, *Pogonatum urnigerum*. 2.
- A. rupestris* Hedw. – Collection sites: 1, 2, 3a,b, 4a, 5b, 6a, 11, 12, 13, 15, 16a,b, 17, 18, 22, 23, 24. In non-calcareous habitats: on surface and in crevices of stones and boulders, on gentle rock outcrops, on fine earth and soil, pockets of soil between stones and boulders, on stones in streams above the water or sometimes particularly submerged. Pure cushions and mixed with *Andreaea rupestris*, *Arctoa fulvella*, *Hymenoloma crispulum*, *Kiaeria glacialis*, *Pogonatum urnigerum*, *Pohlia crudoides*, *Polytrichum hyperboreum*, *P. piliferum*, *Racomitrium lanuginosum*, on wet soil also with *Conostomum tetragonum*, *Kiaeria blyttii*, *Oncophorus wahlenbergii*. 1.
- var. *papillosa* (Lindb.) Podp. – Collection sites: 3b, 22. On fine earth patches, hollows between rock debris. Pure cushions and with *Arctoa fulvella*, *Racomitrium lanuginosum*, *Kiaeria blyttii*.
- Aplodon wormskioldii* (Hornem.) R.Br. – Collection site: 4a. On wet soil. Mixed with *Dicranum angustum*, *Polytrichum jensenii*, *Pohlia* sp. One plant with sporophyte. 1.
- Arctoa fulvella* (Dicks.) Bruch et al. – Collection sites: 1, 2, 3b, 5b, 6a, 9, 15, 16a, 18, 19, 20a, 22. On fine earth patches among stonefields, soil pockets between rock debris and boulders, soil in stony tundra fragments, fine earth over rocks and ledges of outcrops and in crevices, on soil disturbed by frost actions; frequently in moist conditions. Mixed with *Andreaea rupestris*, *Hymenoloma crispulum*, *Pogonatum urnigerum*, *Pohlia* spp., *Racomitrium lanuginosum*, places with *Conostomum tetragonum*, *Kiaeria starkei*, *Polytrichum piliferum*. 1.
- Aulacomnium palustre* (Hedw.) Schwägr. – Collection sites: 4a, 8. On wet soil covered by liverworts or mosses near water. Mixed with *Sanionia uncinata*, *Warnstorfia fluitans*, also *Ceratodon purpureus*, *Pohlia* sp. 1.
- A. turgidum* (Wahlenb.) Schwägr. – Collection sites: 1, 4a, 5c, 6e. On wet soil and protuberances in moss-liverworts communities often accompanied by *Luzula* and *Carex* species, once in crevice in moist rock wall covered by mosses. Pure turfs and with different species – *Bartramia ithyphylla*, *Conostomum tetragonum*, *Oncophorus wahlenbergii*, *Pohlia drummondii*, *Polytrichastrum alpinum*, *Warnstorfia sarmentosa*. 1.
- Bartramia ithyphylla* Brid. – Collection site: 4a, 6d. On soil, with *Arctoa fulvella*, *Aulacomnium turgidum*, *Ditrichum flexicaule*, *Pohlia drummondii*, *Straminergon stramineum*, *Warnstorfia sarmentosa*. 1.
- **Blindia acuta* (Hedw.) Bruch et al. – Collection site: 4a, 15. On stones near water. Pure cushions or mixed with *Andreaea rupestris*, *Conostomum tetragonum*, *Oncophorus wahlenbergii*, *Pohlia drummondii*, *Warnstorfia sarmentosa*. 1.
- Bryum cryophilum* Mårtensson – Collection site: 8. On wet soil, on streamsides and bed. With *Warnstorfia sarmentosa* and *Pohlia* sp. 1.
- **B. cyclophyllum* (Schwägr.) Bruch et al. – Collection sites: 6c,e. On vertical and steep rock wall surfaces and in crevices, also near trickling water. Mixed with *Bryum rutilans*, *Ceratodon purpureus*, *Philonotis fontana*, *Pohlia andrewsii*, *P. cruda*, *Platydictya jungermannioides*, *Sanionia uncinata*, *Syntrichia ruralis*. Frisvoll & Elvabakk (1996) excluded this taxon from the list of Svalbard mosses. Plants are with fascicles of flagelliform propagules in leaf-axils in all specimens. Leaves vary over a wide range. Most of them are soft, narrowly decurrent, costa ending below apex. In some specimens leaves are slightly concave, rounded obtuse and rounded ovate, but in other samples they are strongly concave and imbricate or even cucullate, in one case – narrower and with shorter blunt apex. A few plants have slightly pink color.
- B. pseudotriquetrum* (Hedw.) P. Gaertn., B. Mey. & Scherb. – Collection site: 6c. In a crevice in a cliff. Pure turf and mixed with *Pohlia drummondii*, *Polytrichastrum alpinum*. 1.
- **B. rutilans* Brid. – Collection sites: 6c,e. Fine earth on inclined or vertical stone surface of rock outcrops and cliffs. In moss cover with *B. cyclophyllum*, *Ceratodon purpureus*, *Pohlia andrewsii*. Abundant flagelliform propagules are developed in leaf-axils of adult plants. In one specimen the leaves look like those of *Bryum elegans*, but have pink color. The leaves are broadly ovate, concave and imbricate, with an indistinct border, with plane or below narrowly recurved margins and with strong costa excurrent in a short recurved hair-point. Frisvoll and Elvabakk noticed: “Arnell’s (1900) *B. elegans* var. *sanguineum* described from Svenskøya is *B. rutilans* (type material seen, pers. comm E. Nyholm).” (Frisvoll & Elvabakk, 1996: p. 124).
- Ceratodon heterophyllus* Kindb. (*C. purpureus* var. *rotundifolius* Berggr.) – Collection sites: 6c,d. On crevices and ledges of cliffs. With *Bryum cyclophyllum*, *Polytrichastrum alpinum*. 3.
- C. purpureus* (Hedw.) Brid. – Collection sites: 5d, 6d,e, 7, 8. On crevices, mossy stone walls and soil, often in moist conditions, also in habitats affected by colonial sea birds. Pure turfs or with many other mosses. 1. Frisvoll & Elvabakk (l. cit.) included *C. antarcticus* Cardot in their list, but according to Ochyra *et al.* (2008) this species is a synonym of *C. purpureus*.
- ***Cinclidium subrotundum* Lindb. – Collection site: 4a. On wet soil, with *Conostomum tetragonum*, *Bryum* sp., *Polytrichastrum alpinum*. 2.
- ****Cnestrum schisti* (F. Weber & D. Mohr) I. Hagen. – Collection site: 4a. On wet soil. Little scattered plants among liverworts.
- **Codriophorus fascicularis* (Hedw.) Bednarek-Ochyra & Ochyra (*Racomitrium fasciculare* (Hedw.) Brid.) – Collection sites: 1, 5a, 6a, 13, 15, 23. On soil between stones including banks of streams and river, occasionally partly in water, also in crevices and other shaded places in out-



Fig. 2. Stonefields on a first marine terrace on a coast of Rijpfjorden Bay.

crops. Pure cushions and turf-like cushions or with *Andreaea rupestris*, *Hymenoloma crispulum*, *Kiaeria glacialis*, *Pogonatum urnigerum*, *Racomitrium lanuginosum*. 2. In one population the plants have leaves with a short costa and almost smooth cells.

Conostomum tetragonum (Hedw.) Lindb. – Collection sites: 1, 3b, 4a, 9, 10a, 11, 12, 13, 14a,b, 15, 16a, 17, 18. On soil, more rarely on stones and rock outcrops, pockets of soil between boulders and debris. Usually on moist sites, in trickling or flowing water. Pure turfs and with many species, particularly *Andreaea rupestris*, *Oncophorus wahlenbergii*, *Polytrichastrum alpinum*, *Warnstorfia sarmentosa*. 1.

***Dicranella subulata* (Hedw.) Schimp. – Collection sites: 3a,b, 11. On soil disturbed by frost actions, in cracks on the ground. Pure loose turfs and with *Pohlia cruda*, *P. cruidoides*. 2.

***Dicranum angustum* Lindb. – Collection sites: 1, 4a. On protuberances of *Luzula* sp., on wet sandy soil. Pure turfs and with *Dicranum elongatum*, *D. spadiceum*, *Warnstorfia sarmentosa*. Uncertain.

D. elongatum Schleich. ex Schwägr. – Collection sites: 1, 4a,b, 11. On *Luzula* and moss hummocks, soil under bryophyte communities, between stones, solifluction spots. Pure turfs and with *Racomitrium lanuginosum*, *Polytrichastrum alpinum*, *Conostomum tetragonum*. 1.

D. fuscescens Turner – Collection sites: 5c, 24. On soil between boulders and in deep clefts of rock outcrop. With *Pohlia nutans*, *Polytrichastrum alpinum*, *Sanionia uncinata*, *Timmia austriaca*. 1.

***D. spadiceum* J.E. Zetterst. – Collection sites: 1, 5c, 6d. On soil between boulders and near cliff base, on hummocks formed by *Luzula* sp. or dying mosses. Pure turfs, or with other *Dicranum* species, *Racomitrium lanuginosum*. 1.

Grimmia incurva Schwägr. – Collection site: 1, 3a,b, 18. On soil in hollows between rocks and boulders, once - on base of a rock block. Pure cushions and with *Andreaea rupestris*, *Isopterygiopsis pulchella*, *Kiaeria glacialis*, *Racomitrium lanuginosum*. 1.

***G. torquata* Drumm. – Collection sites: 1, 6e. On sheltered stone walls, on stony moist soil. Pure cushions, on soil growing with *Polytrichastrum alpinum* and *Oncophorus wahlenbergii*. 2

****Hygroamblystegium tenax* (Hedw.) Jenn. – Collection sites: 22. On soil shaded by ledge of boulder. Together with *Pohlia andrewsii*, *P. nutans*, *Pogonatum urnigerum*.

Hygrohypnum luridum (Hedw.) Jenn. – Collection site: 4a. On moist soil. As admixture with *Oncophorus wahlenbergii*, *Warnstorfia fluitans*, *W. sarmentosa*, *Cinclidium subrotundum*, *Scorpidium revolvens*. 2. The leaves are small and look like leaves of *H. styriacum* (Limpr.) Broth. But the sample is very poor so identification is uncertain.

Hylocomium splendens (Hedw.) Bruch et al. – Collection site: 6d. Close to a cliff base, on soil. Almost pure turf, with few *Racomitrium lanuginosum*. 1.

**Hymenoloma crispulum* (Hedw.) Ochyra (*Dicranoweisia crispula* (Hedw.) Milde) – Collection sites: 1, 3a, 4b, 6b,d, 16a,b, 17, 18, 24. On fine soil over stones and gentle rock outcrops, in crevices, between boulders and rocks, on soil in stony habitats. Usually pure cushions (turfs) or also with many other mosses – *Andreaea rupestris*, *Arctoa fulvella*, *Polytrichum* spp., *Racomitrium lanuginosum*. 1.

Isopterygiopsis pulchella (Hedw.) Z. Iwats. – Collection sites: 3b, 5a. On shaded stones and rock outcrops. Mixed with *Grimmia incurva*, *Polytrichastrum alpinum*, *Pohlia cruda*, *Racomitrium lanuginosum*. 1.

**Kiaeria blyttii* (Bruch et al.) Broth. – Collection sites: 1, 3b, 6a, 12, 13, 14a. On mineral soil between rocks and outcrops, once – on stones in streambed, on stony soil in *Luzula* spp.-mosses-liverworts communities, on boulder fields, near snow patches; in dry and moist conditions. In mixed turfs, in some areas abundant. 1.

**K. glacialis* (Berggr.) I. Hagen – Collection sites: 1, 3b, 10b, 14a, 15, 17. On soil between rocks, over ledges and in crevices of outcrops and stones, in moss and liverwort cover, usually on stream banks and lake shores, sometimes in flowing water. With many species, for example, *Andre-*

- aea blyttii*, *A. rupestris*, *Codriophorus fascicularis*, *Niphotrichum canescens*, *Pohlia cruda*, *Polytrichastrum alpinum*. 1.
- ***K. starkei* (F. Weber & D. Mohr) I. Hag. – Collection sites: 1, 3a, 4a, 8, 15, 20a, 24. On soil between rocks and gravel, near the bases of cliffs, often on banks of streams and pools. Pure turfs, but more frequently with many other mosses - *Arctoa fulvella*, *Pogonatum urnigerum*, *Warnstorfia sarmentosa*. 3.
- Niphotrichum canescens* (Hedw.) Bednarek-Ochyra & Ochyra (*Racomitrium canescens* (Hedw.) Brid.) – Collection sites: 3b, 6c, 15, 17, 18. On soil between stones and over outcrops, in moist or, more usually, drier conditions. Pure cushions and turfs or with *Kiaeria starkei*, *Pogonatum urnigerum*. 1. In one population (locality 18), the leaves of plants have no hair-points and papillae.
- ***Ochyraea alpestris* (Hedw.) Ignatov & Ignatova (*Hygrohypnum alpestre* (Hedw.) Loeske) – Collection site: 7. Close to boulder – on soil and boulder face. With *Polytrichastrum alpinum*, *Sanionia uncinata*, *Timmia austriaca*, *Dicranum fuscescens*. 2.
- Oncophorus wahlenbergii* Brid. – Collection sites: 1, 4a, 12, 13, 14a, 15. On wet and moist soil, sometimes partly in water, on pockets of soil between stones, on sides of tussocks. With many other species (*Aulacomnium turgidum*, *Conostomum tetragonum*, *Dicranum angustum*), occasionally without admixture. 1.
- Philonotis fontana* (Hedw.) Brid. – Collection site: 6e. On a wet moss-covered stone wall, with *Ceratodon purpureus*, *Pohlia cruda*, *Sanionia uncinata*, *Syntrichia ruralis*, *Warnstorfia* sp. This species was excluded from the list of Svalbard by Frisvoll & Elvebakk (1996).
- P. tomentella* Molendo – Collection sites: 6c,e. On crevices in cliffs, on a wet moss-covered stone wall, with *Polytrichastrum alpinum*, *Racomitrium lanuginosum*. 1.
- **Plagiothecium denticulatum* (Hedw.) Brich et al. – Collection site: 3b. On fine soil beneath overhang. Pure carpet. 2.
- **Platydictya jungermannioides* (Brid.) H.A. Crum – Collection site: 6e. On inclined rock face supplied with trickling water. Mixed with *Pohlia cruda*, *Bryum cyclophyllum*. 1.
- ***Pogonatum dentatum* (Brid.) Brid. – Collection site: 19. On mineral soil. Pure loose turfs. 2.
- ***P. urnigerum* (Hedw.) P. Beauv. – Collection sites: 3b, 4a, 5d, 6a, 8, 9, 15, 16a, 17, 18, 19, 20a,b, 22, 24. On bare mineral soil between rocks, on solifluction spots, places below late snow patches, near bases of cliffs and blocks as well as on soil over stones, ledges and gentle outcrops, once – among dead mosses. Grows on moist to dry sites. With many species, sometimes without admixture, or as individual plants. 1.
- Pohlia andrewsii* A.J. Shaw – Collection sites: 3b, 6c,e. In crevices in stone walls, on a wet moss-covered stone wall, and on mineral soil between scree debris. With *Bryum cyclophyllum*, *B. rutilans*, *Ceratodon purpureus*, *Kiaeria blyttii*, *Pohlia cruda*. Uncertain. In one specimen plants have short ovate bulbs as well as very long propagules, which look like those of *P. prolifera*. Short kinds of gemmae have concave primordia. Both kinds of propagules are on the same plants.
- ****P. beringiensis* Shaw. – Collection site: 4a. On moist sandy soil close to a stone. Pure turf. Plants look like *P. cruda*, but have one gemma per leaf-axil on upper part of shoots. Leaves strongly shiny, light-yellowish-greenish, lanceolate, denticulate in upper part, decurrent. Costa of lower leaves is reddish at the base. Bulbs are pale green when young and reddish-brown when mature.
- P. cruda* (Hedw.) Lindb. – Collection sites: 3b, 4a, 5a,b, 6c,d,e, 7, 14a, 15, 24. In dry or moist conditions on cliffs and outcrops – on surface and crevices, including ornithogenic habitats, sporadically on soil in fragments of tundra or moss communities, once among dead mosses. Mostly mixed with many species, sometimes pure turfs. 1.
- ***P. crudoides* (Sull. & Lesq.) Broth. – Collection sites: 1, 3b, 5b, 11, 14a, 16a,b, 17. On soil disturbed by frost, on polygons, between stones, in epigeal moss and lichen communities, over ledges and rock faces, in crevices in stones and outcrops. With *Conostomum tetragonum*, *Hymenoloma crispulum*, *Kiaeria blyttii*, *Pohlia* spp., *Polytrichum hyperboreum*, *P. piliferum*. 3.
- **P. drummondii* (Müll. Hal.) A.L. Andrews – Collection sites: 1, 4a,c, 14a, 24. On thin soil over stones and between them on streamsides, also on cracks in outcrops, on soil in moist depressions near lakes and streams, sometimes in close moss communities. Usually thin turfs growing with other mosses – *Bryum pseudotriquetrum*, *Conostomum tetragonum*, *Warnstorfia sarmentosa*. 1.
- P. nutans* (Hedw.) Lindb. – Collection sites: 1, 2, 3b, 4a, 5d, 7, 9, 11, 19, 20a,b, 22, 24. Grows in a wide range of habitats: on mineral and peat soil among rocks, between stones, in crevices, ledges and gentle faces of outcrops and cliffs; on tussocks and moss protuberances; on bare soil and soil under bryophytes and lichen communities, on polygons; in stream beds and in dry conditions. Pure turfs and admixed with many species. 1.
- P. wahlenbergii* (F. Weber & D. Mohr) A.L. Andrews – Collection sites: 6e, 8, 10a. On sandy soil on wet or moist habitats – by stream sides and melt water runnels, on stream beds, often partly in water, more rarely on seepage gentle slopes or on stone walls supplied with trickling water. Pure turfs and with *Aulacomnium turgidum*, *Conostomum tetragonum*, *Pohlia cruda*, *Polytrichastrum alpinum*, *Warnstorfia sarmentosa*. 3.
- Polytrichastrum alpinum* (Hedw.) G.L. Sm. – Commonest species, collection sites: 1, 3a,b, 4a, 5a,c,d, 6c,d,e, 10a, 11, 12, 14a,b, 15, 16b, 17. On bare and covered with mosses soil – in moss and liverwort communities, on polygons, solifluction spots, over gentle outcrop faces and in crevices, near the bases of cliffs, between stones and boulders, on depressions in the ground, along stream sides and, rarely, in flowing water on seepage banks or on steep stone walls. Usually in moist habitats. Grows as separate plants, pure sparse turfs or mixed with many other mosses. 1.
- var. *fragile* (Bryhn) D.G. Long – Collection sites: 6c. On soil in moss and liverwort community. With *Ceratodon purpureus*, *Pohlia cruda*, *P. nutans*.
- ****P. sexangulare* (Flörke ex Brid.) G.L. Sm. – Collection sites: 6b, 10a. On moist soil near melting late snow patches or lakes. Pure turfs and with *Pohlia* spp., *Hymenoloma crispulum*. 1. soil, among other mosses – *Andreaea rupe-*

- tris*, *Arctoa fulvella*, *Hymenoloma crispulum*, *Pogonatum urnigerum*, *Pohlia crudoides*, *Polytrichum piliferum*, *Racomitrium lanuginosum*. 1.
- ***P. jensenii* I. Hagen – Collection site: 4a. On wet soil, rarely on mineral soil over stones, also in streams and flowing water among stones. Mixed with *Scorpidium revolvens*, *Warnstorfia fluitans*, *W. sarmentosa*. 2. Leaf margins entire, apical cells of lamellae slightly furrowed.
- **P. juniperinum* Hedw. – Collection site: 4a. On moist soil, with *Dicranum angustum*, *Pohlia* sp., *Aplodon wormskioldii*. Uncertain.
- P. piliferum* Hedw. – Collection sites: 10, 11, 13, 16a. On mineral soil between stones, on bare soil and on soil under scanty vegetation; in more or less dry habitats. Grows as individual plants or thin turfs, with *Dicranum elongatum*, *Hymenoloma crispulum*, *Polytrichum hyperboreum*, *Racomitrium lanuginosum*. 1.
- P. swartzii* Hartm. – Collection sites: 4a. On wet soil, sometimes in water. Mixed with *Aulacomnium turgidum*, *Cinclidium subrotundum*, *Polytrichastrum alpinum*, *Straminergon stramineum*. 2. Leaf margins entire, apical cell of lamellae transversely elongated, flat or with a very little furrow.
- **Psilopilum cavifolium* (Wilson) I. Hagen – Collection sites: 1, 12, 14b, 15 17. On moist soil near flowing water or streams. Pure loose turfs or with liverworts and mosses *Conostomum tetragonum*, *Polytrichastrum alpinum*, *Kiaeria blyttii*, *K. glacialis*, *Warnstorfia sarmentosa*. Uncertain. Leaf margins almost entire (not denticulate) in the upper part, with indistinct border in the lower half, with only few rhomboidal cells. Leaves strongly concave, sometimes cucullate.
- **P. laevigatum* (Wahlenb.) Lindb. – Collection sites: 1, 3b, 14a, 15. On and among stones, on moist soil, sometimes in water. With *Arctoa fulvella*, *Conostomum tetragonum*, *Oncophorus wahlenbergii*, *Pohlia drummondii*, *Warnstorfia sarmentosa*. 1. Leaf margins almost entire or with short and blunt teeth; border of 1-2 cell rows on a very short stretch on both sides of the leaf lamina.
- Racomitrium lanuginosum* (Hedw.) Brid. – Commonest species, frequently dominant in some tundra fragments and in moss communities. Collection sites: 1, 2, 3b, 4a,b, 5b,c, 6d,e, 7, 11, 15, 16a, 17, 18, 22. On soil under bryophyte communities, often over scree debris, stonefields, ledges and surfaces of outcrops, including areas under sea bird colonies. Usually on exposed sites, with moderate moisture contents. Pure turfs and cushions and admixed with *Arctoa fulvella*, *Dicranum spadiceum*, *Hylocomium splendens*, *Hymenoloma crispulum*, *Polytrichum hyperboreum*, *Timmia austriaca* and many other mosses. 1. In some localities we found populations (clons?) of *R. lanuginosum* without or with poorly developed hair points on the leaves.
- ***Rhizomnium* sp. – Collection site: 1. A few small, poorly developed plants with 2-3 leaves were found in one point – on moist soil between stones on the banks of a stream, with *Kiaeria glacialis* and *Warnstorfia sarmentosa*.
- Sanionia georgico-uncinata* (Müll. Hal.) Ochyra & Hedenäs (*Sanionia nivalis* Hedenäs) – Collection sites: 6b, 7, 8, 20a, 24. Moist soil near streams and lakes, below late snow patches, also on peaty soil on slopes under colonial sea bird nesting. Pure turf-like wefts, or with *Pohlia nutans*. 2.
- S. uncinata* (Hedw.) Loeske – Collection sites: 3b, 5a,c, 4a, 6a,c,e, 7. On soil patches among rock fields, on fine earth over boulders, rocks and outcrops, more rare in crevices, sometimes growing in shaded moist steep stone walls, stones in streams above water. The species is invariably found in bird nesting areas enriched with nitrogen. Pure wets or with numerous other mosses. Sometimes dominates in tundra fragments and in dense moss cover. 1.
- ***Schistidium platyphyllum* (Mitt.) Perss. – Collection site: 6d. A steep stone wall at the base of a cliff under a sea bird nesting area. Pure cushion. Uncertain. This species was not included in the list of Svalbard (Frivoll & Elvabakk, 1996), but H.H. Blom (1998) pointed to it for the archipelago.
- ***S. cf. rivulare* (Brid.) Podp. – Collection site: 5a. On a shaded steep dry stone wall. Pure cushion, in a poor state. 1.
- ***S. sordidum* I. Hagen – Collection site: 15. On stone near water. With *Andreaea rupestris*, *Blindia acuta*, *Conostomum tetragonum*, *Pogonatum urnigerum*, *Warnstorfia sarmentosa*. Uncertain. This species was not included in the list of Svalbard (Frivoll & Elvabakk, 1996), but H.H. Blom (1998) pointed to it for the archipelago.
- ***Scorpidium cossonii* (Schimp.) Hedenäs (*Limprichtia cossonii* (Schimp.) L.E. Anderson) – Collection site: 5b. On fine earth over gentle rock. Pure. 1.
- ***S. revolvens* (Sw. ex anon.) Rubers* (*Limprichtia revolvens* (Sw. ex anon.) Loeske) – Collection site: 4a. On wet soil or partly in water. Mixed with *Cinclidium subrotundum*, *Oncophorus wahlenbergii*, *Polytrichastrum alpinum*, *Polytrichum swartzii*, *Straminergon stramineum*, *Warnstorfia fluitans*, *W. sarmentosa*. Uncertain.
- Straminergon stramineum* (Dicks. ex Brid.) Hedenäs (*Calliergon stramineum* (Dicks. ex Brid.) Kindb.) – Collection site: 4a. On moist and wet soil. As admixture in dense moss cover with *Aulacomnium turgidum*, *Bartramia ithyphylla*, *Cinclidium subrotundum*, *Scorpidium revolvens*, *Warnstorfia sarmentosa*. 1.
- Stereodon* sp. – Collection sites: 6a,d. On soil close to a cliff base and on fine soil on boulder run. With some species, for example, – *Hymenoloma crispulum*, *Timmia austriaca*.
- Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr (*Tortula ruralis* (Hedw.) P. Gaertn., B. Mey. & Schreb.) – Collection site: 6e. On a shaded steep mossy stone wall supplied with trickling water. Mixed with *Sanionia uncinata*, *Ceratodon purpureus*, *Pohlia cruda*, *Philonotis fontana*. 1.
- Timmia austriaca* Hedw. – Collection sites: 5c, 6d. On soil between boulders and near cliff base. Mixed with *Dicranum fuscescens*, *Hymenoloma crispulum*, *Ochyraea alpestris*, *Sanionia uncinata*. 1.
- ***Warnstorfia exannulata* (Bruch et al.) Loeske – Collection sites: 4a, 23. On wet soil and on stones in water of a shallow channel. With admixed *Warnstorfia sarmentosa*. 2.
- ***W. fluitans* (Hedw.) Loeske – Collection sites: 4a. On soil and stones in streams and pools, rarely on banks. Mixed with *Warnstorfia sarmentosa*, *Sanionia uncinata*, *Aulacomnium palustre*, *A. turgidum*, *Scorpidium revolvens*, *Polytrichum jensenii*. 2.

W. sarmentosa (Wahlenb.) Hedenäs (*Calliergon sarmentosum* (Wahlenb.) Kindb., *Sarmentypnum sarmentosum* (Wahlenb.) Tuom. & T.J. Kop.) – The commonest species, frequent dominant in moss communities. Collection sites: 1, 3b, 4a, 5b, 8, 10a, 12, 14a, 15, 20a, 21, 23. Along streams and pools, on gentle seepage slopes, usually on moist and wet soil, but also on stones towering above flowing water. Pure extensive covers and with many hygrophytic and some mesophytic mosses. 1.

Thus, 78 mosses have been found in the Prince Oscar Land. Three species are new for Svalbard (*Cnestrum schisti*, *Hygroamblystegium tenax*, *Pohlia beringiensis*), 25 – for Nordaustlandet region and 38 – for Nordaustlandet. 2 species earlier excluded from the check-list of Svalbard mosses (Frisvoll & Elvebakk, 1996) have been confirmed by our collections. New localities of 13 rare and 4 very rare species have been found. Some of these mosses avoid calcareous substrates and prefer, for example, areas with granite. Granite is not a common bedrock in Svalbard, so some species such as *Pohlia wahlenbergii*, *Andreaea blyttii*, *Warnstorffia exannulata*, are not frequent on the archipelago.

We did not collect 46 species early known in Nordaustlandet. Part of them are calcicolous mosses, which are absent in the area studied (species of genera *Distichium*, *Encalypta*, *Orthothecium*, and many other). Some mosses could be missed during the collecting. The territory of investigation was not large and some mosses could grow outside it because of sporadic or sparse distribution on the archipelago (*Henediella heimii*, *Splachnum vasculosum*). The absence or presence of many species can be attributed to the large role of casual factors affecting mosses invasion (coming and especially survival). Closely located areas with similar environmental conditions may have a different composition of mosses. In the polar desert randomness plays possibly a more important role in the distribution of mosses than in other zones.

In the Prince Oscar Land the most frequent species are *Andreaea rupestris*, *Pogonatum urnigerum*, *Pohlia nutans*, *Polytrichastrum alpinum*, *Racomitrium lanuginosum*, *Conostomum tetragonum*, *Warnstorffia sarmentosa*. Three last mosses can form dense cover and be dominant or codominant of plant communities. *Polytrichastrum alpinum* can prevail too, but it grows by separate plants or by little groups.

Distinct moss complexes associated with the certain habitats can not be distinguished. This is due to a small number of habitat types and lack of clear distinction between them (except humidity). As for the differences in moisture conditions, absolutely all species prefer moist habitats in polar desert zone on the Prince Oscar Land. Dry places are almost devoid of mosses.

In total, moss diversity of the Prince Oscar Land flora is lower than in local moss floras in tundra zone on Vestspitsbergen Island, but it is similar to the richness of another local moss flora of Nordaustlandet – of Nordvika area (Murchisonfjorden).

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