

CONTRIBUTION TO THE HEPATIC FLORA OF SVALBARD IV: HEPATICS OF THE
COAST OF THE SÆTHERBUKTA (ORVIN LAND, DUVEFJORDEN,
NORDAUSTLANDET)

К ФЛОРЕ ПЕЧЕНОЧНИКОВ ШПИЦБЕРГЕНА IV: ПЕЧЕНОЧНИКИ ПОБЕРЕЖЬЯ
СÆТЕРБУХТЫ (ЗЕМЛЯ ОРВИНА, ДУВЕФЬОРДЕН, СЕВЕРО-ВОСТОЧНАЯ ЗЕМЛЯ)

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Abstract

An annotated list of hepatics of Orvin Land (in Nordaustlandet in the Svalbard archipelago) is compiled for the first time. It is based on the collections gathered by the authors in 2012 on the coast of Sætherbukta in Duvefjorden and counts 32 species, which comprise ca. 50% of the liverworts known for Nordaustlandet. It is the second studied local hepatic flora of Nordaustlandet. Annotations to the species include distribution, description of habitats, and some morphological characteristics of the studied specimens. *Cephalozia bicuspidata*, *Cephaloziella divaricata*, *Lophozia savicziae* and *L. wenzelii* var. *lapponica* are reported as new for Nordaustlandet. A comparison with the other previously studied local flora of Nordaustlandet in Murchisonfjorden shows significant differences, which are mainly explained by differences in the composition of the underlying rocks, carbonate in Murchisonfjorden and granites and gneisses in Sætherbukta. It was found that two species (*Marsupella arctica* and *Scapania spitsbergensis*) that are treated as vulnerable in Europe occur sporadically and can be abundant in the studied area.

Резюме

Впервые приводится аннотированный список печеночников для Земли Орвина (остров Северо-Восточная Земля, архипелаг Шпицберген). Список подготовлен на основании определения коллекции, собранной авторами в 2012 году на побережье Сæтербухты в Дувэфьорде и насчитывает 32 вида, что составляет около 50% видов печеночников, известных для о. Северо-Восточная Земля. Это вторая изученная докальная флора на этом острове. Аннотации к видам включают распространение, описание местообитаний и некоторые морфологические характеристики изученных образцов. *Cephalozia bicuspidata*, *Cephaloziella divaricata*, *Lophozia savicziae* и *L. wenzelii* var. *lapponica* приводятся впервые для Северо-Восточной Земли. Сравнение с ранее изученной локальной флорой Северо-восточной Земли, расположенной в Мэрчисон фьорде, показывает значительные различия этих двух флор, обусловленные в основном различиями подстилающих пород – карбонатных в Мэрчисон фьорде и гранитов и гнейсов в Сæтербухте. Обнаружено, что два вида, рассматриваемые как “угрожаемые” в Европе (*Marsupella arctica* и *Scapania spitsbergensis*) на изученной территории встречаются спорадически и могут быть местами обильны.

KEYWORDS: Hepatics, distribution, phytogeography, reproduction, ecology, flora, Svalbard, Nordaustlandet, Orvin Land

INTRODUCTION

Orvin Land is one of the 28 geographical regions of Svalbard, located in the north of the largest and northernmost island of the archipelago – Nordaustlandet. This is the least accessible island of the archipelago, the central and southern part of which are covered with glaciers. The territories occupied by vegetation are located in more or less wide strips along the fjords and bays in the west and north of the island (Fig. 1). We managed to work on Nordaustlandet in five areas including two in

Gustav V Land (coast of Nordvika Bay and vicinity of Kinnvika Scientific Station in Murchisonfjorden) two in Prins Oscars Land (western coast of Prins Oscars Land near Bluffvarden and southern coast of Invika Bay) and one in Orvin Land (the coast of the Sætherbukta). All specimens have been identified and an annotated list has been compiled for only one of them — Murchisonfjorden (Konstantinova & Savchenko, 2012). In addition the most interesting findings and some preliminary results have been published and recently summarized by Söderström

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et al. (2021). As shown in the latter publication (i.e., fig. 3) Orvin Land is one of the four geographical regions of Svalbard for which no species of liverworts has been ever recorded. Given the inaccessibility of the region and the poor knowledge on local liverwort floras in Svalbard and especially Nordaustlandet we believe that the publication of a complete list of species of studied area will be useful. In addition, such a list can serve as a basis for monitoring of hepatic flora in the context of global climate change.

STUDY AREA

The area under consideration is located in the northern part of Orvin Land in the north of Nordaustlandet, Spitsbergen Archipelago. We studied the slopes of Polarklubben on the east coast of Lusegrasvika Bay and Sætherbukta in Duvefjorden (Fig. 1). Polarklubben is a low mountain with absolute elevations not exceeding 413 m. It is composed of a complex of crystalline rocks of the Proterozoic: gneisses, amphibolites and granites. Avalanche-talus slopes of various steepness, up to rocky cliffs, descend to sea level. The steepness of the slopes, often has a stepped profile, reflecting the occurrence of different rocks. The gentle slopes and areas between boulders in the boulder scree are partially covered with fragments of various plant communities, particularly lichen-bryophyte tundra and meadows. There are frequent small seepages and streams. There is a small plain at the base of the mountain on the coast of Lusegrasvika Bay. The plain has a slightly hilly relief which is formed by deposits of glacial moraine and consists of debris, boulders, sand and gravel. Small lakes on the plain are of glacial origin (Fig. 2).

MATERIAL AND METHODS.

We gathered liverworts on the coasts of Sætherbukta and Lusegrasvika Bay and the slopes of Polarklubben (Orvin Land, Duvefjorden) from July 26 to August 1st 2012. In total 154 specimens were collected. The coordinates and elevations were measured using GPS for all collecting sites. Collecting localities are grouped into 26 sites and are shown on the map as five groups I – V (Fig. 1, 2):

I. East coast of Sætherbukta, south-west facing slope of Polarklubben: 1. Rock outcrops on west facing slope, 80,2795°N – 23,9604°E, 16 m alt.; 2. *Salix polaris*-bryophyte tundra, 80,2769°N – 23,9667°E, 9 m alt.; 3. *Philonotis*-dominated communities with *Ranunculus* and *Saxifraga cernua* along a brook, 80,2766°N – 23,971°E, 24 m alt.; 4. Mossy meadow with a small brook under a bird colony, *Salix polaris*-*Luzula*-*Polygonum viviparum* lichen-moss community, 80,2763°N – 23,9702°E, 6 m alt.; 5. Boulder scree on a slope facing the sea, 80,2761°N – 23,9705°E, 5 m alt.; 6. Boulder scree with a stream, 80,2754°N – 23,9716°E, 8 m alt.;

II. Base of the west slope of Polarklubben: 7. Gentle landslide covered by lichens and bryophytes, 80,2707°N – 23,9859°E, 2 m alt.; 8. Boulder scree on the left side of

a waterfall, 80,2704°N – 23,9998°E, 91 m alt.; 9. Boulder scree under a waterfall, meadow, *Salix polaris*-*Luzula*-moss community, 80,2704°N – 24,0011°E, 106 m alt. 10. Boulder scree on the left side of a waterfall, 80,2695°N – 23,9924°E, 40 m alt.; 11. South-west facing gentle slope, base of a cliff, between boulders, *Racomitrium-Ochrolechia-Cladonia* community, 80,2688°N – 23,9921°E, 31 m alt.; 12. South-west facing gentle slope, 80,2683°N – 23,992°E, 23 m alt.; 13. Gentle slope at the base of Polarklubben, 80,2679°N – 23,9908°E, 22 m alt.; 14. Seepage on the bank of a lake at the base of Polarklubben, 80,2675°N – 23,9891°E, 8 m alt.; 15. Rocky tundra with non-sorted circles on the plain at the base of a slope, 80,2675°N – 23,9892°E, 7 m alt.;

III. 16. The east coast of Lusegrasvika Bay, rocky outcrops on slopes of the height of 46 meters in the center of a small peninsula, 80,2669°N – 23,9638°E, 18 m alt.;

IV. The east coast of Lusegrasvika Bay, the seaside plain. 17. Gentle slope to a small lake, 80,2664°N – 23,9733°E, 10 m alt.; 18. Seepage on a gentle slope to a small lake, 80,2664°N – 23,9721°E, 1 m alt.; 19. Valley of a small lake, along a brook, 80,2665°N – 23,98°E, 1 m alt.; 20. Sandy beach of a small lake, 80,2666°N – 23,9879°E, 2 m alt.; 21. Non-sorted circles, 80,2655°N – 23,9866°E, 1 m alt.; 22. Large area with seepages and non-sorted circles, 80,2639°N – 23,9957°E, 8 m alt.; 23. Large area with seepages and non-sorted circles on the coast of the bay, 80,2626°N – 24,0003°E, 1 m alt.;

V. The east coast of Lusegrasvika Bay, west facing slope of Polarklubben: 24. Boulder scree with a brook, 80,2605°N – 24,0279°E, 18 m alt.; 25. Herb-moss meadow with a brook under a bird colony, 80,2599°N – 24,0304°E, 18 m alt.; 26. Herb-moss community with *Potentilla*, *Ranunculus*, *Phleum*, *Salix* etc. under a bird colony, 80,2582°N – 24,0428°E, 65 m alt.

All studied specimens are deposited in the Herbarium of Polar-Alpine Botanical Garden-Institute of the Kola Scientific Center, Russian Academy of Sciences (KPABG). Specimen voucher information is incorporated in the information system, available at <https://isling.org/hepatics>. Distribution maps are based both on the basis of specimens collected by us and literature data.

ANNOTATED LIST OF SPECIES

The annotated list of hepatics of the studied area includes 32 species and is based solely on the specimens we have collected and identified.

The nomenclature generally follows Söderström *et al.* (2021). Synonyms that are used in Frisvoll & Elvebakk (1996) and Konstantinova *et al.* (2009) are listed in square brackets. After the species name the presence of reproductive structures is given in parentheses (and. – androecia; gyn. – gynoecia; per. – perianths or pseudoperianths; spor. – sporophytes; gem. – gemmae). The collecting sites are listed according to the descriptions in material and methods. Habitat characteristics and some accompanying species are given for sporadic and wide-

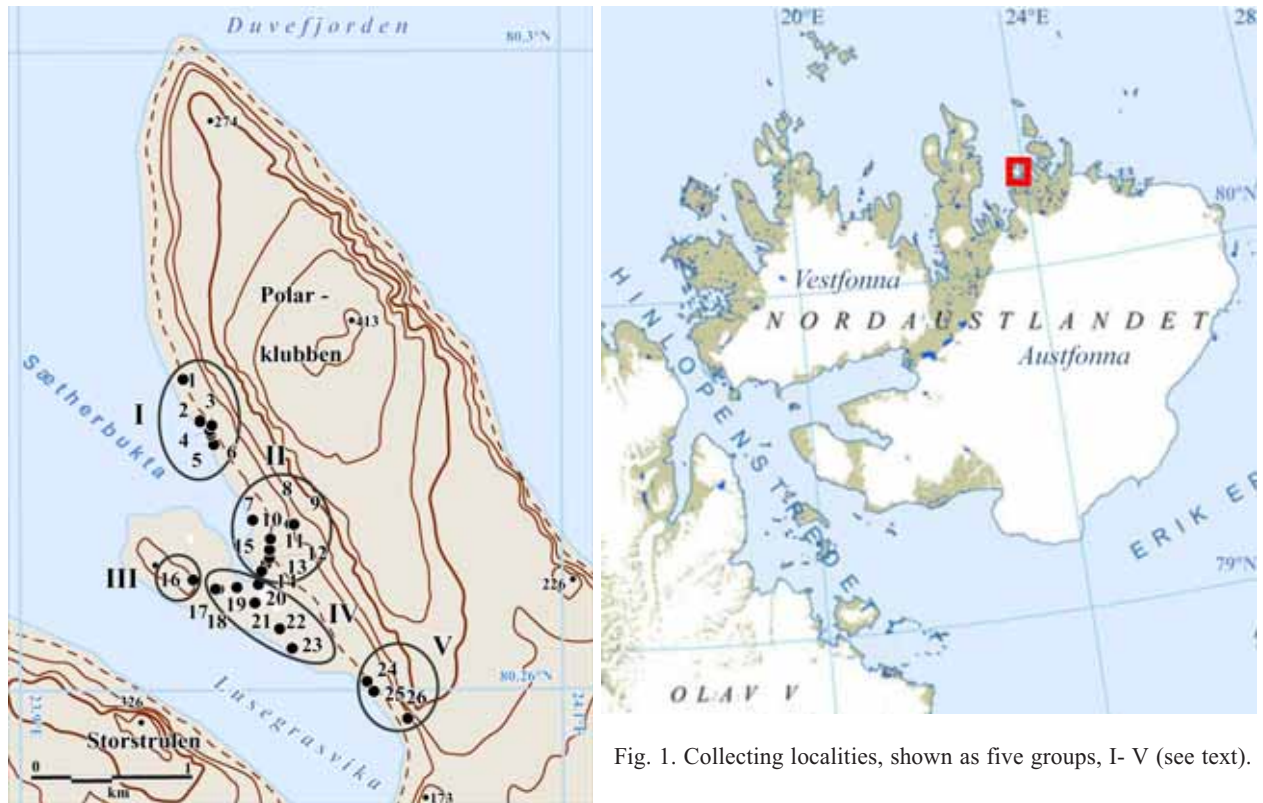


Fig. 1. Collecting localities, shown as five groups, I- V (see text).

spread species. The frequency is characterized as: sporadic (3–6 localities), frequent (7–13 localities) and common (more than 13 localities) and at least one reference to herbarium specimen in the herbarium of Polar-Alpine Botanical Garden-Institute (KPABG) is given citing the links in the its information system – <https://isling.org/hepatics> in square brackets. For species collected from 1–2 (3) localities, labels are given in full and the herbarium numbers of specimens in the Herbarium of Polar-Alpine Botanical Garden-Institute (KPABG) are specified.

Anthelia juratzkana (Limpr.) Trevis. (spor.) – I: 1, 2, 3, 4, 5, 6; II: 7; IV: 17, 20, 21. On sandy and humus moist soil on slopes to brooks, on gentle landslide covered by lichens and bryophytes, in micro depression on polygons, non-sorted circles and mud boils, on soil in seepages, in crusts of algae and liverworts on moist soil, on soil in depression and on sides of bumps in mossy meadow including that under a bird colony, at base of boulders in late snow bed communities, at base of rock on dead mosses, on grainy soil covered boulder, under rock in boulder fields, on sandy beaches of small lakes. Common, both dominating in mats and occurring scattered among other liverworts [124697].

Barbilophozia hatcheri (A. Evans) Loeske (gem.) – I: 5, 6; II: 8; III: 16; V: 25. On soil covered rocks, fine earth, sometimes on dead mosses between boulders, on sides of boulders, in crevice on soil covered rock, almost exclusively in boulder fields [124603]. Sporadic, often occurring in pure mats.

B. sudetica (Nees ex Huebener) L. Söderstr., De Roo et Heddi. [*Pseudolophozia sudetica* (Nees ex Huebener) Konstant. et Vilnet, *Lophozia sudetica* (Nees ex Huebener) Grolle] (gem.) – I: 5. On grainy soil covered boulder, under rock in boulder

field on the slope facing sea [124598]; II: 12. On grainy soil in fault the rocks ca. 0.5 m wide and 1 m high [124736].

Blepharostoma brevirete (Bryhn et Kaal.) Vilnet et Bakalin – I: 1, 4; II: 7, 9, 10, 12, 13; III: 16; IV: 17, 18, 20, 21. On moist clay or grainy soil between rocks in boulder field, on overmoistened soil near snow fields and in seepages, on sandy beaches of small lakes, on dead mosses, in micro depressions and crusts on nonsorted circles and mud boils, on overmoistened side of bumps in herb-moss meadow under a bird colony, on sandy clay soil on banks of brooks, on sandy clay soil under boulders, in late snow bed community. One of the most common species almost everywhere. Occurs in almost pure mats [124634] or mixed with other bryophytes.

Cephalozia bicuspidata (L.) Dumort. s. lat. including *C. ambigua* C. Massal. – I: 4; II: 7; IV: 17, 18, 20, 22; V: 24. On moist sandy soil and on dead mosses on gentle slopes to lakes and brooks, in micro depressions on nonsorted circles, on peat soil in a mossy meadow under a bird colony, on grainy soil covered boulders, under rock in boulder field. Scattered. Mostly mixed with other bryophytes.

Cephaloziella divaricata (Sm.) Schiffn. – II: 15. Rocky tundra with non-sorted circles, in micro crevices [124626].

C. varians (Gottsche) Steph. (per., and., spor., gem.) – I: 1, 2, 3, 4, 6; II: 7, 9, 12, 13; III: 16; IV: 17, 18, 20, 21; V: 25. In all habitats, almost everywhere, both in pure mats [124743] and mixed with other bryophytes.

Fuscocephaloziopsis pleniceps (Austin) Vána et L.Söderstr. [*Cephalozia pleniceps* (Austin) Lindb.] (per., and.) – I: 3, 4; IV: 17, 18, 20, 21; V: 25. On soil on bumps, on bare moist soil both on bumps and in micro depressions in herb-moss meadow and mossy meadow including that under bird colonies, on sandy soil and partly on dead mosses in seaside plain on gentle slopes to small pools. Common, dominating in some

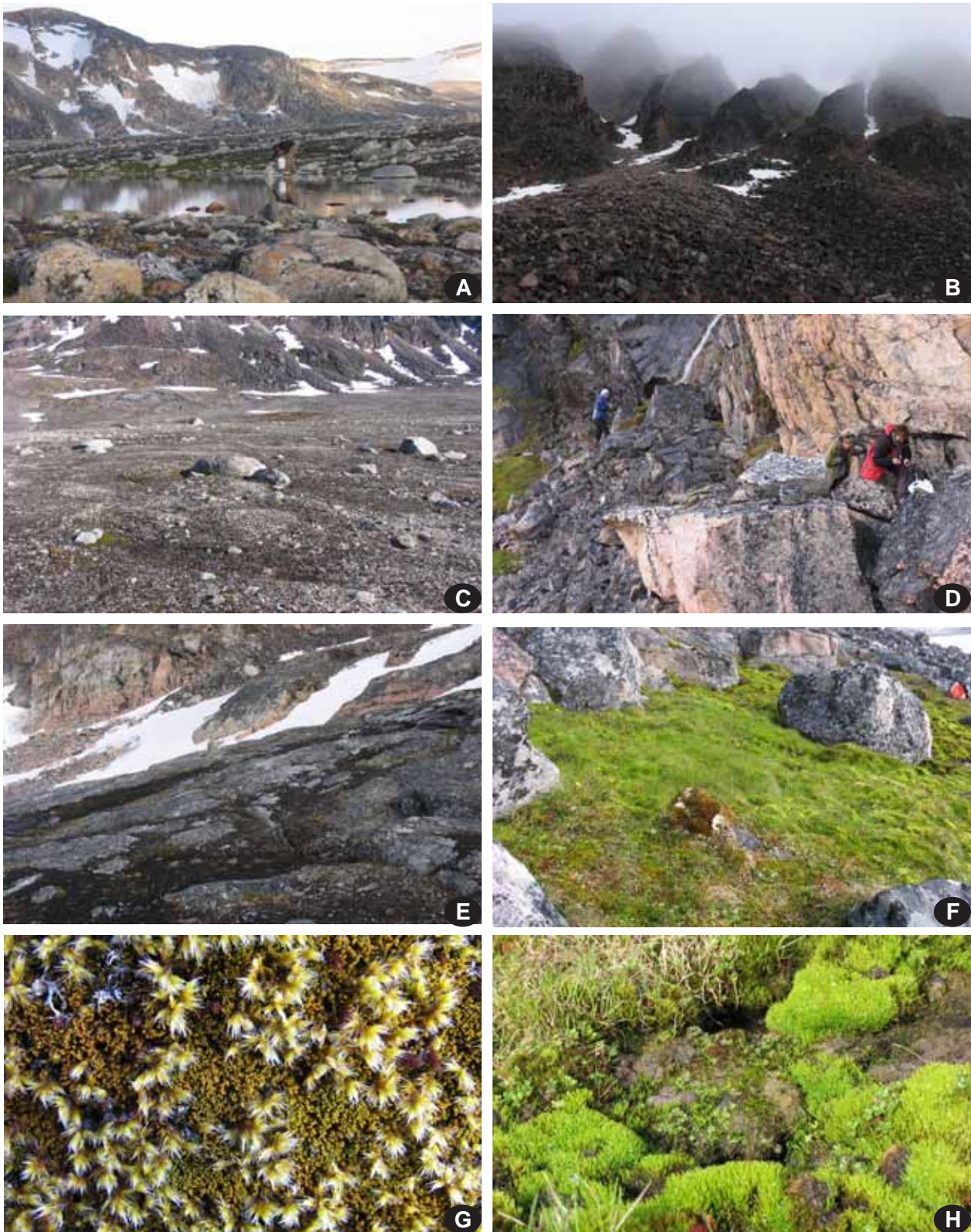


Fig. 2. Main habitats of hepatics on the east coast of Lusegrasvika Bay and Sætherbukta in Duvefjorden. A: seaside plain with boulders on the bank of a lake; B: cliffs with rocky scree at the base; C: seaside plain covered by rocky tundra with non-sorted circles; D: waterfall among rock outcrops; E: *Cephaloziella varians*-dominated communities in depressions on a gentle slope; F: meadow at the base of a steep slope; G: *Tetralophozia setiformis*-*Rhacomitrium lanuginosum* community between boulders; H: Seepage with *Marchantia polymorpha* subsp. *montivagans* on bare soil between *Philonotis* turfs.

mats [124651] but mostly mixed with other liverworts, occurring more often with other common species: *Cephalozia varians*, *Blepharostoma brevirete*, *Anthelia juratzkana*. *Gymnomitrium concinnatum* (Lightf.) Corda – I: 1, 6; II: 12, 13; IV: 17, 21. On grainy soil in depression in micro cracks on gentle slopes on seaside, between boulders and on soil covered boulders in boulder fields, in rock crevices on banks of temporary streams, on sandy clay soil between rocks, at base of boulders in late snow bed communities. In small clusters or as single shoots in mats of other bryophytes or in almost pure mats [124748] with admixture of some other widespread liverworts.

G. corallioides Nees (spor.) – I: 1, 5, 6; II: 12, 13; III: 16; IV: 17, 18, 20, 21. On grainy soil covered boulders and between boulders in boulder fields and rock outcrops, on grainy soil in crusts on nonsorted circles and mud boils on sea side plain, at base of boulders in late snow bed community, on bare soil on sandy beach to the lake. Often in pure and sometimes extensive mats [124699] or mixed with other widespread liverworts.

Jungermannia polaris Lindb. – IV: 21. In micro depression on nonsorted circles in seaside plain [124745] mixed with *Mesoptychia heterocolpos* var. *arctica* and *Blepharostoma brevirete*. 22. On moist clay soil between rocks [124684] with *Trilophozia quinqueidentata*.

Lophozia murmanica Kaal. (gem.) – II: 9; V: 25, 26. On humus soil and among mosses (mostly *Dicranum* spp.) in tundra herb-moss meadow and in *Salix polaris*-*Luzula* lichen tundra under bird colonies. Dominating in mats [124640] or scattered among bryophytes.

L. savicziae Schljakov (per., gem.) – I: 5. *Salix polaris*-*Luzula* bryophyte community between boulders, in *Dicranum* turfs [124599].

L. wenzelii (Nees) Steph. var. *lapponica* H. Buch et S.W. Arnell (gem.) – II: 7, 13; IV: 20; V: 25. In herb-moss meadow with brooks and *Salix*-herb-moss communities under bird colony, on dead mosses and in turfs of mosses on banks of brooks and pools. Dominating in mats [124668] or mixed with other bryophytes, e.g. *Dicranum elongatum*. Sporadic. We referred all specimens of this species to var. *lapponica*.

Lophozia excisa (Dicks.) Konstant. et Vilnet [*Lophozia excisa* (Dicks.) Dumort.] (per., and., spor., gem.) – I: 3; IV: 21; V: 25. On humus soil on bank of brook, on sides of dead mosses covered boulders in herb-moss communities under bird colony, in crack of cliff, in micro depression on nonsorted circles. We referred one specimen [124683] to var. *elegans* (R.M.Schust.) Konstant. et Vilnet.

L. polaris (R.M.Schust.) Konstant. et Vilnet [*Lophozia polaris* (R.M.Schust.) R.M.Schust. et Damsh.] (gem.) – I: 1, 3, 6; II: 8, 10, 12; IV: 19; V: 25. On over-moistened humus soil and dead mosses along brooks including that in meadow under bird colonies, and in boulder field with streams under boulders and on banks of waterfalls, in seepage near snow field, at bases of rocks, on soil covered sides of rocks in deep clefts and between boulders. Occurs often in pure mats [124670] rarely with small admixture of *Trilophozia quinqueidentata*, *Barbilophozia hatcheri* or *Blepharostoma brevirete*, etc.

Marchantia polymorpha L. subsp. *montivagans* Bischl. et Boissel.-Dub. [*M. alpestris* (Nees) Burgeff] – I: On bare soil in *Philonotis*-dominated communities with *Ranunculus* and *Saxifraga cernua* along the brook, among and on mosses [124610]. In pure mats.



Fig. 3. Distribution of *Marsupella arctica* in Svalbard. Squares: literature data; Circles: our records.

Marsupella apiculata Schiffn. – II: 12. On grainy soil in the fault ca. 0.5 m wide and 1 m high, in the rocks, dominating in mats [124737] or scattered on sides of mats with mixture of *Gymnomitrium corallioides*, *G. concinnatum*, *Scapania obcordata*, *Sphenolobus minutus*, *Barbilophozia sudetica* [124739].

M. arctica (Berggr.) Bryhn et Kaal. – I: 1; II: 12; IV: 18. Along seepage on gentle slope to small lake and on ledge of rock on gentle slope, on rocks at base of cliffs, in depression in micro cracks [124632]. Dominating in mats.

Mesoptychia heterocolpos (Thed. ex Hartm.) L. Söderstr. et Vána [*Leiocolea heterocolpos* (Thed. ex Hartm.) H.Buch] (gem.) – I: 7; IV: 21, 22; V: 25. On moist humus, clay or grainy soil between boulders, at base of rocks in areas with seepages or along brooks. The species occurs both as the typical variety (with gemmae) [124649] as well as var. *arctica* (S.W. Arnell) L. Söderstr. et Vána [124745] and var. *harpanthoides* (Bryhn et Kaal.) L. Söderstr. et Vána [124555].

Nardia geoscyphus (De Not.) Lindb. (per. and, spor.) – I: 2, 3; II: 7; V: 24. On sandy clay and humus soil in depressions and under boulders on banks of brooks, in *Salix polaris*-bryophyte tundra. Always in mats with other liverworts, more often with *Anthelia juratzkana*, *Cephalozia bicuspidata* and other species widespread in the area [124614].

Odontoschisma macounii (Austin) Underw. – I: 1; II: 15; III: 16; IV: 17, 18, 20, 21. On seaside plains where it is not rare on spots of bare grainy over-moistened soil on gentle slopes, at bases of slopes, in micro crevices on nonsorted circles and mud boils in rocky tundra on gentle slopes, along seepages, on spots of sandy clay soil between rocks. In small, almost pure crusts but mostly mixed with other liverworts wide-



Fig. 4. Distribution of *Scapania spitsbergensis* in Svalbard. Squares: literature data; Circles: our records.

spread in the region [124675].

Prasanthus suecicus (Gottsche) Lindb. (per., and., spor.) – I: 3, 5; II: 9, 13; IV: 20, 21. In crusts on bare grainy soil on bumps in late snow bed community, on banks of brooks, between boulders in boulder fields, on sandy soil on bank of a lake. Sometimes dominating but usually as small patches in crusts with mixture of the liverworts most widespread in the area such as *Anthelia juratzkana*, *Cephaloziella varians* *Gymnomitrium* spp. etc.

Ptilidium ciliare (L.) Hampe – I: 1, III: (16); 5; IV: 21; V: 25. Mostly in pure and often extensive mats [124604] or among mosses between boulders in boulder fields and rock outcrops, sometimes on peat soil and dead mosses in temporary watercourses and in *Salix polaris*-*Luzula* bryophyte communities.

Saccobasis polymorpha (R.M. Schust.) Schljakov – IV: 17, 23. In two localities in seaside plain: on over-moistened bumps on gentle slope to the small lake [124672] and on rock in area with seepages and nonsorted circles [124644]. Both specimens were mixed with *Blepharostoma brevirete*.

Scapania ligulifolia R.M. Schust. (gem.) – IV: 20. On gentle slope to a lake, scattered in mats dominated by *Odontoschisma macounii* and *Blepharostoma brevirete* [24690]; 21. On spots of sandy clay soil between rocks, single shoots in mats dominated by *Gymnomitrium corallioides* with admixture of *Sphenolobus minutus* and *Cephaloziella varians* [124553].

S. obcordata (Berggr.) S.W. Arnell (gem.) – I: 2, 3, 4, 5, 6; II: 9, 12, 13, 15; IV: 20, 21; V: 25. On bare grained, humus and peat soil both in micro depressions and on micro bumps on slopes to brooks, between boulders, in *Salix polaris* bryophyte tundra, in mossy meadow, crevices on nonsorted circles and on side of dead mosses covered boulders under bird colonies, on grainy soil covered boulder and between boul-

ders in boulder fields, at base of boulders and among bryophytes in late snow bed communities. Scattered among other bryophytes or in extensive mats [124598].

S. spitsbergensis (Lindb.) Müll. Frib. (gem.) – I: 6; II: 11, 12; III: 16; V: 25. On rocks and soil covered rocks between boulders, in boulder field, at the base of huge boulders under snowfields, on rocks in crevices in the rocks near stream, at base of cliffs near stream, between boulders in *Rhacomitrium-Ochrolechia-Cladonia* communities. Usually in pure mats [124587]. Among associates more often with *Barbilophozia hatcheri*, *Trilophozia quinquedentata*, *Lophozia* spp., sometimes *Gymnomitrium* spp.

Schljakovianthus quadrilobus (Lindb.) Konstant. et Vilnet – III: 16. Boulder field with the stream, on boulders among *Tetralophozia setiformis* [124589]; IV: 20. On gentle slope to a lake, scattered in mat with eutrophic and calciphyte liverworts like *Scapania ligulifolia*, *Odontoschisma macounii*, *Blepharostoma brevirete*, *Trilophozia quinquedentata* and widespread ubiquitous like *Sphenolobus minutus*, *Cephaloziella varians* [124690]

Sphenolobus minutus (Schreb.) Berggr. including fo. *grandis* (Gottsche ex Lindb.) Schiffn. – I: 1, 3, 5, 5, 6; II: 8, 9, 12; III: 16; IV: 17, 18, 20, 21; 25. On peat, sandy clay and grainy soil, in crevices at base of rocks, on rock outcrops, between boulders in boulder fields, on banks of brooks, on cliffs, in temporary watercourses, on dead mosses, in turfs of mosses in mossy meadows under bird colonies and in different tundra communities. Mostly mixed with other bryophytes or in almost pure mats [124586].

Tetralophozia setiformis (Ehr.) Schljakov – I: 1, 6; III: (16). On soil covered rocks between boulders and on boulders in boulder fields and on cliffs. In pure mats [124575] or mixed with *Sphenolobus minutus*.

Trilophozia quinquedentata (Huds.) Bakalin – I: 1, 3, 4; II: 7, 12, 13, 15, III: 16; IV: 17, 20, 21; V: 25. On humus soil, soil covered rocks, dead mosses and dead lichens (*Peltigera*) on banks of brooks and pools, in herb-moss meadows under bird colonies, on soil covered rocks on gentle ledges with seepages, in micro crevices on nonsorted circles and mud boils in complex communities on sea side plains, at bases of slopes, between boulders in boulder fields. One of the most widespread species varying very much in size and occurring together with most other liverworts [124694].

DISCUSSION

In total, we recorded 32 species which is about half of the species currently known for Nordaustlandet. This is one species more than we found on the north coast of Murchisonfjorden (Konstantinova & Savchenko, 2012). Despite the fact that the number of species is almost the same in Murchisonfjorden, both the species composition, their occurrence and abundance are strikingly different. Only thirteen species, i.e. about 40% are common for both floras. Three of them (*Blepharostoma brevirete*, *Cephaloziella varians*, *Lophozia polaris*,) that are ubiquitous in Svalbard, are widespread in both areas while the other differ significantly in frequency of occurrence. Particularly *Jungermannia polaris*, *Mesoptychia heterocolpos*, *Scapania ligulifolia*, *Schljakovianthus quadrilobus* are frequent on the north coast of Murchisonfjorden but are extremely rare on the coast of Sætherbukta. On

the contrary, the species widely distributed on the coast of Sætherbukta (*Anthelia juratzkana*, *Barbilophozia hatcheri*, *Cephalozia bicuspidata*, *Sphenolobus minutus*, *Trilophozia quinqueidentata*) are extremely rare on the north coast of Murchisonfjorden. This is explained by the difference in the composition of the underlying rocks that are carbonate in Murchisonfjorden and granite-gneiss in Orvin Land. This also explains the fact that in the studied area we did not find both the widespread (*Aneurara pinguis*, *Marchantia quadrata*, *Sauteria alpina*, *Tritomaria scitula*) and scattered (*Clevea hyalina*, *Mesoptychia badensis*, *M. collaris*, *M. gillmanii*, *Scapania gymnostomophila*) in Svalbard species restricted to carbonate rocks. At the same time, we found a number of rare species in Svalbard, characteristic of acidic and neutral rocks, e.g. *Lophozia excisa*, *Marsupella apiculata*, *Nardia geoscyphus*. Four hepatics, namely *Cephalozia bicuspidata* s.lat., *Cephaloziella divaricata*, *Lophozia savicziae*, *L. wenzelii* var. *lapponica* are reported as new for Nordaustlandet. Among them *Cephalozia bicuspidata* and *L. wenzelii* var. *lapponica* are not rare in Svalbard whereas *Lophozia savicziae* is poorly understood taxon and *Cephaloziella divaricata*, which we give with a question mark.

Of particular interest are the records of two species considered vulnerable in Europe (Hodgetts *et al.*, 2019). These are *Marsupella arctica* and *Scapania spitsbergensis*, which we found in several sites where they are quite abundant. Both species were described from Svalbard and were considered rare here for a long time (Frisvoll & Elvebakk, 1996). In the course of our work in Svalbard, we found them in many studied areas (Fig. 3, 4), and both often occur in extensive mats.

Taxonomical notes. The difficulty of hepatics identification in the Arctic has been repeatedly discussed by all scientists working in the Arctic. They are described in the most detail in two books on Greenland liverworts (Schuster & Damsholt, 1974; Schuster, 1988) and in comments on Arctic species in Schuster's Hepaticae and Anthocerotae of North America (Schuster, 1969, 1974, 1980). In short it is the very small size of plants, often quite special color explained by the specific nature of insolation in the Arctic, frequent absence of gametangia and the frequent growth scattered in the mats of other bryophytes. All this makes impossible accurate identification of species in many cases. An attempt to solve this problem with the help of molecular genetic methods are also facing numerous problems. First of all the data available in the GenBank is often difficult or impossible to interpret, since similar loci are represented there under different names. Secondly, for many Arctic species there is no data in the GenBank at all. Thirdly, there is no such data for many subspecies, varieties and forms described from the Arctic. These problems can be solved only in the course of an integrative study of a significant number of samples from all parts of the each taxon's range including type localities. Since this is a long process and

while waiting for the solution of taxonomic problems, we have to resort to various compromise solutions. Below are examples of some of our recent solutions.

We referred *Lophozia* specimens with dark purple red gemmae and relatively large cells, 25–30(32) µm in the middle of leaves, to *L. polaris*. At first several specimens were identified as *Lophozia jurensis* (Meyl. ex Müll. Frib.) Mamontov et Vilnet or *Lophozia rubrigemma* (R.M. Schust.) Konstant. et Vilnet based on sparse gemmae and shape of leaves in the first and relatively large cells (up to 35 µm) in the latter. However, repeated careful study of the specimens, including sequencing of some of them, convinced us that they all belong to *L. polaris*, which is obviously quite widespread and very variable in the studied area.

As always, the identification of *Lophozia* spp. with colorless gemmae was a big problem. We referred the small (0.5–0.7 mm wide and up to 5–7 mm long) dark reddish-brown to warm brown plants with upper leaves often distally dark brightly red contrasted with colorless or green gemmae and relatively large leaf cells (23–25 µm) to *Lophozia wenzelii* var. *lapponica*, which seems to be the most widespread species in the region under consideration. We placed mostly green and dark dirty green, relatively large plants with colorless or green gemmae in *L. murmanica*.

It is almost impossible to distinguish *Cephalozia ambigua* C. Massal. and *C. bicuspidata* in the Arctic. We have not found a single more or less convincing feature or set of features that allow us to distinguish between these two taxa. We fully agree with Schuster (1988: 180) that “When chromosome counts (n=9 vs. n=18 in ssp. *bicuspidata*) are not available, identification of much material remains highly subjective”. So we treated them as *C. bicuspidata* sensu lato.

We attributed all small *Jungermannia*-like plants without gametangia to *J. polaris*. In the Arctic, *Jungermannia polaris* can be confused not only with *J. pumila*, but also with small forms of *Plectocolea subelliptica*. The exact identification of sterile forms that are represented in the studied area is almost impossible.

We referred all specimens of the genus *Cephaloziella* to *C. varians* with the exception of one specimen, which we identified as *C. cf. divaricata* on the basis of a very wide stem and leaf insertion characteristic of the species.

We treated all small *Scapania* with green gemmae as *Scapania obcordata*, although some specimens gave us doubts about belonging to this species. Particularly we initially identified one of the specimens as *S. perssonii* based on relatively large gemmae and a relatively small dorsal lobe of leaf, but the sequence of this specimen did not differ from the specimens assigned to *S. obcordata*. Another specimen was identified as *S. scandica*, which was also not confirmed by its sequencing data. As emphasized by Schuster (1972: 237): “In no other genus of the Hepaticae is it more important to base identification on mature plants than in *Scapania*”. However, we have not found any plants

of small *Scapania* with perianth and our identifications are based solely on sterile plants with gemmae.

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