

# PHYTON

## ANNALES REI BOTANICAE

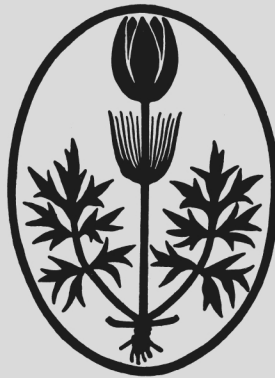
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### **Terricolous Lichens in the Glacier Forefield of the Morteratsch Glacier (Eastern Alps, Graubünden, Switzerland)**

By

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With 1 Figure

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#### Summary

BILOVITZ P. O., NASCIBENE J. & MAYRHOFER H. 2015. Terricolous lichens in the glacier forefield of the Morteratsch glacier (Eastern Alps, Graubünden, Switzerland). – *Phyton* (Horn, Austria) 55 (2): 193–199, with 1 figure.

Three sampling sites were established at increasing distance from the Morteratsch glacier to investigate lichen communities on soil in the glacier forefield. The

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survey yielded 13 lichen species and one lichenicolous fungus. *Peltigera extenuata* (NYL. ex VAIN.) LOJKA (*Peltigerales*) is new to the canton of Graubünden.

### Zusammenfassung

BILOVITZ P. O., NASCIMBENE J. & MAYRHOFER H. 2015. Terricolous lichens in the glacier forefield of the Morteratsch glacier (Eastern Alps, Graubünden, Switzerland). [Terricole Flechten im Gletschervorfeld des Morteratschgletschers (Ostalpen, Graubünden, Schweiz)]. – *Phyton* (Horn, Austria) 55 (2): 193–199, mit 1 Abbildung.

Es wurden drei Aufnahmeflächen mit zunehmender Entfernung vom Morteratschgletscher festgelegt, um Flechtengemeinschaften auf Erde im Gletschervorfeld zu untersuchen. Die Erhebung ergab 13 Flechtenarten und einen lichenicolen Pilz. *Peltigera extenuata* (NYL. ex VAIN.) LOJKA (*Peltigerales*) ist ein Neufund für den Kanton Graubünden.

### 1. Introduction

Global warming is causing a continuous retreat of glaciers in the Alps. Simultaneously, the growing areas of recently bared glacier forefields are providing new ecological niches for pioneer organisms. There are several ecological studies dealing with the process of vegetation colonization and succession from pioneer to climax communities in relation to site age in glacier forefields of the Alps (e. g. CACCIANIGA & ANDREIS 2004, RAFFL & ERSCHBAMER 2004, BURGA & al. 2010), but little is known about soil lichens in these special habitats.

In the framework of a project on the impact of changing local conditions on lichen occurrence in glacier retreat regions, we investigated the terricolous lichen biota of five glacier forefields in the Eastern Alps (see also BILOVITZ & al. 2014a, 2014b, 2014c, 2015). The floristic data from the forefield of the Morteratsch glacier (Fig. 1) in Graubünden, Switzerland are presented in this paper.

The Morteratsch glacier is the third largest and by volume the most massive glacier in the Eastern Alps. Periodically length measurements have been recorded since 1878 (Gletscherberichte 1881–2014). Due to the screening effect of the surrounding mountains the climate is continental. The bedrock consists of siliceous rocks, the soils in the forefield area are weakly developed and have a maximum age of 150 years (MAISCH & al. 1999). Vegetation development on the foreland was investigated by BURGA 1999a, 1999b and BURGA & al. 2010. MAISCH & al. 1999 gave an overview of glaciology, geomorphology, geology, soils, flora and vegetation of the foreland of the Morteratsch glacier. BURGA 1999c listed some terricolous (*Cetraria islandica*, *Cladonia rangiferina*, *Thamnolia vermicularis*), saxicolous (*Ophioparma ventosa*, *Rhizocarpon geographicum*) and corticolous lichens (*Letharia vulpina*, *Pseudevernia furfuracea*).



Fig. 1. Morteratsch glacier and its forefield. – Phot. H. Mayrhofer, 28. VIII. 2013.

## 2. Material and Methods

Sampling location: Switzerland, Graubünden, Bernina Range, S of Plauns, Morteratschtal, 46°25'–26°N/09°55'–56"E, 1965–2020 m, glacier forefield of the Morteratsch glacier, 27. & 28.VIII.2013, leg. H. & E. MAYRHOFER.

Three sampling sites were established at increasing distance from the glacier, corresponding to a gradient of moraine age: site 1 = c. 300 m (ice-free for c. 25 years), site 2 = c. 800 m (ice-free for c. 40 years), site 3 = c. 1500 m (ice-free for c. 70 years). In each site, lichens on soil were surveyed within five 1 x 1 m randomly placed plots. Spots with larger stones were avoided. Vascular plants were present in all sites, but, with increasing distance from the glacier, diversity rose and vegetation cover became denser. Each plot was divided into 10 x 10 cm quadrats (BILOVITZ & al. 2014a: Fig. 2), in order to obtain data on species frequency (max. frequency/plot = 100). For each species, specimens were collected for a more accurate identification in the laboratory.

The specimens have been identified mainly with the aid of WIRTH & al. 2013, using routine light microscopy techniques. Some of the identifications required verification by using standardized thin-layer chromatography (TLC), following the protocols of WHITE & JAMES 1985 and ORANGE & al. 2001. The specimens are preserved in the herbarium of the Institute of Plant Sciences, University of Graz (GZU). The nomenclature follows WIRTH & al. 2013.

## 3. Results and Discussion

In total, 13 lichen species (Table 1) and the lichenicolous fungus *Lasiosphaeriopsis stereocaulicola* (Th. Fr. ex LINDS.) O. E. ERIKSS. & R. SANT. on *Stereocaulon alpinum* were found in the three sampling sites. The foliose lichen *Peltigera extenuata* (*Peltigerales*) growing on soil is new to the canton of Graubünden.

At a distance of about 300 m to the glacier (site 1), ground cover with lichens was low with *Stereocaulon alpinum* as the only lichen species (frequency of 97). It appeared much later than pioneer vascular plants such as *Epilobium fleischeri* and *Oxyria digyna*. This observation conforms to BURGA & CORRODI 2011, who found first occurrence of *Stereocaulon alpinum* in an area, which has been ice-free since 1980.

At a distance of about 800 m to the glacier (site 2), we found the 5 fruticose lichens *Cladonia arbuscula* s. l. (2), *C. cf. subulata* (2), *C. pyxidata* s. l. (22), *C. fimbriata* (59), and *Stereocaulon alpinum*, which was not only the most noticeable, but also the most frequent species (356).

The number of species rose significantly at a distance of about 1500 m from the glacier (site 3), where we found 12 lichens. The foliose lichen *Peltigera rufescens* (128) and the fruticose lichens *Cetraria islandica* (129) and *Stereocaulon alpinum* (257) reached the highest frequency values.

Table 1: List of lichenized taxa with the frequency of each species in the three sampling sites.

Taxon	Frequency		
	Site 1	Site 2	Site 3
<i>Cetraria ericetorum</i> OPIZ	0	0	3
<i>Cetraria islandica</i> (L.) ACH.	0	0	129
<i>Cladonia arbuscula</i> s. l.	0	2	0
<i>Cladonia arbuscula</i> (WALLR.) FLOT. subsp. <i>squarrosa</i> (WALLR.) RUOSS	0	0	1
<i>Cladonia borealis</i> S. STENROOS	0	0	1
<i>Cladonia cariosa</i> s. l.	0	0	18
<i>Cladonia fimbriata</i> (L.) FR.	0	59	5
<i>Cladonia gracilis</i> (L.) Willd.	0	0	2
<i>Cladonia macroceras</i> (DELISE) HAV.	0	0	2
<i>Cladonia pyxidata</i> s. l.	0	22	33
<i>Cladonia</i> cf. <i>subulata</i> (L.) WEBER ex F. H. WIGG.	0	2	0
<i>Peltigera extenuata</i> (NYL. ex VAIN.) LOJKA	0	0	1
<i>Peltigera rufescens</i> (WEISS) HUMB.	0	0	128*
<i>Stereocaulon alpinum</i> LAURER	97	356	257

\*) doubtful frequency data

In comparison to the forefields of the Rötkees in South Tyrol (BILOVITZ & al. 2014a) with 29 lichen species, the Matscherferner in South Tyrol (BILOVITZ & al. 2014b) with 34 species, the Pasterze in Carinthia (BILOVITZ & al. 2015) with 35 species and the Gaisbergferner in Tyrol (BILOVITZ & al. 2014c) with 39 species, it is noticeable that lichen diversity in the forefield of the Morteratsch glacier is significantly lower and that crustose lichens are entirely lacking. Probably, the reasons are the acid character of the soils, the huge amount of pebbles and the massive lateral moraines, consisting of loose and bare material.

The number of lichen species in all five glacier forefields adds up to a total of 83 (BILOVITZ & al. 2015: Tab. 2). Five species occurred in each of them, namely *Cetraria islandica*, *Cladonia macroceras*, *C. pyxidata* s. l., *Peltigera rufescens* and *Stereocaulon alpinum*. The latter is a fruticose species and presumably the most constant soil lichen occurring in glacier forelands of the Alps, more precisely in areas which have been ice-free for at least twenty years, e. g. Lys glacier (Italy; TRETER & al. 2002), Rötkees (Italy; BILOVITZ & al. 2014a), Matscherferner (Italy; BILOVITZ & al. 2014b), Morteratsch glacier (Switzerland; this paper, BURGA & CORRODI 2011), Gaisbergferner (Austria; BILOVITZ & al. 2014c), Rotmoosferner (Austria; NAGL & ERSCHBAMER 2010, TÜRK & ERSCHBAMER 2010a), Pasterze (Austria; BILOVITZ & al. 2015) and Winkelkees (Austria; EGGER 1997).

BILOVITZ & al. 2014a, 2014b, 2014c, 2015 showed that increasing lichen diversity and abundance directly correlate with the increasing age of the moraine. These results are similar to those of TÜRK & ERSCHBAMER 2010a, 2010b, who listed 31 lichens growing on soil, plant debris and terricolous mosses from the Rotmoosferner in Tyrol and found the same pattern of lichen diversity in relation to moraine age.

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