



New records of driftwood lichens in the Kaffiøyra Plain (NW Spitsbergen, Svalbard)

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Abstract: This paper refers to lichen biota growing on driftwood in the Kaffiøyra Plain (NW Spitsbergen, Svalbard). The presented list of 25 lichenized fungi includes both the eurytopic, accidental, typical, and stenotopic species. Taxa that belong to the last two groups can be considered as lignicolous. This study confirms the existence of a specific group of lichen species, for which the driftwood is a main substrate in the Arctic. Additionally, five lichen species new for the whole Svalbard were recorded, namely: *Candelariella coralliza*, *Elixia flexella*, *Lecanora saligna*, *Lecidea plebeja*, and *Xylographa sibirica*.

Key words: Arctic, Svalbard, lichen biota, lichenized fungi, lignicolous lichens.

Introduction

Lichens that grow on driftwood in Arctic regions belong to the most interesting groups of species due to the absence of trees in these areas. For ages, there has been a large-scale transportation of driftwood from Siberia. Especially after 1950, the abundance of Siberian driftwood transported by the Transpolar Drift Stream increased in Svalbard (Eggertsson 1994; Dąbrowski and Zielski 2004). The most common species of driftwood found in the archipelago belong to such genera as *Pinus*, *Picea*, and *Larix* (Eggertsson 1994; Johansen 1999). During past centuries, this timber has been used by trappers, hunters, and miners to construct buildings throughout the entire archipelago. Therefore, it was distributed from coastal terrains to the inlands. Currently, most of these buildings are classified as cultural

heritage, and are protected. Both the worked timber and the driftwood act as suitable habitat for lichen communities. These species can be classified as eurytopic, accidental, typical, or stenotopic lichens. Eurytopic and accidental species prefer various substrates and their presence on driftwood is completely by chance. Typical and stenotopic lichens occur only on lignum substrate (Himmelbrant and Kuznetsova 2002; Osyczka and Węgrzyn 2008). Still, there are only a few papers that investigate lichen biota of driftwood in the Arctic (Alstrup 1977; 1987; Brodo and Vänskä 1984; Zhurbenko and Vekhov 2001) and even fewer looking at these groups on Svalbard (Søchting 1989; Osyczka and Węgrzyn 2008).

Contribution to the knowledge of lichen biota in the Kaffiøyra Plain presented Adamska *et al.* (1999). It contained a list of 85 taxa collected in 1978. However, it did not include the driftwood species. Nowadays, fairly large amounts of logs are distributed on the Svalbard coastline, particularly on the west coast of Spitsbergen. The main aim of this study was to determine all lichen species present on the driftwood found in the Kaffiøyra Plain in 1997 and in 2012.

Research area, materials and methods

This study is based on herbal materials collected during the summer season in 1997 (Toruń Polar Expedition XIII) and in 2012 (Toruń Polar Expedition XXXVIII) in the Kaffiøyra Plain. In the research area (Fig. 1), the main landform is a terraced coastal plain (Jaworski 2010). It is bordered on the west by Forlandsundet, and on the east by a massive mountain that is the central part of Oscar II Land. In the north its natural boundaries are: Hornbaekbukta Bay, Aavatsmark Glacier, and Dahlbrebukta Bay with Farmsundet Passage. The Dahl Glacier surrounds the area from the south. Kaffiøyra Plain is 15 km long and 1.5–4 km wide. Seven glaciers come down to the plain from the mountain region. The whole plain is crossed by several glacier rivers (Giżejowski *et al.* 2013; Sobota *et al.* 2013; Zwoliński *et al.* 2013).

The research was conducted near the shoreline, where the logs thrown out by the sea were deposited. Lichen samples were collected for later identification. Traditional taxonomical methods were used for species determination. Additionally, in the case of sterile taxa, a chemotaxonomical analyses were done (Orange *et al.* 2001). Following monographs were used as a guide: Thomson (1984, 1997), Brodo *et al.* (2001), Smith *et al.* (2009), and Wirth (2013). A list of lichen species found on driftwood was prepared (Table 1). The nomenclature follows Smith *et al.* (2009) and MycoBank (2015). The occurrence and distribution of lichen species in Svalbard were checked using the papers by Elvebakk and Hertel (1996), Ovstedal *et al.* (2009), Zhurbenko and Brackel (2013), and Svalbard Lichen Database (2015).

Herbal materials were deposited in Nicolaus Copernicus University in Toruń (TRN), and in the Herbarium of Institute of Botany of Jagiellonian University in Kraków (KRA).

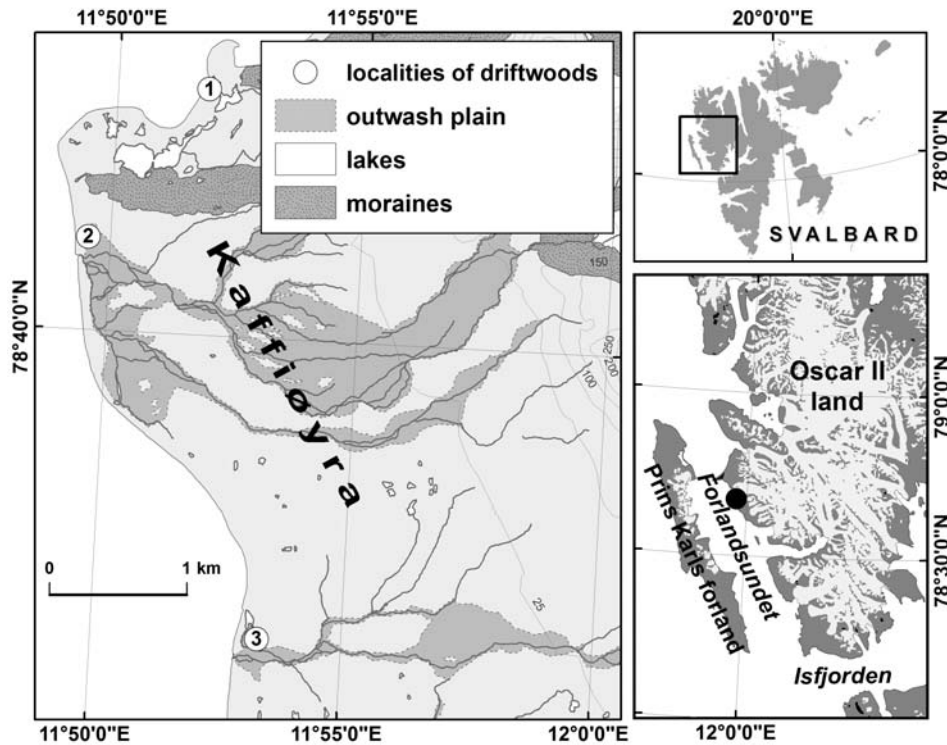


Fig. 1. Distribution of driftwood localities on the coast of the Kaffiøyra Plain. Numbers 1 and 2 mark the localities of logs examined by M. Węgrzyn in July 2012: 1 – $78^{\circ}40'57.9''$ N / $11^{\circ}51'49.1''$ E, alt. 78 m; 2 – $78^{\circ}40'21.8''$ N / $11^{\circ}49'33.4''$ E, alt. 39 m. Number 3 shows the locality of logs examined by E. Adamska in 1997: 3 – $78^{\circ}38'32.0''$ N / $11^{\circ}54'40.3''$ E, alt. 22 m. © Norwegian Polar Institute (www.npolar.no).

Results and discussion

In total, 25 lichen species were found on the driftwood from the Kaffiøyra Plain (Table 1). Five of them are reported for the first time in Svalbard and are new to the archipelago. These are: *Candelariella coralliza*, *Elixia flexella*, *Lecanora saligna*, *Lecidea plebeja*, and *Xylographa sibirica* (Table 1).

Several groups of lichens reported from driftwood can be distinguished in terms of substrate preference. The first one is a group of the stenotopic lichens that consist of three species: *Caloplaca caesiorufella*, *C. fraudans*, and *C. spitsbergensis*. Taxa which belong to the group are characterized by a narrow range of substrate type, and therefore they are considered as specific to the driftwood. *C. caesiorufella* and *C. fraudans* are stenotopic taxa in the area of Svalbard. However, for the entire Arctic, they are treated as a species with a wider tolerance for the type of substrate, because they were repeatedly recorded on mosses, bones, rocks (Søchting 1989; Elvebakk and Hertel 1996; Himmelbrant and Kuznetsova

Table 1
List of species recorded. The numbers refer to the collection sites in Fig. 1.

Species name	Collection site	Previous records on Svalbard	Substrate
<i>Amandinea punctata</i> (Hoffm.) Coppins <i>et</i> Scheid.	1, 3	Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Wood, moss remains, rocks and driftwood (Øvstedal <i>et al.</i> 2009; Himmelbrandt and Kuznetsova 2002)
<i>Bilimbia lobulata</i> (Sommerf.) Hafellner <i>et</i> Coppins	3	Elvebakk and Hertel (1996)	Calcareous soil (Elvebakk and Hertel 1996)
<i>Caloplaca ammiospila</i> (Ach.) H. Olivier	1, 3	Søchting (1989), Elvebakk and Hertel (1996), Adamska <i>et al.</i> (1999), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, mosses, rocks, detritus, bones, and wooden roots (Alstrup 1977; Søchting 1989; Øvstedal <i>et al.</i> 2009)
<i>Caloplaca caesiorufella</i> (Nyl.) Zahlbr.	1	Søchting (1989), Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, mosses, and detritus (Søchting 1989; Øvstedal <i>et al.</i> 2009)
<i>Caloplaca cerina</i> (Hedw.) Th. Fr.	1, 2, 3	Søchting (1989), Elvebakk and Hertel (1996), Adamska <i>et al.</i> (1999), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, mosses, bones, and rocks (Alstrup 1977; Søchting 1989; Adamska <i>et al.</i> 1999; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Caloplaca exsecuta</i> (Nyl.) Dalla Torre <i>et</i> Sarnth.	3	Søchting (1989), Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, bones, and rocks (Søchting 1989; Øvstedal <i>et al.</i> 2009)
<i>Caloplaca fraudans</i> (Th. Fr.) H. Olivier	1, 2, 3	Søchting (1989), Elvebakk and Hertel (1996), Himmelbrandt and Kuznetsova (2002), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, rocks (especially manured), and bones (Søchting 1989; Elvebakk and Hertel 1996; Himmelbrandt and Kuznetsova 2002; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Caloplaca spitsbergensis</i> H. Magn.	1, 2, 3	Elvebakk and Hertel (1996), Adamska <i>et al.</i> (1999), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Driftwood (Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Caloplaca tirolensis</i> Zahlbr.	1, 2	Søchting (1989), Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, mosses, detritus, rocks, and bones (Søchting 1989; Adamska <i>et al.</i> 1999; Øvstedal <i>et al.</i> 2009)
<i>Candelariella arctica</i> (Körb.) R. Sant.	3	Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Shore cliffs and manured silicious rocks, but also on driftwood, and rocks (Alstrup 1977; Elvebakk and Hertel 1996; Øvstedal <i>et al.</i> 2009)
<i>Candelariella coralliza</i> (Nyl.) H. Magn.	1, 3	not reported from Svalbard before	Rocks (Thomson 1997)
<i>Collema ceranicum</i> Nyl.	3	Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009), Redchenko <i>et al.</i> (2010)	Bryophytes (Øvstedal <i>et al.</i> 2009)
<i>Elixia flexella</i> (Ach.) Lumbsch	1, 3	not reported from Svalbard before	–
<i>Lecanora orae-frigidae</i> R. Sant.	1, 3	Elvebakk and Hertel (1996), Himmelbrandt and Kuznetsova (2002), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Driftwood and old wood on shores and beaches (Thomson 1997; Elvebakk and Hertel 1996; Himmelbrandt and Kuznetsova 2002; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)

Table 1 – continued.

Species name	Collection site	Previous records on Svalbard	Substrate
<i>Lecanora saligna</i> (Schrad.) Zahlbr.	1, 3	not reported from Svalbard before	Shrubs (Thomson 1997)
<i>Lecanora zosterae</i> (Ach.) Nyl.	3	Øvstedal <i>et al.</i> (2009)	Bones, driftwood and limestone (Øvstedal <i>et al.</i> 2009)
<i>Lecidea plebeja</i> Nyl.	3	not reported from Svalbard before	–
<i>Lecidella elaeochroma</i> (Ach.) M. Choisy	1	Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Driftwood and shrubs (Thomson 1997; Øvstedal <i>et al.</i> 2009)
<i>Lecidella euphorea</i> (Flörke) Hertel	3	Elvebakk and Hertel (1996), Himelbrant and Kuznetsova (2002)	Driftwood and shrubs (Thomson 1997; Elvebakk and Hertel 1996; Himelbrant and Kuznetsova 2002)
<i>Physcia caesia</i> (Hoffm.) Hampe <i>et</i> Fűrnr.	1, 3	Elvebakk and Hertel (1996), Himelbrant and Kuznetsova (2002), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Wood, driftwood, rocks, lichens and bryophytes (Alstrup 1977; Himelbrant and Kuznetsova 2002; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Polyblastia cupularis</i> A. Massal.	3	Elvebakk and Hertel (1996), Øvstedal <i>et al.</i> (2009)	Limestone and sandstone (Øvstedal <i>et al.</i> 2009)
<i>Protothelenella sphinctrinoidella</i> (Nyl.) H. Mayrhofer <i>et</i> Poelt	2, 3	Elvebakk and Hertel (1996), Himelbrant and Kuznetsova (2002), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Soil, lichens, bryophytes, driftwood (Thomson 1997; Himelbrant and Kuznetsova 2002; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Rinodina archaea</i> (Ach.) Arnold	1, 3	Elvebakk and Hertel (1996), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Driftwood, mosses and dead twigs of <i>Salix</i> sp. (Elvebakk and Hertel 1996; Thomson 1997; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Xanthoria elegans</i> (Link) Th. Fr.	1, 3	Elvebakk and Hertel (1996), Osyczka and Węgrzyn (2008), Øvstedal <i>et al.</i> (2009)	Manured or calcareous rocks, driftwood (Elvebakk and Hertel 1996; Adamska <i>et al.</i> 1999; Osyczka and Węgrzyn 2008; Øvstedal <i>et al.</i> 2009)
<i>Xylographa sibirica</i> Zahlbr.	1, 3	not reported from Svalbard before	Old wood known only from Siberia (Thomson 1997)

2002; Osyczka and Węgrzyn 2008; Øvstedal *et al.* 2009). Therefore, they can be considered as eurytopic species in the whole Arctic.

The typical lichens are represented by six species: *Elixia flexella*, *Lecanora orae-frigidiae*, *L. saligna*, *L. elaeochroma*, *Rinodina archaea*, and *Xylographa sibirica*. They are typical for driftwood, however they can also grow on other types of lignum.

The accidental taxa are those, which were occasionally found on driftwood, because of their preference to completely different substrate. These species are: *Candelariella arctica*, *C. coralliza*, *Lecanora plebeja*, *Bilimbia lobulata*, and *Xanthoria elegans*.

Eleven of the recorded species are considered as eurytopic: *Amandinea punctata*, *Caloplaca ammiospila*, *C. cerina*, *C. exsecuta*, *C. tirolensis*, *Collema ceraniscum*, *Lecanora zosterae*, *L. euphorea*, *Physcia caesia*, *Polyblastia cupularis*, and *Protothenella sphinctrinoidella*. These lichens have a wide range of substrate types.

The presence of species of the last two groups on driftwood may be associated with a high sea salt saturation of the timber. Because of that the wood becomes similar to the rocky substrate.

Within the listed taxa, several species are ornitocoprophilous, such as: *Candelariella arctica*, *C. coralliza*, and *Xanthoria elegans*. Their occurrence on logs is connected with the fertilization of the driftwood by sea birds.

Among all kinds of habitats in Svalbard, driftwood is relatively a homogeneous one. Therefore, regardless of the place of log deposition, it is inhabited by a similar lichen biota. Consecutive studies confirm the presence of regularly occurring species group associated with driftwood. Moreover, on its surface, incidentally appear some additional taxa that increase the species diversity. However, the most interesting are stenotopic lichens for which driftwood is the only type of habitat in the Arctic.

Acknowledgements. — We wish to thank Dr. Ireneusz Sobota, the Station Leader of Nicolaus Copernicus University Polar Station in Kaffiøyra for providing an access to the station. We are grateful to Edwin Liebig (University of Iceland) for the linguistic corrections. We are thankful to reviewers for suggestions and remarks on our manuscript.

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Received 26 January 2015

Accepted 28 April 2015