Lichens of the Innvika Bay, Prins Oscars Land (Nordaustlandet, Svalbard)

Liudmila Konoreva¹*, Sergey Chesnokov²

¹Avrorin Polar-Alpine Botanical Garden-Institute of Kola Scientific Centre of RAS, 184250 Kirovsk, Murmansk Region, Russia
²Komarov Botanical Institute RAS, Professor Popov St. 2, 197376 St. Petersburg, Russia

Abstract
The paper presents a list of lichens for the Innvika Bay, which includes 157 lichenized and 2 lichenicolous fungi. Alectoria gowardii and Peltigera elisabethae are new to Svalbard. Furthermore, 36 other species were found new to Nordaustlandet. Twenty-seven species are rare on Svalbard, among them Aspilidea myrinii, Candelariella borealis, Gyalecta erythrozona, Miriquidica deusta, Rhizocarpon viridiatrum (reported for the second time), and Aspicilia cinerea, Cetraria nigricans, Cladonia arbuscula, Cystocoleus ebeneus, Lecidea ecrustacea, Peltigera frippii, Rhizocarpon eupetraeoides, Rinodina terrestris, Stereocaulon cumulatum, Toninia squalida, Verrucaria hydrela. Localities, substrates and distribution in Svalbard are given for each species. For rare and extremely rare species, all known locations are given. For some species, differences from closely related species are given.

Key words: Arctic, lichen biota, new records, Norway, rare species

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Introduction
The Innvika Bay is part of the Prince Oscar Land located in the northern part of Nordaustlandet. Nordaustlandet is the second largest island in the Svalbard Archipelago. Its area is 14.443 square kilometres, three-quarters of which are covered by glaciers. 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 to -8°C. The warmest months are July and August with mean daily temperature +2.3 to +2.4°C, the coldest – February or March (-18 to -20°C).

According to the Norwegian bedrock map (Dallmann et al. 2002), the prevailing rocks on the northern part of the Prince

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*Corresponding author: L. Konoreva <ajdarzapov@yandex.ru>
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Oscar Land are Neoproterozoic quartzite and shale. The largest area (center and south-west) is formed by granite. 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 et al. 2015).

There is fragmentary information about lichens of the Nordaustlandet (Fries 1867, Scholander 1934, Lyenge 1938, Santesson 1939, Hagen 1950, Øvstedal et al. 2009, Nordin 2010, Zhurbenko and Brackel 2013, etc.). The most complete list of lichens of the Nordaustlandet is presented on website ‘Svalbard Lichen Database’ [1], where 239 taxa are listed. Later, the authors of this paper added 58 species of lichens to the list (Konoreva et al. 2019, Czernyadjeva et al. 2020). Before our research, 293 species were known for Nordaustlandet, among them 186 species are widespread, 72 species are rare and 35 species are extremely rare. However, there is no information on lichens for Innvika Bay.

**Materials and Methods**

This work is a part of a comprehensive field study carried out in Svalbard by the Avrorin Polar-Alpine Botanical Garden-Institute Kola SC RAS. The lichens were collected by Liudmila Konoreva in the area of Innvika Bay (Nordaustlandet) in July 2011 (Fig. 1). About 500 lichen specimens were collected. Morphological and anatomical features of lichens were analyzed by standard light microscopy and chemical tests (Smith et al. 2009). Voucher lichen specimens are deposited in the herbarium of the Avrorin Polar-Alpine Botanical Garden-Institute (KPABG). The geographical names and topographic bases for Fig. 1 respect the topographic map of Svalbard [2]. The nomenclature of lichens mainly follows Westberg et al. (2021) taking into account additions and changes published in a number of other studies (e.g. Lumbsch and Huhndorf 2010, Kondratyuk et al. 2020).

**Fig. 1.** Location of sampling sites in Innvika Bay. *Source:* ‘TopoSvalbard’[2].

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List of localities:

1. Nordaustlandet, Prince Oscars Land, Fotherby fjorden, south coast of Innvika Bay, SW coast of Depotlaguna, right bank of Ringgåsdalen, 80°06'20.5"N, 23°01'39.9"E, alt. 25 m, stone rubble, 23.07.2011
2. ibidem, 80°06'18.1"N, 23°01'31.3"E, alt. 27 m, rocky tundra, 23.07.2011
3. ibidem, 80°06'15.4"N, 23°01'31.2"E, alt. 32 m, rocky tundra near the lake, 23.07.2011
4. ibidem, 80°06'12.9"N, 23°01'46.5"E, alt. 74 m, rocks, 23.07.2011
5. ibidem, 80°06'08.8"N, 23°01'41.8"E, alt. 94 m, seashore colony of birds, 23.07.2011
6. ibidem, west slope of Vikvaktaren, 80°06'33"N, 23°05'13"E, alt. 35 m, huge boulders with numerous rivuletes, 24.07.2011
7. ibidem, foot of west slope Vikvaktaren, 80°06'36"N, 23°05'39"E, alt. 38 m, bryophyte community under snow field, 24.07.2011
8. ibidem, 80°06'46.4"N, 23°08'26.9"E, alt. 16 m, slope by the stream on the bay, 25.07.2011
9. ibidem, Grådal, foot of the slope Krykkjefloget, 80°06'32.0"N, 23°10'31.1"E, alt. 45 m, near seashore colony of birds, 25.07.2011
10. ibidem, near Innvikvatnet, 80°05'48.7"N, 23°16'32.9"E, alt. 157 m, rocks on the bank of lake, 25.07.2011
11. ibidem, steep north-northeast slope of Vikvaktaren, 80°06'47"N, 23°07'59"E, alt. 45 m, with huge boulders covered by vegetation, 26.07.2011
12. ibidem, Grådal, 80°06'33"N, 23°09'25"E, alt. 28 m, left bank of the river near of seashore colony of birds, 26.07.2011
13. ibidem, 80°06'26"N, 23°09'42"E, alt. 57 m, rock field on left bank of river, 26.07.2011
14. ibidem, 80°06'18"N, 23°10'18"E, alt. 141 m, right bank of river rock outcrops on western slope of Krykkjefloget, 26.07.2011
15. ibidem, near Innvikvatnet, 80°05'56"N, 23°14'20"E, alt. 184 m, tundra, 26.07.2011
16. ibidem, SW coast of Depotlaguna, right bank of Ringgåsdalen, 80°06'45"N, 23°03'52"E, alt. 4 m, gentle slope to the river, 27.07.2011
17. ibidem, Ringgåsdalen, north-east end of Ringgåsvatnet, 80°06'35"N, 23°01'20"E, alt. 19 m, stone rubble, 28.07.2011
18. ibidem, north-west bank of Ringgåsvatnet, 80°06'30"N, 22°58'00"E, alt. 12 m, left bank of steam, 28.07.2011
19. ibidem, west bank of Ringgåsvatnet, 80°06'10"N, 22°56'18"E, alt. 40 m, glacial terrace on lake shore, 28.07.2011
20. ibidem, Ringgåsdalen, 80°06'02.5"N, 22°55'44.6"E, alt. 34 m, rocks on the southwestern part of Ringgåsvatnet, 28.07.2011
21. ibidem, west coast of Innvika Bay, north-west coast of Depotlaguna, left bank of Ringgåsdalen River, 80°07'09.4"N, 23°02'59.8"E, alt. 44 m, moss-lichen-cereal tundra with stone placers and flowing streams, 29.07-30.07.2011
22. ibidem, 80°07'23.6"N, 23°02'25.4"E, alt. 115 m, rocks, 29.07.2011
23. ibidem, 80°07'28.3"N, 23°01'20.1"E, alt. 49 m, stone rubble, 29.07.2011
24. ibidem, 80°07'29.9"N, 23°00'12.1"E, alt. 41 m, river floodplain, 29.07.2011
25. ibidem, 80°07'31.8"N, 22°59'23.5"E, alt. 45 m, shale rocks, 29.07.2011
26. ibidem, 80°07'10"N, 23°03'01"E, alt. 56 m, south facing slope with rivulets and boulders, 30.07.2011
Results

The study resulted in an annotated list of species, which includes 157 lichenized and 2 lichenicolous fungi. Localities, substrates and distribution in Svalbard are given for each species. The distribution of the species in Svalbard was estimated according to the studies of Elvebakk and Her tel (1996), Oszczeka (2006), Krzewicka and Maciejowski (2008), Urbanavichene and Koroleva (2008), Øvstedal et al. (2009), Ziaja et al. (2009), Redchenko et al. (2010), Konoreva (2011), Singh and Ravindra (2013), Zhurbenko and Brackel (2013), Węgrzyn et al. (2015), Breuss (2017), Wietrzyk et al. (2017), Konoreva and Chesnokov (2018), Maciejowski et al. (2018), Inoue et al. (2019), Konoreva et al. (2019), and Svalbard Lichens Database [1]. For rare and extremely rare species, all known locations on the Svalbard are given. For some species, differences from closely related species are given.

All identified species are new to Inni- ka Bay, among them Alectoria gowardii and Peltigera elisabethae are new to Sval bard, 36 species are new to Nordaustlandet. Twenty-seven species are rare and extremely rare on Svalbard, among them Aspilidea myrinii, Candelariella borealis, Galecta erythrocona, Miriquidica deusta, Rhizocarpon viridiatrum reported for the second time, and Aspicilia cinerea, Cetraria nigricans, Cladonia arbuscula, Cystolecus ebe neus, Lecidea ecrustacea, Peltigera frispi, Rhizocarpon eupetraeoides, Rinodina terestris, Stereocalon cumulatum, Toninia squalida, Verrucaria hydrela – for the third time for Svalbard.

The following abbreviations and notation are in the list:
! – new to Svalbard;
* – new to Nordaustlandet;
+ – lichenicolous fungi;
KPABG – herbarium of the Polar-Alpine Botanical Garden-Institute, Kirovsk, Murmansk Region, Russia;
O – herbarium of the University of Oslo;
BG – herbarium of the University of Bergen;
TROM – herbarium of the Arctic University of Norway, Tromso.

The list of species

Acarospora veronensis A. Massal. – 26 (KPABG 13485), on siliceous stone. Widely distributed throughout Svalbard.
*Adelolecia kolaënsis (Nyl.) Hertel & Rambold – 4, 16, 20 (KPABG 13631), on siliceous stones. Widely distributed throughout Svalbard, but easily overlooked species.
*Agonimia gelatinosa (Ach.) M. Brand & Diederich – 16, on mosses. Widely distributed throughout Svalbard.
**Alectoria gowardii** Lumbsch – 1 (KPABG 13640), on soil. The species was described by Halonen et al. (2009) as **Gowardia arctica** Halonen et al. It is distinguished from the closely related **Alectoria nigricans** by shiny thallus and mainly uniform color, as well as the absence of well-defined main branches. **Alectoria gowardii** could be confused with **Bryoria nitidula** (Th. Fr.) Brodo & D. Hawksw. and **Bryocaulon divergens** (Ach.) Kärnefelt. However, **Bryoria nitidula** has dark-colored pseudo-cyphellae and produces fumarprotocetraric acid (K-, PD+ red); and **Bryocaulon divergens** is readily separated by its red-brown color. In the world, the species is known from northern regions of Canada and Russia along the Arctic Ocean coast and islands (Halonen et al. 2009).

**Alectoria nigricans** (Ach.) Nyl. – 4 (KPABG 13610, 13622), 6 (KPABG 13575), 11, 17, 25 (KPABG 13493), 26 (KPABG 13535), on soil, on soil over the boulders, on deadwood. Widely distributed throughout Svalbard and common.

**Alectoria ochroleuca** (Hoffm.) A. Massal. – 4 (KPABG 13519, 13623), 20 (KPABG 13633), on soil, among the stones, on rocks. Widely distributed throughout Svalbard.

**Allantoparmelia alpicola** (Th. Fr.) Essl. – 1, 4, 13 (KPABG 13643), 15 (KPABG 13585), 17 (KPABG 13502), on siliceous stones. Widely distributed throughout Svalbard.

* **Amandinea coniops** (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer – 21, on siliceous stone. Widely distributed throughout Svalbard, especially along the seashore colony of birds and rocks.

**Arthrorhaphis citrinella** (Ach.) Poelt – 4 (KPABG 13610), 9, 12 (KPABG 13628), on soil. Widely distributed throughout Svalbard.

* **Aspicilia cinerea** (L.) Körb. – 16 (KPABG 13564), on stone. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from Sørkapp Land (Øvstedal et al. 2009) and Nordenskiöld land – between Vestpynten and Bjørndalen (O-L116816) [1].

* **Aspilidea myrinii** (Fr.) Hafellner – 16 (KPABG), on stone. Rare on Svalbard. Reported to the second time from Svalbard. Previously reported from Davishamna (Øvstedal et al. 2009).


**Biatora cuprea** (Sommerf.) Fr. – 4 (KPABG 13512), on soil. Widely distributed throughout Svalbard, but not common.

**Biatora ementiens** (Nyl.) Printzen – 9 (KPABG), on mosses and soil. Widely distributed throughout Svalbard, but not common.

**Biatora subduplex** (Nyl.) Rasanen ex Printzen – 11 (KPABG 13616), 16 (KPABG 13556, 13595), 21, on soil, on plant debris, on mosses. Widely distributed throughout Svalbard and common.

**Blastenia ammiospila** (Wahlenb.) Arup et al. – 20, on mosses. Widely distributed throughout Svalbard and common.

**Brodoa oroarctica** (Krog) Goward – 4 (KPABG 13621), on siliceous stones. Widely distributed throughout Svalbard.

**Bryocaulon divergens** (Ach.) Kärnefelt – 26 (KPABG 13536), on soil. Widely distributed throughout Svalbard and common.

* **Bryonora castanea** (Hepp) Poelt – 16, on soil and mosses. Sporadically distributed throughout Svalbard.
Bryonora septentrionalis Holt.-Hartw. – 16, on soil and mosses. Widely distributed throughout Svalbard.

*Bryoplaca jungermanniae* (Vahl) Sochting et al. – 5, on mosses. Widely distributed throughout Svalbard.

*Bryoplaca tetraspera* (Nyl.) Sochting et al. – 1 (KPABG 13480, 13614), on soil. Widely distributed throughout Svalbard.

Calvitimela armeniaca (DC.) Hafellner – 6, 9, 15, on siliceous stones. Widely distributed throughout Svalbard.

*Candelariella aurella* (Hoffm.) Zahlbr. – 16, on limestone. Widely distributed throughout Svalbard.

*Candelariella borealis* M. Westb. – 21, on soil and mosses. Rare on Svalbard. Reported to the second time from Svalbard. Previously reported from Nordaustlandet – Damflya (Konoreva et al. 2019). *Candelariella borealis* very similar to *C. placodizans*, but distinguished by larger and darker yellow thallus with a smooth surface and squamules uneven with swollen tips (Westberg 2007).

*Candelariella placodizans* (Nyl.) H. Magn. – 9 (KPABG 13538), 25 (KPABG), on soil. Sporadically distributed throughout Svalbard. *Candelariella placodizans* characterized by greenish yellow to pale yellow thallus and squamules granular to flattened, with pulvcrulent surface (Westberg 2007).

*Candelariella vitellina* (Hoffm.) Mull. Arg. – 9 (KPABG 13509), 16, 26 (KPABG 13545), on siliceous stones. Widely distributed throughout Svalbard and common.

*Cetraria aculeata* (Schreb.) Fr. – 16 (KPABG 13557), on soil. Widely distributed throughout Svalbard and common.

*Cetraria ericetorum* Opiz – 26 (KPABG 13532), on soil. Widely distributed throughout Svalbard.

*Cetraria islandica* (L.) Ach. – 6 (KPABG 13626), 7 (KPABG 13548), 10 (KPABG 13543), 21, 23 (KPABG 13499), on soil among mosses. Widely distributed throughout Svalbard.

*Cetraria muricata* (Ach.) Eckfeldt – 1, 16 (KPABG 13593), on soil. Widely distributed throughout Svalbard, although it is far less common than *C. aculeata*.

*Cetraria nigricans* Nyl. – 1 (KPABG 13638), on soil. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from two localities from Nordaustlandet – Duvepynten (Ovstedal et al. 2009) and Damflya (Konoreva et al. 2019).

*Cetrariella delisei* (Bory ex Schaer.) Karnefelt & Thell – 1 (KPABG 13470), 8 (KPABG 13606) 25 (KPABG 13491), 25, on soil among mosses in swampy communities. Widely distributed throughout Svalbard.

*Cladonia amaurocraea* (Florke) Schaer. – 21 (KPABG 13555), on soil among mosses. Widely distributed throughout Svalbard.

*Cladonia arbuscula* (Wallr.) Flot. – 17 (KPABG 13601), on soil among mosses. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from two localities from Edgeoya – Kvalpynten (Ahti 1961) and Liedefjorden (Ovstedal et al. 2009).

*Cladonia coccifera* (L.) Willd. – 1 (KPABG 13476, 13483), 4, 8 (KPABG 13550), 11 (KPABG 13615), 25, 26 (KPABG 13536), on soil among stones, on mosses, on driftwood. Widely distributed throughout Svalbard.

*Cladonia deformis* (L.) Hoffm. – 25, 26 (KPABG 13531), on soil and mosses. Widely distributed throughout Svalbard, but not common.

*Cladonia gracilis* ssp. *elongata* (Wulfén) Vaill. – 1 (KPABG 13475), 4 (KPABG 13525), 5 (KPABG 13515), 6 (KPABG 13574), 8 (KPABG 13550), 17, 23 (KPABG 13615), 26 (KPABG 13545), 25, 26 (KPABG 13536), on soil among stones, on mosses, on driftwood. Widely distributed throughout Svalbard.

*Cladonia nigricans* Nyl. – 1 (KPABG 13638), on soil. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from two localities from Nordaustlandet – Duvepynten (Ovstedal et al. 2009) and Damflya (Konoreva et al. 2019).
LICHENS OF INNVIKA BAY (SVALBARD)


*Dactylina ramulos*a (Hook.) Tuck. – 9 (KPABG 13539), 16 (KPABG 13590, 13594), on soil. Widely distributed in the north and north-west parts of Svalbard and is rare in the southern regions. *Endococcus propinquus* (Körb.) Trevis. s. lat. – 1, on thallus of *Rhizocarpon* sp. Rare on Svalbard. These reports refer to *Endococcus propinquus* s. lat., because *E. propinquus* s. str. is restricted to hosts of the genus *Porpidia* (Sérusiaux et al. 1999). *Endococcus propinquus* s. lat. known from a few scattered sites of Svalbard: Sørkapp Land – Hornsund; Albert I Land – Kobbefjorden; Ny-Friesland – Sorgfjorden; Nordaustlandet – Wahlenbergfjorden; Bjørnøya (Zhurbenko and Brackel 2013). *Endococcus propinquus* s. str. known only Wedel Jarlsberg Land – Rålstranda and Låkpynten (Kukwa and Jabłońska 2008).

*Farnoldia micropsis* (A. Massal.) Hertel – 14, on limestone. Known from a few scattered sites of Svalbard: Hinlopenstretet (Fries 1867); Bjørnøya (Lynge 1926); Amsterdamøya (Hertel and Ullrich 1976); Oscar II Land – Ny-Ålesund area (Hertel 1977), Beach from Brandalpynten to Stuphallet, Bayelva (Breuss 2017); Axeløya; Dickson Land – Lyckholmdalen (Øvstedal et al. 2009).


*Hypogymnia austerodes* (Nyl.) Rääsänen – 4 (KPABG 13512), on siliceous stone. Rare on Svalbard. By Øvstedal et al. (2009) *Hypogymnia subobscura* (Vain.) Poelt included in *H. austerodes*. According Westberg et al. (2011) *H. subobscura* is a separate taxon and differs from *H. austerodes* in having papillae that never breaks up into soralia and in lacking 3-hydroxyphysodic acid. Known from a few scattered sites

*Ionaspis lacustris* (With.) Lutzoni – 24, on wet siliceous stone. Widely distributed throughout Svalbard.

*Japewia tornoensis* (Nyl.) Tønsberg – 14, 28 (KPABG 13484, 13505), on soil and mosses, on driftwood. Widely distributed throughout Svalbard.

*Lasiosphaeriopsis stereocaulicola* (Th. Fr. ex Linds.) O. E. Erikss. & R. Sant. – 14, on phyllocladia of *Stereoaulon* sp. Widely distributed throughout Svalbard.

*Lecanora epibryon* (Ach.) Ach. – 7 (KPABG 13546), on soil and mosses. Widely distributed throughout Svalbard.

*Lecanora intricata* (Ach.) Ach. – 4 (KPABG 13525), 19 (KPABG 13603), 23, on siliceous stones. Known from a few scattered sites of Svalbard: Sørkapp Land and Sørkappøya (Lynge 1924); Edgeøya (Aptrot and Aistrup 1991); Barentsøya – Steinjorden; Nordenskiöld Land – Bjørndalen (Øvstedal et al. 2009), Nordenskiöldfjellet (Breuss 2017), coast from Colesbay to Grumant (Konoreva and Chesnokov 2018); Danskøya – Virgohamna (Øvstedal et al. 2009); Nordaustlandet – Damflya (Konoreva et al. 2019).

*Lecanora polytropa* (Ehrh. ex Hoffm.) Rabenh. – 1, 4 (KPABG 13619), 9, 11, 16 (KPABG 13558), 20 (KPABG 13631), on siliceous stones. Widely distributed throughout Svalbard.

*Lecidea atrobrunnea* (Ramond ex Lam. & DC.) Schaer. – 9, on siliceous stones. Widely distributed throughout Svalbard.

*Lecidea auriculata* Th. Fr. – 8, 15, 17, on siliceous stones. Widely distributed throughout Svalbard.

*Lecidea confluens* (Weber) Ach. – 16, 19, 21, on siliceous stones. Sporadically distributed throughout Svalbard.

*Lecidea ecrustacea* (Anzi ex Arnold) Arnold – 4, on siliceous stone. Rare on Svalbard.

*Lecidea lapicida* var. *pantherina* Ach. – 16, 21, on siliceous stones. Widely distributed throughout Svalbard.

*Lecidea lapicida* Th. Fr. – 16, on soil. Widely distributed throughout Svalbard.

*Lecidea ramulosa* Th. Fr. – 16, on soil. Widely distributed throughout Svalbard.

*Lecidea swartzioidea* Nyl. – 17 (KPABG 13504), on siliceous stone. Rare on Svalbard.

Known from a few scattered sites of Svalbard: Amsterdamøya (Hertel and Ulrich 1976); Nordenskiöld Land – Longyearbyen (as *L. cf. swartzioidea*; Hartmann 1980); Wedel Jarlsberg Land – Mariaholmen (Øvstedal et al. 2009); Oskar II Land – Zeppelinfjellet (Breuss 2017); Nordaustlandet – Damflya (Konoreva et al. 2019).

*Lecidoma demissum* (Rutstr.) Gotth. Schneid. & Hertel – 1, on soil. Widely distributed throughout Svalbard.

*Lendemeriella exsecuta* (Nyl.) S. Y. Kondr. – 21, on siliceous stone. Rare on Svalbard.

Known from a few scattered sites of Svalbard: Nordenskiöld Land – Longyeardalen, Reindalen; Oskar II Land – Thusbukta at Ny-Alesund (Søchting et al. 2008), Kafføya (Węgrzyn et al. 2015); Bjørnøya as *Blastenia arctica* (Lynge 1926); Haakon VII Land – Möllerfjorden (Søchting 1989).

*Lendemeriella tornoensis* (H. Magn.) S.Y. Kondr. – 16, on mosses. Rare on Svalbard.

Known from a few scattered sites of Svalbard: Sabine Land – Sassendalen (Søchting et al. 2008); Nordaustlandet – Damflya (Konoreva et al. 2019); Nordenskiöld Land –
Reindalen (Søchting 1992); Funglesongen Nordvestøyane – Ytre Norskøya (O-L160168) [1].

*Lepraria gelida* Tønsberg & Zhurb. – 9 (KPABG 13542), 16, on soil and mosses. Spot tests: K+ yellow to orange, C−, KC+ red, Pd+ yellow to orange; contains alectorialic and porphyrilic acids (Øvstedal et al. 2009, Saag et al. 2009). *Lepraria gelida* can be confused with *Lepraria eburnea* J. R. Laundon, but is distinct by its bluish granular or warty-ganular thallus with granular soredia (*L. eburnea* has powdery to cottony thallus with farinose soredia) and present porphyrilic acid (Saag et al. 2009, Makarova and Himelbrant 2008). Widely distributed throughout Svalbard.

*Lepraria neglecta* (Nyl.) Lettau – 1, 4, 8, 10, 12, 14, 21, on soil and mosses, on stones.


*Lichenomphalia umbellifera* (L.:Fr.) Redhead et al. – 6 (KPABG 13602), 9 (KPABG 13537), on soil and mosses. Widely distributed throughout Svalbard.

*Lopadium coralloideum* (Nyl.) Lyne – 1, 8, 16 (KPABG 13592), 23 (KPABG 13496), 25 (KPABG 13495), on mosses and soil. Widely distributed throughout Svalbard.

*Lopadium pezizoides* (Ach.) Körb. – 11, 21, 25, on mosses and soil. Widely distributed throughout Svalbard.

*Melanelia hepatizon* (Ach.) A.Thell – 4 (KPABG 13523), 6 (KPABG 13571), on siliceous stones. Widely distributed throughout Svalbard.

*Melanelia stygia* (L.) Essl. – 1, 4 (KPABG 13619), 6 (KPABG 13568), 15, 27 (KPABG 13528), on siliceous stones. Widely distributed throughout Svalbard.

*Melanohalea infumata* (Nyl.) O. Blanco et al. – 18 (KPABG 13540), on siliceous stone. Widely distributed throughout Svalbard.

*Micarea incrassata* Hedl. – 20, on soil. Known from a few scattered sites of Svalbard: Bjørnøya (Lyne 1926); Oskar II Land – Ny-Ålesund (Hertel 1977), Saddle between Zeppelinfjellet and Lundryggen (Breuss 2017), Austre Brøggerbreen (Inoue et al. 2019); Nordenskiöld Land – Kapp Laila (Øvstedal et al. 2009), Rieperbreen (Wietrzyk et al. 2017); Ny-Friesland – between Austbotnhytta and Smutsdalen (Øvstedal et al. 2009); Dickson Land – Petuniabukta (Redchenko et al. 2010); Norautlandet – Damflya (Konoreva et al. 2019).

*Miriquidica deusta* (Stenh.) Hertel & Rambold – 16, on siliceous stone. Rare on Svalbard. Reported to the second time from Svalbard. Previously reported from Colesdalen (Øvstedal et al. 2009).

*Miriquidica lulensis* (Hellb.) Hertel & Rambold – 16, on siliceous stone. Widely distributed throughout Svalbard.

*Miriquidica nigropleurosa* (Vain.) Hertel & Rambold – 4 (KPABG 13618), 6, 10, on siliceous stones. Known from a few scattered sites of Svalbard: Blomstrandhalvoya (Hertel 1977); Amsterdamoya (Hertel and Ullrich 1976, Sechting et al. 2008); Haakon VII Land – Bockfjorden (Hafellner 1982); Sørkapp Land (Olech 1990); Norautlandet – Phippsøya, Lágoya (Øvstedal et al. 2009), Damflya (Konoreva et al. 2019).

*Myriospora smaragdula* (Wahlenb. ex Ach.) Nägeli ex Uloth – 21 (KPABG 13458), on siliceous stone. Widely distributed throughout Svalbard.

*Ochrolechia frigida* (Sw.) Lyne – 1 (KPABG 13637), 4 (KPABG 13519, 13525), 6 (KPABG 13626), 8 (KPABG 13526), 9 (KPABG 13538), 14, 15 (KPABG 13585),
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Orphniospora moriopsis (A. Massal.) D. Hawksw. – 15, 16, on siliceous stones. Widely distributed throughout Svalbard.

Parmelia omphalodes (L.) Ach. – 6 (KPABG 13576), 8 (KPABG 13604), 22, 23, 25, on soil over siliceous stones and mosses. Widely distributed throughout Svalbard.

Parmelia saxatilis (L.) Ach. – 6 (KPABG 13576), 8 (KPABG 13604), 22, 23, 25, 26 (KPABG 13533), on soil over siliceous stones and mosses. Widely distributed throughout Svalbard.

Peltigera aphthosa (L.) Willd. – 5 (KPABG 13586), 6 (KPABG 13624), 21, on soil and among mosses. Widely distributed throughout Svalbard.

Peltigera canina (L.) Willd. – 1, 5 (KPABG 13587), 6 (KPABG 13625), 8 (KPABG 13607), 18, on soil and mosses. Widely distributed throughout Svalbard.

Peltigera didactyla (With.) J. R. Laundon – 9, 21 (KPABG 13461), on soil. Widely distributed throughout Svalbard.

Peltigera elisabethae Gyeln. – 6, on soil and mosses. Probably much overlooked, but usually easily distinguished by schizidia-like propagules, veinless lower surface but with small pale or white interstices (Vitikainen 2007). In the arctic, the species is known from Europe, Asia, North America (Vitikainen 2007).

Peltigera frippii Holt.-Hartw. – 1 (KPABG 13476), among mosses. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported only from Nordaustlandet – Lady Franklinfjorden and Brennevinsfjorden (Vitikainen 1994).

Peltigera kristinssonii Vitik. – 6, on soil and mosses. Rare on Svalbard. Known from a few scattered sites of Svalbard: Bjørnøya (Engelskjøn 1986); Nordaustlandet – Murchisonfjorden; Nordenskiöld Land – Linnedalen; Oskar II Land – Gluudneset (Elvebakk and Hertel 1996).

Peltigera leucophlebia (Nyl.) Gyeln. – 1, 6 (KPABG 13624), 21 (KPABG 13554), on soil and among mosses. Widely distributed throughout Svalbard.

Peltigera lyngii Gyeln. – 1 (KPABG 13477), 4 (KPABG 13520), 7 (KPABG 13547), 18 (KPABG 13486), 27 (KPABG 13534), on soil, among mosses and driftwood. Rare on Svalbard. Known from a few scattered sites of Svalbard: Danskekoya – Kobbefjorden (Gyelnik 1932); Nordenskiöld Land – Sveagruva (as P. malacea var. lyngii; Eurola 1971), Gronfjorden, Adventfjorden; Nordaustlandet – Nordkapp, Floraberget (Vitikainen 1994).

Peltigera malacea (Ach.) Funck – 6 (KPABG 13570), on soil. Widely distributed throughout Svalbard.

Peltigera rufescens (Weiss) Humb. – 5 (KPABG 13588), 7 (KPABG 13549), 16 (KPABG 13596), 21 (KPABG 13462, 13553), 25 (KPABG 13635), on soil among mosses, in depressions. Widely distributed throughout Svalbard.

Peltigera scabrosa Th. Fr. – 6, on soil. Widely distributed throughout Svalbard.

Peltigera venosa (L.) Hoffm. – 5 (KPABG 13589), 16 (KPABG 13562), on soil in wet conditions. Widely distributed throughout Svalbard.

Pertusaria geminipara (Th. Fr.) C.Knight ex Brodo – 25, on soil. Widely distributed throughout Svalbard.

Pertusaria oculata (Dicks.) Th. Fr. – 1 (KPABG 13481), 4 (KPABG 13517, 13518, 13525, 13611), 9 (KPABG 13538), 10 (KPABG 13543), 16 (KPABG 13597), 21, 25 (KPABG 13488, 13494), 26 (KPABG 13533), on soil among stones, over mosses. Widely distributed throughout Svalbard.

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Physcia caesia (Hoffm.) Furnr. – 23 (KPABG 13497), on siliceous stone. Widely distributed throughout Svalbard and common.

Pleopsidium chlorophanum (Wahlenb.) Zopf – 4 (KPABG 13598), 9 (KPABG 13600), 15 (KPABG 13599), on siliceous stones. Widely distributed throughout Svalbard and common.

*Polyblasia sendtneri* Kremp. – 16, on soil. Widely distributed throughout Svalbard and common.

*Polyblasia septentrionalis* Lynge – 16, on siliceous stone. Rare on Svalbard. Known from a few scattered sites of Svalbard: Nordaustlandet – Brennevinsfjorden; N end of Prins Karls Forland (Øvstedal et al. 2009); Nordenskiöld Land – Nordenskiöldfjellet (Breuss 2017); Nathorst Land – Cape Blix (O-L168356) [1].

*Polysporina simplex* (Borrer ex Hook.) Vězda – 16, on siliceous stone. Known from a few scattered sites of Svalbard: Kong Karls Land – Abeløya (Lynge 1939), Hårfagrehaugen (Øvstedal et al. 2009); Hornsund (Nowak 1965); Sørkapp Land (Olech 1990); Bünsow Land – Gipsdalen (Elvebakk and Hertel 1996); Nathorst Land – Between Vestpynten and Bjørndalen (O-L116687) [1], Rieperbreen (Wietrzyk et al. 2017); Oskar II Land – Irenebreen (Wietrzyk et al. 2017), saddle between Zeppelinfjellet and Lundryggen (Breuss 2017).

*Porpidia flavicunda* (Ach.) Gowan – 4, 6, 9, on siliceous stones. Widely distributed throughout Svalbard but it is not common.

*Porpidia melinodes* (Körb.) Gowan & Ahti – 1, 6, on siliceous stones. Widely distributed throughout Svalbard and common.

Protopannaria pezizoides (Weber) P. M. Jørg. & S. Ekman – 5 (KPABG 13515), 6 (KPABG 13569), 26 (KPABG 13545), on soil and mosses. Widely distributed throughout Svalbard and common.

*Pseudephebe minuscula* (Nyl. ex Arnold) Brodo & D. Hawksw. – 1, 3 (KPABG 13508), 4 (KPABG 13617, 13620, 13621), 6 (KPABG 13567), 11, 14, 20 (KPABG 13632), 21, on siliceous stones. Widely distributed throughout Svalbard and common.

*Pseudephebe pubescens* (L.) M. Choisy – 1 (KPABG 13641), 4, 6, 15 (KPABG 13585), 16, 17 (KPABG 13501), 26, on siliceous stones. Widely distributed throughout Svalbard and common.

Rhizocarpon baadioatrum (Flörke ex Spreng.) Th. Fr. – 1, 4, on siliceous stones. Widely distributed throughout Svalbard and common.

*Rhizocarpon copelandii* (Korb.) Th. Fr. – 6, 15 (KPABG 13583), 17 (KPABG 13630), 27 (KPABG 13527, 13529), on siliceous stones. Widely distributed throughout Svalbard and common.

*Rhizocarpon eupetraeoides* (Nyl.) Blomb. & Forssell – 15 (KPABG 13581), on siliceous stone. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from Amsterdamøya (Hertel and Ullrich 1976); Nordaustlandet – Damflya (Konoreva et al. 2019).

*Rhizocarpon ferax* H. Magn. – 4, 11, on siliceous stones. Widely distributed throughout Svalbard and not common.
Rhizocarpon geminatum Körb. – 4 (KPABG 13620), 16 (KPABG 13558), on siliceous stones. Widely distributed throughout Svalbard.

Rhizocarpon geographicum (L.) DC. – 4 (KPABG 13521, 13617, 13620), 9 (KPABG 13552), 13 (KPABG 13642), 15 (KPABG 13584), 16 (KPABG 13559, 13561, 13563), 17 (KPABG 13503, 13630), 24 (KPABG 13506), 27 (KPABG 13530), on siliceous stones. Widely distributed throughout Svalbard.

Rhizocarpon grande (Flörke) Arnold – 11, on siliceous stone. Widely distributed throughout Svalbard.

*Rhizocarpon hochstetteri (Körb.) Vain. – 4, on siliceous stone. Sporadically distributed throughout Svalbard.

Rhizocarpon inarense (Vain.) Vain. – 1, 4 (KPABG 13522), 6, 10, 15 (KPABG 13582, 13584), 17 (KPABG 13457), on siliceous stones. Widely distributed throughout Svalbard.

Rhizocarpon intermediellum Räsänen – 16, on siliceous stone. Sporadically distributed throughout Svalbard.

*Rhizocarpon rittokense (Hellb.) Th. Fr. – 4 (KPABG 13618), 6, 16 (KPABG 13561), on siliceous stones. Known from a few scattered sites of Svalbard: Hornsund (Fries 1867); Sveagruva (Eurola 1971); Bockfjorden (Schuhwerk 1992); Nordenskiöld Land – Bolterdalen (Breuss 2017); Bünsow Land – Gipshuken (TROM-L564677); Ny-Friesland – Austbotnhytta (BG-L94924) [1].

Rhizocarpon superficiale (Schaer.) Vain. – 15, on siliceous stone. Sporadically distributed throughout Svalbard.

*Rhizocarpon viridiatrum (Wulfen) Körb. – 1, on siliceous stone. Rare on Svalbard. Reported to the second time from Svalbard. Previously reported from Nordenskiöld Land – Colesbukta (Konoreva and Chesnokov 2018).

Rhizoplaca melanophthalma (DC.) Leuckert & Poelt – 12 (KPABG 13629), on siliceous stone. Widely distributed throughout Svalbard.

*Schaereria fuscocinerea (Nyl.) Clauzade & Cl. Roux – 17, on stone. Known from a few scattered sites of Svalbard: Hornsund (Fries 1867); Edgeøya (Aptroot and Alstrup 1991); Isfjorden (Hertel 1991); Recherchefjorden (Øvstedal et al. 2009); Nordenskiöld Land – Torsokfjorden; Ny-Friesland – Austbotnhytta (BG-L94924) [1].

Rinodina terrestris Tomin. – 20 (KPABG 13507), on mosses. Rare on Svalbard. Reported to the second time from Svalbard. Previously reported from Danskøya – Kobbefjorden (Øvstedal et al. 2009); Ny-Friesland – Austbotnhytta (BG-L94924) [1].

Rinodina turfacea (Wahlenb.) Korb. – 8 (KPABG 13550), on soil and mosses. Widely distributed throughout Svalbard.

Rusavskia elegans (Link) S. Y. Kondr. & Kärnefelt – 5 (KPABG 13510), 10 (KPABG 13544), 16, 21, on siliceous stones. Widely distributed throughout Svalbard.

Rusavskia sorediata (Vain.) S. Y. Kondr. & Kärnefelt – 6 (KPABG 13566), on siliceous stone. Widely distributed throughout Svalbard.

*Solorina bispora Nyl. – 9 (KPABG 13542), 16 (KPABG 13565), on calcareous soil. Widely distributed throughout Svalbard.

Solorina crocea (L.) Ach. – 1 (KPABG 13478, 13482, 13639), 4 (KPABG 13608), 6 (KPABG 13578), 9, 25 (KPABG 13636), on acidic soil. Widely distributed throughout Svalbard.

Solorina spongiosa (Ach.) Anzi – 16, on calcareous soil. Widely distributed throughout Svalbard.
Sphaerophorus fragilis (L.) Pers. – 4 (KPABG 13524), 8, 23 (KPABG 13634), on soil among mosses. Widely distributed throughout Svalbard.

Sphaerophorus globosus (Huds.) Vain. – 6 (KPABG 13572), 8 (KPABG 13550), on soil among mosses. Widely distributed throughout Svalbard.

Sporastatia polyspora (Nyl.) Grummann – 1, on siliceous stone. Widely distributed throughout Svalbard.

Sporastatia testudinea (Ach.) A. Massal. – 16, 25 (KPABG 13487), on siliceous stone. Widely distributed throughout Svalbard.

Stereocaulon alpinum Laurer – 25, on soil among mosses. Widely distributed throughout Svalbard.

Stereocaulon botryosum Ach. – 4, on soil on boulder. Widely distributed throughout Svalbard.

*Stereocaulon cumulatum (Sommerf.) Timdal – 23 (KPABG 13500), on mosses. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from Bünsow Land – Gipsvika; Brøggerhalvøya – Ny-Ålesund (Øvstedal et al. 2009).

Stereocaulon glareosum (Savicz) H. Magn. – 1, 4, 6, 9, 12, 16, 20, on soil among mosses. Widely distributed throughout Svalbard.

Stereocaulon rivulorum H. Magn. – 14, on soil among mosses. Widely distributed throughout Svalbard.

Tetramelas insignis (Nägeli ex Hepp) Kalb – 1 (KPABG 13469, 13613), 5 (KPABG 13514), on soil and mosses. Widely distributed throughout Svalbard.

Tetramelas papillatus (Sommerf.) Kalb – 1, on soil. Widely distributed throughout Svalbard.

Thamnolia vermicularis (Sw.) Schaer. – 4 (KPABG 13623), 6 (KPABG 13573), 21 (KPABG 13553), 23 (KPABG 13499), 26 (KPABG 13536), on soil, among mosses. Widely distributed throughout Svalbard.

*Toninia squalida (Ach.) Massal. – 4, on calcareous soil. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from Prins Karls Forland – Carls Forland (Timdal 1991); Dickson Land – Tysneset (TROM-L565889) [1].

Tremolecia atrata (Ach.) Hertel – 4 (KPABG 13521), 9 (KPABG 13552), 10, 14, 24 (KPABG 13506), on siliceous stones. Widely distributed throughout Svalbard.

Umbilicaria arctica (Ach.) Nyl. – 25, on siliceous stone. Widely distributed throughout Svalbard.

Umbilicaria cylindrica (L.) Delise ex Duby – 1 (KPABG 13479), 4, 6 (KPABG 13577), 8 (KPABG 13511), 9, on siliceous stones. Widely distributed throughout Svalbard.

Umbilicaria decussata (Vill.) Frey – 4, on siliceous stone. Widely distributed throughout Svalbard.

Umbilicaria hyperborea (Ach.) Hoffm – 1, 4, 23, on siliceous stones. Widely distributed throughout Svalbard.

Umbilicaria lyngei Scholander – 6, 23, on siliceous stones. Widely distributed throughout Svalbard.

Umbilicaria proboscidea (L.) Schrad. – 4, 6, 15, 17, on siliceous stones. Widely distributed throughout Svalbard.

Umbilicaria torrefacta (Lightf) Schrad. – 6 (KPABG 13579), on siliceous stone. Widely distributed throughout Svalbard.

Umbilicaria virginis Schaeer – 8, 21, on siliceous stones. Widely distributed throughout Svalbard.

*Verrucaria hydrela Ach. – 18, on wet siliceous stone. Rare on Svalbard. Reported to the third time from Svalbard. Previously reported from Ny-Friesland – S of the mouth.
of Ringhorndalen (Øvstedal et al. 2009); Nordenskiöld Land – Kolfjellet (O-L138803) [1].

*Verrucaria nigrescens* Pers. – 16, on sandstone. Rare on Svalbard. Known from a few scattered sites of Svalbard: Bjornøya (Summerhayes and Elton 1923, Lynge 1926); Nathorst Land – Mitterhuken (Øvstedal et al. 2009), Forsbladhamna (O-L128320) [1]; Nordenskiöld Land – Berzeliusfjellet (Øvstedal et al. 2009); Wedel Jarlsberg Land – Calypso – Sørhuk (O-L125325) [1].

Xanthonemenda borealis (R. Sant. & Poelt) Söchting et al. – 18 (KPABG 13541), on siliceous stone. Known from a few scattered sites of Svalbard: Amsterdamøya; Nordenskiöld Land – Longyearbyen (Elvebakk and Hertel 1996); Nordaustlandet – Damflya (Konoreva et al. 2019); Oskar II Land – Zeppelinfjellet (Breuss 2017); Indre Norskøya – Sabineodden (Øvstedal et al. 2009); Bünsow Land – Gipshuksletta (TROM-L564667); Andree Land – Munningen av Kartdalen (O-L127847) [1].

**Conclusion**

As a result of our research, we found 2 species new to Svalbard and 27 species that are rare and extremely rare on Svalbard. Among them the new species for Svalbard *Alectorion gowardii* which was described by Halonen et al. (2009) as *Gowardia arctica* Halonen et al. It was probably previously determined as *Alectorion nigriceps* or other closely related taxa (see comment under species). The second species new to Svalbard *Peltigera elisabethae*, is probably more widespread, but often overlooked. From the 27 rare and extremely rare species, 15 are saxicolous lichens (for example, *Aspicilia cinerea*, *Henrica melaspora*, *Lecidea ecrustacea*, *Lemnemeristella exigua*, *Miriouca deusta*, etc). They are small in size and difficult for collection and identification. Species such as *Cetraria nigricans*, *Cladonia arbuscula*, *Cystocoleus ebeneus*, *Peltigera frigii*, *Peltigera kroistinssonii*, and *Peltigera lyngei*, prefer humid habitats as well as those protected from the wind. They were found by us near Ringgåsvatnet Lake, where there are suitable conditions. *Toninia squalida* was also found on the calcareous soil on the rocks near Ringgåsvatnet. Thus, in this study area, the Ringgåsvatnet Lake is very interesting for lichenologists because of the suitable conditions (the presence of calcareous rocky outcrops, humidity and protection from the wind). Another extremely rare species of the Svalbard is *Gyrolea erythrozona*, that was found on rocks near the sea shore.

**References**


Web sources / Other sources
