Addition to the lichen biota of Prins Karls Forland (Svalbard Archipelago)

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Abstract. Sixty-one species of lichens and four lichenicolous fungi (*Catillaria stereocaulorum, Cercidospora stereocaulorum, Endococcus macrosporus, E. propinquus*) are reported for the first time for the Prins Karls Forland as a result of the study of lichens collected in 2016. Among them, *Xylographa trunciseda* is reported for the first time for Arctic, *Rhizocarpon cinereonigrum* is new to Svalbard. Differences from closely related species and distribution in the Arctic are discussed for the species, which are rare on the Svalbard. In total, 216 species of lichens and 4 lichenicolous fungi are currently known for the Prins Karls Forland.
Keywords: new records, Arctic, Norway, Prins Karls Forland.

Дополнение к лихенобиоте острова Земля Принца Карла (архипелаг Шпицберген)

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Резюме. В результате изучения коллекций лишайников, собранных в 2016 г. на о. Земля Принца Карла, был выявлен 61 вид лишайников и четыре лихенофильных гриба (*Catillaria stereocaulorum, Cercidospora stereocaulorum, Endococcus macrosporus, E. propinquus*), новых для острова. Среди них *Xylographa trunciseda* является новым видом для Арктики, *Rhizocarpon cinereonigrum* впервые обнаружен на архипелаге Шпицберген. Обсуждаются отличия от близких видов и особенности распространения редких таксонов. Всего к настоящему времени для о. Земля Принца Карла известно 216 видов лишайников и 4 лихенофильных гриба.
Ключевые слова: новые находки, Арктика, Земля Принца Карла, Норвегия.

Prins Karls Forland is an island stretching from north to south, 85 km long and 5–11 km wide, located in the west of the Svalbard. It is separated from Western Spitsbergen by the Forlandsundet Strait. In general terms, Prins Karls Forland is an uplifted block of metamorphic basement between the continental margin to the west and the Forlandsundet Graben to the east. The island is subdivided into two major approximately equal in area bedrock blocks, separated by the curved Baklia Fault Zone, trending roughly north to south. The Fuglehuken block in the northern part consists of interbedded quartzite- or dolomite-conglomerate, sandstone and slate. The

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Glenbegdalen block to the south is composed of phyllite and quartzite with interlayered carbonate rocks, conglomerate and green schist (Hjelle *et al.*, 1999; Dallmann, 2020). The study area is a typical plain, in the northern part of which mountainous relief prevails. The mountains are heavily indented with many gorges, most of which are occupied by glaciers. All glaciers are concentrated on the eastern coast and face the Forlandsundet strait.

The meteorological station closest to Prins Karls Forland is in Ny-Ålesund, about 50 km to the east. There, mean annual air temperature (MAAT) is –6.2 °C and mean annual precipitation (MAP) is 372 mm (Hanssen-Bauer *et al.*, 1990). The climate is probably somewhat warmer at the study site because of open waters all year round in the vicinity (Berthling *et al.*, 1998).

Due to the diversity of rocks and the influence of the Gulf Stream, the study area is of great interest for lichenological research. However, the area is still poorly explored. Despite two large generalizing works about lichens of the Svalbard (Elvebakk, Hertel, 1996; Øvstedal *et al.*, 2009), there is no list of lichens for Prins Karls Forland. There is only fragmentary information about lichens in a number of publications (Paulson, 1923; Summerhayes, Elton, 1923; Lynge, 1924, 1936, 1938; André, 1992; Elvebakk, Hertel, 1996; van der Wal *et al.*, 2001; Øvstedal *et al.*, 2009; Zawierucha *et al.*, 2017). Some unpublished information about lichens from Prins Karls Forland is presented on the website of Svalbard Lichen Database (2023), where 75 taxa are listed. Before our research, 155 species of lichens were known for Prins Karls Forland.

Material and Methods

The lichens were collected by the first author (LK) in the central part of Prins Karls Forland near Baklia Fault Zone in August 2016 (Fig. 1). All geographical coordinates are given in the coordinate system WGS 1984. The laboratory study was carried out according to the standard technique (The lichens..., 2009; Stepanchikova, Gagarina, 2014) in the Laboratory of Flora and vegetation of the Avrorin Polar-Alpine Botanical Garden and Institute of the Kola Scientific Centre of RAS using a binocular stereoscopic microscope MBS 10, transmitted light microscope Zeiss Primo Star, a standard set of chemical reagents for carrying out color spots reactions for identification of certain groups of lichen substances in thalli. All collected and identified specimens are stored in the herbarium of the Avrorin Polar-Alpine Botanical Garden and Institute of the Kola Scientific Centre of RAS (KPABG). The nomenclature of lichens mainly follows Lumbsch, Huhndorf (2010), Kondratyuk *et al.* (2020) and Westberg *et al.* (2021).

The map were prepared using GIS Axioma 4.4 program. The topographic information used (Fig. 1) were obtained from the Topographical Svalbard Map Service of the Norwegian Polar Institute (2023).

List of localities

Svalbard, Prins Karls Forland: 1 — Sørflaket, Sessflya, near Sesshogda, 78°33′51.8″N, 11°16′45.6″E, 20 m a. s. l., rocky tundra, 3 VIII 2016; 2 — Krokodillen, glacier crossbar, 78°35′35.3″N, 11°11′47″E, 74 m a. s. l., willow (*Salix polaris* Wahlenb.) grass tundra, 7 VIII 2016; 3 — coast of

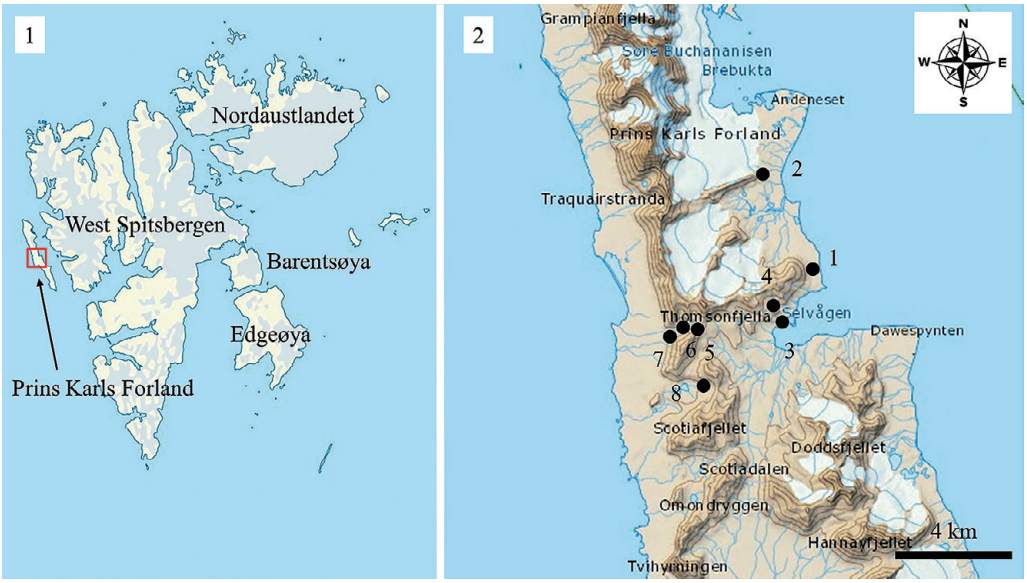

Fig. 1. Study area: 1 — location of Prins Karls Forland, 2 — location of sampling sites.

Kulpen, Selvågen, 78°32′43.3″N, 11°14′15.7″E, 14 m a. s. l., gravelly coast with separate clumps of plants and lichens with driftwood, on driftwood, 7 VIII 2016; 4 — *ibid*., Thomsonfjella, at the top of the hill, 78°32′54.8″N, 11°12′37.1″E, 214 m a. s. l., rocky tundra, 8 VIII 2016; 5 — near Petuniaskaret, among Thomsonfjella and Conquerorfjellet, 78°32′36.8″N, 11°06′13.1″E, 240 m a. s. l., rocky tundra with sedge, 9 VIII 2016; 6 — *ibid*., 78°32′39.4″N, 11°05′05.4″E, 125 m a. s. l., rocks near creek, 9 VIII 2016; 7 — *ibid*., 78°32′32.0″N, 11°03′50.8″E, 92 m a. s. l., rocks near creek, on siliceous stone, 9 VIII 2016; 8 — near Røyshaugen, pass, 78°31′26.0″N, 11°07′42.5″E, 102 m a. s. l., stony moss-lichen tundra, on siliceous stone, 11 VIII 2016.

Results

Altogether 65 species are reported here, including 61 lichens and four lichenicolous fungi (marked with "#"). The taxa are arranged in the alphabetical order. For each species the localities, habitat types and substrates are listed. All species are reported for the first time for Prins Karls Forland, among them *Rhizocarpon cinereonigrum* and *Xylographa trunciseda* are new to the Svalbard (marked with "!"), and also *X. trunciseda* is reported for the first time from the Arctic. Differences from closely related taxa and distribution in the Arctic are discussed for the species which are new for the archipelago or rare in Svalbard.

Adelolecia kolaensis (Nyl.) Hertel et Rambold — 5, 7, on stone, *LK 168, 193*.

Alectoria gowardii Lumbsch — 7, on soil, *LK 193*. Rare in the Svalbard. Reported for the third time from the Svalbard archipelago. Previously reported from Nordaustlandet — Innvika Bay (Konoreva, Chesnokov 2021) and Barentsøya (Konoreva, Chesnokov, 2022).

Amygdalaria panaeola (Ach.) Hertel et Brodo — 2, 8, on stone, *LK 118, 215*.

Brodoa oroarctica (Krog) Goward — 2, 5, 7, 8, on stone, *LK 126, 162, 168, 191, 213, 219*.

Bryoplaca tetraspora (Nyl.) Søchting et al. — 6, on soil and plant debris, *LK 173, 174*.

Bryostigma lapidicola (Taylor) S. Y. Kondr. et J.-S. Hur — 1, on stone, *LK 32*.

Caloplaca stillicidiorum (Vahl) Lynge — 6, on soil over stone, *LK 174*.

Calvitimela armeniaca (DC.) Hafellner — 8, on stone, *LK 207*.

C. melaleuca (Sommerf.) R. Sant. — 8, on stone, *LK 208, 209*.

#Catillaria stereocaulorum (Th. Fr.) H. Olivier — 7, on phyllocladia of *Stereocaulon* cf. *rivulorum*, *LK 201*.

#**Cercidospora stereocaulorum** (Arnold) Hafellner — 2, 8, on phyllocladia of *Stereocaulon* sp. and *S. vesuvianum* Pers., *LK 118, 122, 206*.

Cladonia coccifera (L.) Willd. — 8, on soil, *LK 215*.

C. gracilis (L.) Willd. — 7, on soil, *LK 203*.

C. pocillum (Ach.) O. J. Rich. — 6, on soil, *LK 173*.

Eiglera flavida (Hepp ex Kremp.) Hafellner — 6, on stone, *LK 172*.

#**Endococcus macrosporus** (Hepp ex Arnold) Nyl. — 7, 8, on thallus of *Rhizocarpon copelandii*, *LK 220*.

#**Endococcus propinquus** (Körb.) Trevis. — 8, on thallus of *Porpidia* sp. and *P. melinodes*, *LK 210, 219*.

Euopsis granatina (Sommerf.) Nyl. — 8, on stone, *LK 219*.

Japewia tornoensis (Nyl.) Tønsberg — 5, on mosses, *LK 163*.

Lecanora marginata (Schaer.) Hertel et Rambold — 6, on limestone, *LK 172*.

Lecidea ecrustacea (Anzi ex Arnold) Arnold — 8, on stone, *LK 219*.

Lecidoma demissum (Rutstr.) Gotth. Schneid. et Hertel — 2, on soil, *LK 122*.

Leciophysma finmarkicum Th. Fr. — 6, on soil, *LK 173*.

Lendemeriella exsecuta (Nyl.) S. Y. Kondr. — 1, on stone, *LK 32*.

Lepraria gelida Tønsberg et Zhurb. — 5, 7, on soil, *LK 163, 201*.

Lichenomphalia umbellifera (L.) Redhead et al. — 4, on mosses and soil, *LK 148*.

Melanelia stygia (L.) Essl. — 7, 8, on stone, *LK 192, 209*.

Micarea assimilata (Nyl.) Coppins — 2, 8, on soil, *LK 118*.

M. incrassata Hedl. — 6, 7, on soil, *LK 189, 203*.

Miriquidica nigroleprosa (Vain.) Hertel et Rambold — 7, on stone, *LK 195*.

Ophioparma ventosa (L.) Norman — 7, on stone, *LK 191*.

Orphniospora moriopsis (A. Massal.) D. Hawksw. — 7, 8, on stone, *LK 191, 212*.

Pannaria hookeri (Borrer) Nyl. — 6, 7, on soil, *LK 187, 192*.

Peltigera lyngei Gyeln. — 6, on soil, *LK 175*.

Placopsis gelida (L.) Linds. — 6, 7, on stone, *LK 183, 200, 201*.

Placynthium nigrum (Huds.) Gray — 6, on stone, *LK 176*.

Polyblastia gothica Th. Fr. — 4, 7, on soil, *LK 148, 198*.

Porpidia melinodes (Körb.) Gowan et Ahti — 2, 5, 7, 8, on stone, *LK 118, 157, 159, 162, 199, 211, 215, 219*.

Protoblastenia rupestris (Scop.) J. Steiner — 6, on limestone, *LK 172*.

Protomicarea alpestris (Sommerf.) McCune — 7, on soil, *LK 198*.

Protopannaria pezizoides (Weber) P. M. Jørg. et S. Ekman — 6, 7, on soil, *LK 175*.

Protoparmelia badia (Hoffm.) Hafellner — 5, 8, on stone, *LK 167, 214*.

Protothelenella sphinctrinoidella (Nyl.) H. Mayrhofer et Poelt — 6, on dead mosses, *LK 185*.

Pseudephebe pubescens (L.) M. Choisy — 5, 8, on stone, *LK 159, 163, 213*.

Psoroma tenue Henssen var. **boreale** Henssen — 6, on soil, *LK 173, 174, 185*.

Rhizocarpon alpicola (Fr.) Rabenh. — 8, on stone, *LK 209*.

!**R. cinereonigrum** Vain. — 8, on siliceous stone, *LK 211*. The species is characterized by the dark grayish to dark brown thallus, epihymenium K+ violet-red, large brown 1–septate ascospores and the presence of stictic acid in the thallus (Foucard, 2002). It morphologically resembles *R. badioatrum* (Flörke ex Spreng.) Th. Fr, *R. copelandii* and *R. jemtlandicum* Malme. However, *R. badioatrum* differs by more prominent areolae and contains ±stictic, ±norstictic or diffractaic acids; *R. copelandii* and *R. jemtlandicum* differ by olive to green-black epithecium (K–) (Foucard, 2002; The lichens..., 2009; Wirth *et al*., 2013). The nearest localities are known from Norway, Sweden, and Finland (Wesberg *et al*., 2021), also Greenland (Thomson, 1997), Novaya Zemlya (Magnusson, 1927; Lynge, 1928), and Murmansk Region (Melekhin, 2017).

R. cinereovirens (Müll. Arg.) Vain. — 2, on stone, *LK 128*.

R. copelandii (Körb.) Th. Fr. — 5, 7, 8, on stone, *LK 157, 191-193, 199, 208, 213, 219, 220*.

R. expallescens Th. Fr. — 7, on stone, *LK 193, 199*.

R. ferax H. Magn. — 2, 5–8, on stone, *LK 126, 159, 183, 192, 193, 219*.

R. hochstetteri (Körb.) Vain. — 7, on stone, *LK 200*.

R. inarense (Vain.) Vain. — 5, on stone, *LK 157, 162*.

Rinodina olivaceobrunnea C. W. Dodge et G. E. Baker — 6, 7, on mosses, soil, and plant debris, *LK 174, 178, 193, 198*.

R. roscida (Sommerf.) Arnold — 6, on plant debris, *LK 178*.

Scytinium intermedium (Arnold ex Malbr.) Otálora et al. — 6, on plant debris, *LK 176*.

Sporastatia testudinea (Ach.) A. Massal. — 8, on stone, *LK 211*.

Sporodictyon terrestre (Th. Fr.) Savić et Tibell — 6, on stone, *LK 187*.

Stereocaulon botryosum Ach. — 8, on soil, *LK 206, 210, 214, 216, 220*.

S. capitellatum H. Magn. — 2, on soil, *LK 128*.

S. glareosum (Savicz) H. Magn. — 6, on soil, *LK 172, 173*.

S. rivulorum H. Magn. — 7, on soil, *LK 199, 201*.

Umbilicaria crustulosa (Ach.) Lamy — 2, on stone, *LK 122*.

Vestergrenopsis elaeina (Wahlenb.) Gyeln. — 1, on stone, *LK 32*.

!**Xylographa trunciseda** (Th. Fr.) Minks ex Redinger — 3, on driftwood, *O. A. Belkina B355-16*. It is easily recognized by the short pale brown to grayish brown ascomata which regenerate from tips of ascomatal shells, presence of confriesiic acid (K–, P–) (Spribille *et al*., 2014). Morphologically *X. trunciseda* can be confused with *X. erratica* T. Sprib. and *X. vermicularis* T. Sprib. But *X. erratica* can be distinguished by the presence of stictic acid (K+ yellow, P+ orange), and areolate thallus. *Xylographa vermicularis* can also be distinguished by the presence of stictic acid, higher hymenium (*X. vermicularis* — 80–120 μm, *X. trunciseda* — 60–85 μm), and larger ascospores (*X. vermicularis* — 12.2–14.1 × 6.8–8.4 μm, *X. trunciseda* — 10.1–11.3 × 5.2–6.1 μm; see Spribille *et al*., 2014). *Xylographa trunciseda* is a widespread and characteristic lichen of the boreal and oroboreal zones. The species is reported for the first time for the Arctic. The nearest localities are known from Norway, Sweden, Finland (Wesberg *et al*., 2021), Murmansk Region (Urbanavichus, Urbanavichene, 2021), Republic of Karelia (Tarasova *et al*., 2015), and Arkhangelsk Region (Tarasova *et al*., 2016).

Discussion

We identified 61 species of lichens and 4 lichenicolous fungi that were not previously reported for Prins Karls Forland. Most of the reported species are common in

the Svalbard and Arctic. This fact once again shows that the lichens of the study area are poorly investigated.

The find of *Xylographa trunciseda* in the Arctic is most interesting, because the species is typical for the boreal and oroboreal zones (Spribille *et al*., 2014). Apparently, this species, like other *Xylographa* taxa, has a wider distribution in the Arctic: the distribution of this genus is limited only by the availability of wood. Due to the strong wood association of *Xylographa* species, they were for a long time attributed to non-lichenized fungi and were skipped during collection (Spribille *et al*., 2014).

At the moment, the list of lichens of the Prins Karls Forland includes 216 species of lichens and 4 lichenicolous fungi. Due to the close proximity of the Gulf Stream and complex geology, we estimate that the lichen diversity on Prins Karls Forland could be around 400 species.

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