

# Terricolous lichens in the glacier forefield of the Matscherferner (Eastern Alps, South Tyrol, Italy)

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Two sampling sites were established at increasing distance from the glacier to investigate lichen communities on soil, plant debris and terricolous mosses in the glacier forefield of the Matscherferner. The survey yielded 34 lichen species and one lichenicolous fungus. In addition, 19 lichen species and one lichenicolous fungus were found by collecting at random, outside the two sampling sites.

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cole Flechten im Gletschervorfeld des Matscherferners (Ostalpen, Südtirol, Italien).**

Es wurden zwei Aufnahmeflächen mit zunehmender Entfernung vom Gletscher festgelegt, um Flechtengemeinschaften auf Erde, Pflanzenresten und terricolen Moosen im Gletschervorfeld des Matscherferners zu untersuchen. Die Erhebung ergab 34 Flechtenarten und einen lichenicolen Pilz. Bei stichprobenartigen Aufsammlungen außerhalb der Aufnahmeflächen wurden 19 Flechtenarten und ein lichenicoler Pilz gefunden.

**Keywords:** Lichenized ascomycetes, biodiversity, ecology, flora, floristics, Alps, alpine belt, glacier retreat.

## Introduction

Global warming is causing a continuous retreat of glaciers in the Alps. Between 1983 and 2006, the total glacier area in South Tyrol decreased from 136.6 km<sup>2</sup> to 93.4 km<sup>2</sup>, a decline of 31.6 %. The Ötztal Alps and the Ortler-Cevedale Group are particularly affected by the loss of glacier volume (KNOLL & KERSCHNER 2009). Simultaneously, the growing areas of recently bared glacier forefields are providing new ecological niches for pioneer organisms such as terricolous lichens. These organisms are suitable indicators of various environmental disturbances of alpine regions, because of their direct contact with the soil, their competition with other ground vegetation and their sensitivity to anthropogenic influences (St. CLAIR et al. 2007, RAI et al. 2012).

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 et al. 2014a, 2014b). The floristic data from the forefield of the Matscherferner in South Tyrol are presented in this paper.

The Matscherferner is situated in a valley called Matschertal in South Tyrol, Italy. It is a side valley of the Vinschgau, runs from southwest to northeast, extends to about 20 km and covers an area of about 100 km<sup>2</sup> (MAIR 2011). Due to the screening effect of the surrounding mountains the climate is continental. The bedrock consists of siliceous rocks with no percentage of limestone, thus the soils have an acid character (VAROLO & ZERBE 2012). According to SCHIRRMACHER (2012), the landscape of the upper Matschertal is characterized by forests between 1700 and 2100 m, alpine grasslands, and sparsely vegetated glacier moraines at a higher elevation. The characteristics of abiotic factors along the proglacial chronosequence and their influences on the development of plant communities were investigated by SCHIRRMACHER (2012).

## Material and Methods

Sampling location: Italy, South Tyrol, Ötztal Alps, NE of Matsch, Matscher-  
tal, 46°46'N/10°41'E, 2390–2560 m, glacier forefield of the Matscherferner, 20. &  
22.VIII.2013, leg. V. TUTZER & A. WALLNER.

Two sampling sites were established at increasing distance from the glacier, corresponding to a gradient of moraine age: site 1 = c. 800 m, site 2 = c. 1400 m. In each site, lichens were surveyed within five 1 x 1 m randomly placed plots, both on soil (ter) and on plant debris or decaying terricolous mosses (deb). Spots with larger stones were avoided. Vascular plants were present in both 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 et 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 et 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 et al. (2001). The specimens are preserved in the herbarium of the Institute of Plant Sciences, University of Graz (GZU). The nomenclature mainly follows WIRTH et al. (2013), or other modern treatments.

## Results and Discussion

In total, 34 lichen species and the lichenicolous fungus *Arthonia stereocaulina* (Ohlert) R. Sant. on *Stereocaulon alpinum* were found in the two sampling sites.

Unfortunately, we could not sample terricolous lichens near the current immediate front of the glacier. At a distance of about 800 m to the glacier (site 1), we found 22 species. The fruticose lichens *Stereocaulon alpinum* and *Cetraria islandica* reached the highest frequency values, followed by *Cladonia borealis*, *Flavocetraria nivalis*, *Cladonia pyxidata* s. l., *Thamnolia vermicularis*, *Cetraria muricata*, *Cladonia macroceras* and the foliose lichen *Solorina crocea*. The rest of the species only occurred with frequency values less than 30.

At a distance of about 1400 m to the glacier (site 2), we found a similar species assemblage with 30 species. Again, the fruticose lichens *Stereocaulon alpinum* and *Cetraria islandica* reached the highest frequency values, followed by *Cladonia* cf. *mitis*, *Flavocetraria nivalis*, *Thamnolia vermicularis*, *Cladonia* cf. *pleurota*, *Cetraria muricata*, *Solorina crocea*, *Cladonia borealis* and *Peltigera rufescens*. The rest of the species only occurred with frequency values less than 30.

In comparison to the glacier forefields of the Rötkees in South Tyrol (BILOVITZ et al. 2014a) with 29 lichen species, and the Gaisbergferner in Tyrol (BILOVITZ et al. 2014b) with 39 species, it is noticeable that crustose lichens on plant debris or decaying terricolous mosses are almost lacking in the forefield of the Matscherferner. However, lichen species such as *Caloplaca stillicidiorum* agg., *C. tirolensis*, *Lecidella wulfenii*, *Lecanora epibryon* and *L. hagenii* var. *fallax* usually occur on remains of plant species growing on calcareous soil and for this reason are probably missing here.

Tab. 1: List of lichenized taxa with their substrata and the frequency of each species at the two sampling sites. – Tab. 1: Liste der lichenisierten Taxa mit ihren Substraten und Frequenz jeder einzelnen Art in den beiden Aufnahmefflächen.

Taxon	Substratum	Site 1	Site 2
<i>Amandinea punctata</i> (Hoffm.) Coppins & Scheid.	deb	0	1
<i>Arthrorhaphis citrinella</i> (Ach.) Poelt	ter	2	1
<i>Caloplaca ammiospila</i> (Wahlenb.) H. Olivier	deb	0	9
<i>Cetraria ericetorum</i> Opiz	ter	3	0
<i>Cetraria islandica</i> (L.) Ach.	ter	139	127
<i>Cetraria muricata</i> (Ach.) Eckfeldt	ter	42	59
<i>Cladonia arbuscula</i> s. l.	ter	11	3
<i>Cladonia borealis</i> S. Stenroos	ter	76	36
<i>Cladonia cariosa</i> s. l.	ter	7	0
<i>Cladonia macroceras</i> (Delise) Hav.	ter	41	17*
<i>Cladonia</i> cf. <i>mitis</i> Sandst.°	ter	0	121
<i>Cladonia</i> cf. <i>pleurota</i> (Flörke) Schaer.	ter	0	66
<i>Cladonia pyxidata</i> s. l.	ter	57*	10*
<i>Cladonia uncialis</i> (L.) Weber ex F. H. Wigg.	ter	0	24
<i>Cladonia</i> spec.	ter	2	19
<i>Dibaeis baeomyces</i> (L. f.) Rambold & Hertel	ter	6	4*
<i>Flavocetraria nivalis</i> (L.) Kärnefelt & Thell	ter	72	102
<i>Lecidea hypnorum</i> Libert	ter	0	1
<i>Lecidoma demissum</i> (Rutstr.) Gotht. Schneid. & Hertel	ter	0	3
<i>Lepraria</i> cf. <i>diffusa</i> (J. R. Laundon) Kukwa	ter	0	10
<i>Lepraria eburnea</i> J. R. Laundon	deb	0	4
<i>Lepraria finkii</i> (Hue) R. C. Harris	deb, ter	4	3
<i>Peltigera didactyla</i> (With.) J. R. Laundon	ter	0	1
<i>Peltigera rufescens</i> (Weiss) Humb.	ter	8	33
<i>Psoroma hypnorum</i> (Vahl) Gray	ter	0	10
<i>Psoroma tenue</i> Henssen var. <i>boreale</i> Henssen	ter	1	4
<i>Pycnothelia papillaria</i> (Ehrh.) Dufour	ter	28*	9*
<i>Rinodina mniaraea</i> (Ach.) Körb.	deb, ter	0	7
<i>Solorina crocea</i> (L.) Ach.	ter	40	48
<i>Stereocaulon alpinum</i> Laurer	ter	361	283
<i>Tetramelas insignis</i> (Nägeli) Kalb	deb	1	0
<i>Thamnolia vermicularis</i> (Sw.) Schaer.	ter	56	98
<i>Trapeliopsis granulosa</i> (Hoffm.) Lumbsch	ter	2	1
sterile, sorediate crustose lichen	ter	12	0

\*) doubtful frequency data. °) TLC only showed usnic acid.

The number of lichen species in all three glacier forefields adds up to a total of 66. Ten species occurred in each of the three forefields, namely *Cetraria islandica*, *C. muricata*, *Cladonia cariosa* s. l., *C. macroceras*, *C. pyxidata* s. l., *Peltigera rufescens*, *Psoroma tenue* var. *boreale*, *Rinodina mniaraea*, *Stereocaulon alpinum* and *Thamnolia vermicularis*.

Interestingly, *Psoroma tenue* var. *boreale*, an overlooked species and at least similarly common and widely distributed in the Alps as *Psoroma hypnorum* (BREUSS 2012), seems to be

rather frequent in glacier forefields. This observation corroborates the findings of JØRGENSEN (2004) who described the species as a weak competitor, preferring wet, naked soils that can be found near glaciers, in tundra environments, or in late snow beds.

According to WIRTH et al. (2013), both leprose species found in this study, *Lepraria eburnea* and *L. finkii*, occur up to the montane level. However, our records from the alpine zone indicate that they can establish at higher elevation as well (see also the records of *L. eburnea* from the alpine zone in BILOVITZ et al. 2014b).

BILOVITZ et al. (2014a, 2014b) 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.

Ecological analyses on our dataset can be conducted in more depth when data will be available for all five glacier forefields covered by the project.

Random collections in the higher part of the valley (Italy, South Tyrol, Ötztal Alps, NE of Matsch, Matschertal, 46°47'04"–10°N/10°41'37"–43°E, 2730–2810 m, surroundings of the Matscherferner, 21.VIII.2013, leg. V. TUTZER & A. WALLNER) yielded 19 additional lichen species and the lichenicolous fungus *Illosporium carneum* Fr. on *Peltigera rufescens*.

The species composition of this locality, that had been ice-covered for a long time, was similar to that of site 2, 14 out of 19 species being shared.

*Arthrorhaphis citrinella* (Ach.) Poelt: ter  
*Bryonora castanea* (Hepp) Poelt: deb  
*Cetraria islandica* (L.) Ach.: ter  
*Cetraria muricata* (Ach.) Eckfeldt: ter  
*Cladonia borealis* S. Stenroos: ter  
*Cladonia cariosa* s. l.: ter  
*Dibaeis baeomyces* (L. f.) Rambold & Hertel: ter  
*Lecidoma demissum* (Rutstr.) Gotth. Schneid. & Hertel: ter  
*Lepraria eburnea* J. R. Laundon: ter  
*Lepraria finkii* (Hue) R. C. Harris: ter  
*Peltigera rufescens* (Weiss) Humb.: ter  
*Placynthiella oligotropha* (J. R. Laundon) Coppins & P. James: ter  
*Protopannaria pezizoides* (Weber) P. M. Jørg. & S. Ekman: ter  
*Psoroma tenue* Henssen var. *boreale* Henssen: ter  
*Pycnothelia papillaria* (Ehrh.) Dufour: ter  
*Rinodina mniaraea* (Ach.) Körb.: deb  
*Solorina crocea* (L.) Ach.: ter  
*Stereocaulon alpinum* Laurer: ter  
*Tetramelas insignis* (Nägeli) Kalb: deb

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