Abstract

The choice of lichen photobionts is usually influenced by the environmental conditions in which the lichen grows (e.g. climatic conditions, substrate type and pH). In environments that are stressful to lichens in some way, multiple species (and genera) of photobionts may occur in a single lichen thallus at the same time. In a hostile environment, a mycobiont may also replace its usual photobiont with a photobiont that is better adapted to the environmental conditions. Both of these phenomena appear to occur in lichens growing in recently formed anthropogenic habitats with high levels of heavy metals (dumps, heaps, tailings).

The aim of my work is to determine the species composition of photobionts of lichens growing on serpentinites, which can be considered as natural analogues of anthropogenically formed (post-industrial) habitats with high content of heavy metals, and to compare it with the species composition of photobionts of lichens growing on the control rock amphibolite, which represents a naturally formed substrate with different heavy metal levels. Photobionts of serpentinite lichens are so far only known from only 13 lichen thalli from one serpentinite locality.

I collected thalli of ten euryoecious lichen species and one serpentinite specialist from five serpentinite and five climatically comparable amphibolite localities within the Czech Republic. I confirmed the identity of mycobionts and photobionts based on ITS rDNA. The lichen thalli contained 17 lineages of algae of the genus *Trebouxia* and 11 lineages of algae of the genus *Asterochloris*. These lineages, however, differed only minimally between serpentinites and amphibolites. I detected a plurality of photobionts in a single thallus of the lichen *Lecanora rupicola* using Illumina meta-barcoding. I subsequently confirmed the presence of the genera *Trebouxia* and *Coccomyxa* by light microscopy.

At all sites, I measured heavy metal content using a portable X-ray fluorescence analyzer (XRF), pH and conductivity. I used scanning electron microscopy with energy dispersive spectrometer (SEM-EDS) to verify the presence of metal-rich particles in the lichen thalli and to visualize them. I was thus able to confirm that the crustose lichens take up large amounts of fragments of the rock they grow in their thalli.

The mycobionts of the serpentinite lichens that I examined exhibit a low level of specificity and selectivity towards the photobionts with which they are in a symbiotic relationship. It is likely that heavy metals from the serpentinites are not available to the lichens and therefore serpentinites probably do not represent a toxic substrate for the lichens or free-living photobionts. For this reason, photobionts known from other non-toxic substrates are found in the thalli of lichens from serpentinite sites.

Key words: serpentinite, amphibolite, *Trebouxia, Asterochloris*, heavy metals, pH, XRF, SEM-EDS