Abstract

Lichens are currently viewed as complex symbiotic systems. In addition to the main mycobiont and photobiont, a variety of associated fungi, bacteria and algae/cyanobacteria (minor/accessory photobionts) have been recognized. Their diversity has been intensively studied, but is still far from being fully apprehended. Likewise, recognition of the significance of the associated organisms to the whole system is still at the beginning but various crucial roles, from constitutive morphogenetic through physiological to various means of increasing the lichen's fitness, have already been suggested.

The present thesis attempts to approach lichens in their full complexity. Focusing on two model systems; the *Cladonia-Asterochloris* association and ecologically delimited communities of Verrucariaceae; it aims: i) to examine patterns in photobiont choice and their relationship to lichen ecology; ii) to set a framework for in-vitro mycobiont-photobiont compatibility testing; iii) to explore the diversity of selected associated fungi and their possible relationships with the lichen host.

We have shown that Verrucariaceae in the intertidal zone associate with largely understudied Ulvophycean photobionts. They mainly belong to Kornmanniaceae, Ulvales, and include a variety of novel lineages, one of which was circumscribed as *Undulifilum symbioticum* gen. et sp. nov. Also, *Urospora* sp., Ulotrichales, an order previously not known to include lichen symbionts, has been recognized and confirmed as a photobiont. *Hydropunctaria maura*, a common wide-spread seashore lichen, was highly selective in its photobiont choice. It generally maintained the association with *Pseudendoclonium submarinum*, regardless of its abundance in the pool of free-living algae and regardless of the seawater salinity level.

In-vitro development of *Cladonia fimbriata* soredia generally exhibited the previously published stages. However, no thalline structures were achieved in the experiments. This cannot be evaluated as a sign of incompatibility as, obviously, only compatible partners are spread by soredia. Importantly, the soredium disintegrates at the beginning of its development (both in-vitro and in-situ) and the symbionts need to recognize each other anew. Thus, these observations establish a suitable reference frame for future compatibility testing.

Species of *Cladonia* commonly associated with diverse Cystobasidiomycete yeasts, previously hypothesized to represent a third constituent of the symbiosis. The association was neither constant nor linked to the lichen morphology, i.e., presence of the cortex layer or the specific phenotype of *C. luteoalba*, as suggested by previous studies. Some of the yeasts were isolated into culture for the first time and *Lichenozyma pisutiana* gen. et sp. nov, Microsporomycetaceae, was circumscribed. We also showed that Cystobasidiomycete yeasts, as well as other diverse associated fungi, are spread with lichen soredia.

Thus, the present results contribute to our knowledge of the diversity of lichen symbionts and the patterns in their associations. Yet, they highlight the need for further studies and open more questions for future research.