Abstract

My study is focused on green algal photobionts – lichenized algae from the genera *Asterochloris* and *Trebouxia* (the last was studied in a lesser extent). The principal objectives of the thesis can be characterized as follows: 1) to investigate the chloroplast morphology in lichenized algae *Asterochloris* and *Trebouxia*; 2) to study the photobiont diversity in lichen community growing in heavy metal polluted habitats; 3) to inventorize the photobionts in selected lichen taxa (*Lepraria*, *Stereocaulon*) in order to reveal their ecological requirements.

Using confocal microscopy, significant differences in the chloroplast structure of lichenized and cultured (free-living) algae were detected. Moreover, algae exhibited gradual changes in chloroplast shape and structure during successive phases of cultivation – from the relatively simple lichenized form to the complex lobate chloroplast with several ontogenetic (morphological) stages observable in mature axenic cultures.

Several *Asterochloris* lineages and one *Trebouxia* species were detected in terricolous lichen community from metal-polluted habitats using phylogenetic analysis of algal ITS sequences. All these lineages represented photobionts with broad ecological amplitude and worldwide distribution. In several taxa of pioneer lichens, low specificity as well as selectivity of lichen-forming fungi to their photobionts was revealed. They associated with several algal lineages (even within one thallus). Therefore, they can serve as an important photobiont transferring system.

Using phylogenetic analysis based on the concatenated set of ITS rDNA and actin type I locus sequences, 13 well resolved clades of *Asterochloris* were found to be associated with *Lepraria* and *Stereocaulon* species investigated. Rather low specificity and intensive switching of photobionts was revealed in asexual *Lepraria*. Photobionts from particular algal clades were found in taxonomically different but ecologically similar lichens. The rain and sun exposure was the most significant environmental factor, clearly distinguishing the *Asterochloris* lineages. Moreover, two photobiont lineages were obviously differentiated based on their substrate and climatic preferences. These environmental preferences of photobionts control the ecology of lichens and lead to the existence of specific lichen guilds. During the whole study, almost 240 new photobiont sequences from 154 lichen specimens were produced. From a total of 39 species of lichen-forming fungi, eight species were investigated that have not been analysed for their photobionts to date. Many new lineages of lichenized algae were revealed.