

LIVE: Lichen holobiome diversity along climatic gradients

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Lecideoid Lichens © U. Ruprecht 2022



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Wider research context / theoretical framework

Organisms inhabiting climatically extreme regions are sensitive to changes in environmental conditions. Current climate warming, for instance, forces cold-adapted lichens to shift their natural geographic distributions, which may cause changes in composition and associations between fungi, algae, and bacteria that form the lichen holobiont. Accordingly, lichens are ideal model systems to study the effects of climate warming on species interactions and diversity.

The proposed project aims at gaining a broad-scale view on fungi-algae-bacteria associations in lichen thalli along a latitudinal and elevational gradient with overlapping climate conditions in the southern Polar Regions and in high mountainous areas (Austrian Alps).

Hypotheses / research questions / objectives

The hypotheses for the proposed study are: (1) The composition and diversity of fungal, algal and bacterial communities is shaped by geography, environmental conditions and the identity of the associated partners. (2) The network structure summarizing the association patterns between the three partners are shaped by geography, the environmental conditions as well as on the identity of the associated partners. (3) Certain lichens (i.e. their fungi-algae-bacteria associations) which respond specifically to environmental conditions can be used as bioindicators of climate change by quantitatively measurable decreases or increases in abundance.

Approach / methods

To test these hypotheses, we will record the complete inventory of fungi, algae, and bacteria (lichen holobiont) using advanced molecular tools (next generation sequencing as well as classical phylogenetic analyses). These diverse and complex interaction data will be analyzed by state-of-the-art statistical methods such as network statistics and niche modeling using the concept of n -dimensional hypervolumes.

Level of originality / innovation

This study will provide fundamentally new insights by using community ecology techniques to model the present-day climate-related ecological requirements of fungi-algae-bacteria interactions in lichen holobiomes.

Most of the cost-intensive sampling of the required lichen specimens at the Falkland Islands, Maritime and Continental Antarctica was done prior to the start of the project by the applicant and her cooperation partner. These samples together with existing data and samples from the Austrian Alps will allow for a comprehensive global study on lichen diversity and their fungi-algae-bacteria associations in the context of climate, distribution and niche requirements.

Primary researchers involved

The proposed study will be carried out by the applicant, Ulrike Ruprecht in close collaboration with her co-author [Robert R. Junker](#), cooperation-partner [Wolfgang Trutschnig/IDA Lab Salzburg](#) and two students at the Universities of Salzburg and Marburg.

Publications

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Fryday, A.M., **Ruprecht, U.**, Götz, A.M., Kantvilas, G. (2025) *Aurantiothallia* and *Hertelaria*, two new genera of porpidioid *Lecideaceae* (Ascomycota, *Lecanoromycetidae*, *Lecideales*), and other new porpidioid taxa from Tasmania. *Lichenologist*. <https://doi.org/10.1017/S0024282925101333>

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Science Communication

⇒ scilog FWF: [Adapting to climate change in rock crevices](#)

Lichen working group Salzburg



Austria, Hohe Tauern, Hexenküche: July 2022
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