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Symbionts and changing environment: Lichen diversity and photobiont associations in tropical mountain ecosystems

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Epiphytes comprise a significant component of biodiversity and biomass in tropical forests. They are ecologically important in intercepting and retaining moisture, providing habitat and food for invertebrates, and contributing fixed nitrogen into the ecosystem. Lichens are mutualistic symbioses between lichen-forming fungi (mycobionts) and algae and/or cyanobacteria (photobionts). Most lichen mycobionts are specific in their photobiont choice and the local availability of compatible photobionts may limit their ability to disperse into new habitats.

The aims of this study are to 1) provide the first account of lichen symbiont diversity in tropical mountains, with focus on changes along topographic gradients, and 2) elucidate the effects of human induced environmental change to lichen symbiotic organisms, including the effects of expansion of agricultural and other disturbed ecosystems, and changing climate. The results will be a significant contribution to understanding tropical biodiversity since so far very few studies deploying modern molecular biological methods have included lichens from East Africa.

Lichens, bryophytes, and free-living cyanobacteria and green algae, along the natural environmental gradient of the southern slope of Kilimanjaro including all main ecosystem types. The sampling is focused on study plots established by the KiLi project[1]. The collected specimens will be studied microscopically, with chemical analyses, and molecular biology methods.

So far we have sampled several plots within the natural savanna, maize fields, grassland, and Chagga homegardens (3–5 sampled plots each ecosystem type). The specimens have been studied microscopically. The preliminary results show that clear differences exist in lichen biota between different plot types: lichen abundance seems to depend especially on presence/absence of woody plants, lichen species on the climate, and lichen diversity on substrate variability. In all studied plots lichens mainly occur epiphytically on shrubs and trees.

[1] https://www.kilimanjaro.biozentrum.uni-wuerzburg.de/Default.aspx

Symbionts and changing environment: Lichen diversity and photobiont associations in tropical mountain ecosystems

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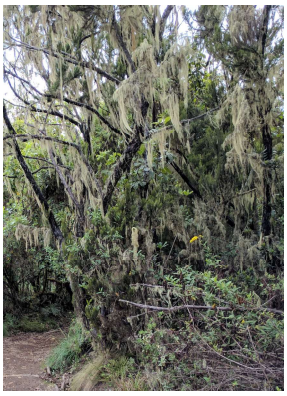
Introduction

Epiphytes comprise a significant component of biodiversity and biomass in tropical forests. They are ecologically important in intercepting and retaining moisture, providing habitat and food for invertebrates, and contributing fixed nitrogen into the ecosystem.



Lichens are mutualistic symbioses between lichen-forming fungi (mycobionts) and algae and/or cyanobacteria (photobionts).

Objectives

1) Provide first account of **lichen symbiont diversity in tropical mountains**, with focus on changes along topographic gradients.
2) Elucidate the effects of human induced **environmental change** to lichen symbiotic organisms, including the effects of expansion of agricultural and other disturbed ecosystems, and changing climate.

Material and Methods

Lichens, bryophytes, and free-living cyanobacteria and green algae are recorded along the natural environmental gradient of the southern slope of Kilimanjaro including all main ecosystem types. The collected specimens are studied microscopically, with chemical analyses, and with molecular biology methods.

Preliminary Results

KiLi project plots so far sampled: Savanna 5 plots, Maize 4 plots, Grass 3 plots, and Home Garden 4 plots.

In all plots lichens mainly occur epiphytically on shrubs and trees.

Clear differences in lichen biota between different plot types: lichen abundance seems to depend especially on presence/absence of woody plants, lichen species on the climate, and lichen diversity on substrate variability.

Savanna. Small, adnate foliose lichens, especially members of the Caliciales (*Physcia, Pyxine, Dirinaria, Heterodermia*) and several species of Collemataceae. Also some parmelioids (*Bulbothrix, Parmotrema*) and *Candelaria* cf. *concolor* are frequent.

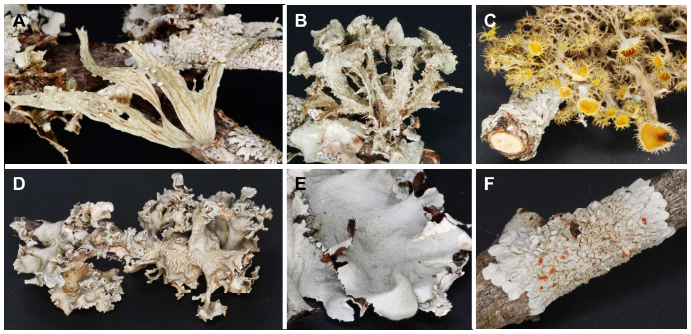


Figure 1. Lichens from grass and home garden habitats from Mt. Kilimanjaro. A) *Ramalina* cf. *celastri*, B) *Ramalina* cf. *africana*, C) *Teloschistes* cf. *chrysophthalmus*, D) *Parmotrema* sp., E) *Parmotrema* cf. *reticulatum*, and F) *Dirinaria* cf. *coccinea*.

Maize. Very few lichens since shrubs and trees are missing: three out of the four investigated plots without any (macro)lichens.

Grass. Foliose and fruticose epiphytes of the families Parmeliaceae (*Parmotrema, Hypotrachyna, Usnea*) and Physciaceae (*Heterodermia, Physcia, Pyxine, Dirinaria)*, and species of *Ramalina* and *Teloschistes* common.

Home Gardens. Foliose and fruticose lichens abundant and diverse especially in the higher canopy. Family Parmeliaceae (*Parmotrema, Hypotrachyna, Usnea*, *Punctelia*) and order Caliciales (*Heterodermia, Physcia, Pyxine)*, and species of *Ramalina* and *Teloschistes* common. Additionally many cyanolichens, including *Leptogium, Collema, Crocodia, Sticta, Lobaria,* and *Coccocarpia.*

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