Enviromental preferences of photobionts associating with epigeic *Cladonia* communities

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Introduction:

Little is known about the ecology of lichen photobionts so far. However, some recent studies observed that physiological responses to abiotic factors, such as temperature, pH and light, may differ even between closely related photobionts. Thus, to ensure high fitness of the whole lichen system, the mycobiont should find the suitable photobiont genotype flourishing in local conditions. We studied the diversity of photobionts in terricolous lichen communities growing in habitats differing especially by the character of substrate.

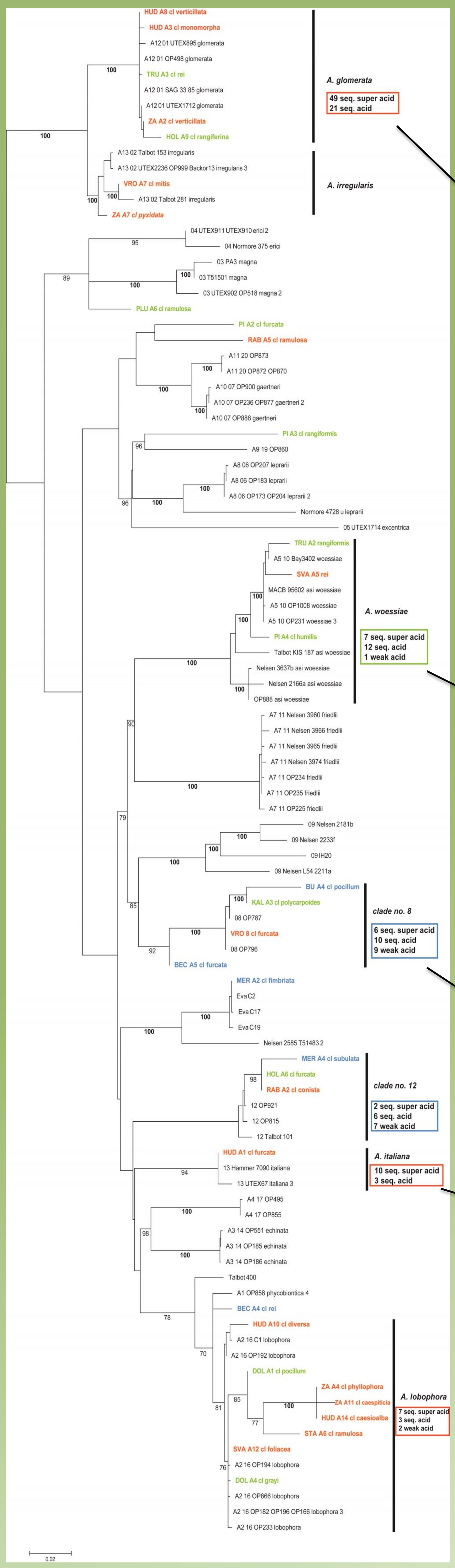
Materials and methods:

Since 2013 we have colected 185 lichen thalli of *Cladonia* at 19 localities in Czech and Slovak Republic. We studied several triplets of localities characterized by similar biotope with specific bedrock (heaths on sandy soils, limestone steppes, schist and serpentinite rocks). We measured pH, altitude and amount of radiation.

We used phylogenetic analysis of ITS rDNA and actin type I locus for inffering phylogenetic tree in GARLI v.2.0. (by the CIPRES Science Gateway v.3.3) The existence of dependence genetic distances on pH was tested in programme R.

Question asked:

Are the photobiont communities different at the localities with dissimilar pH?



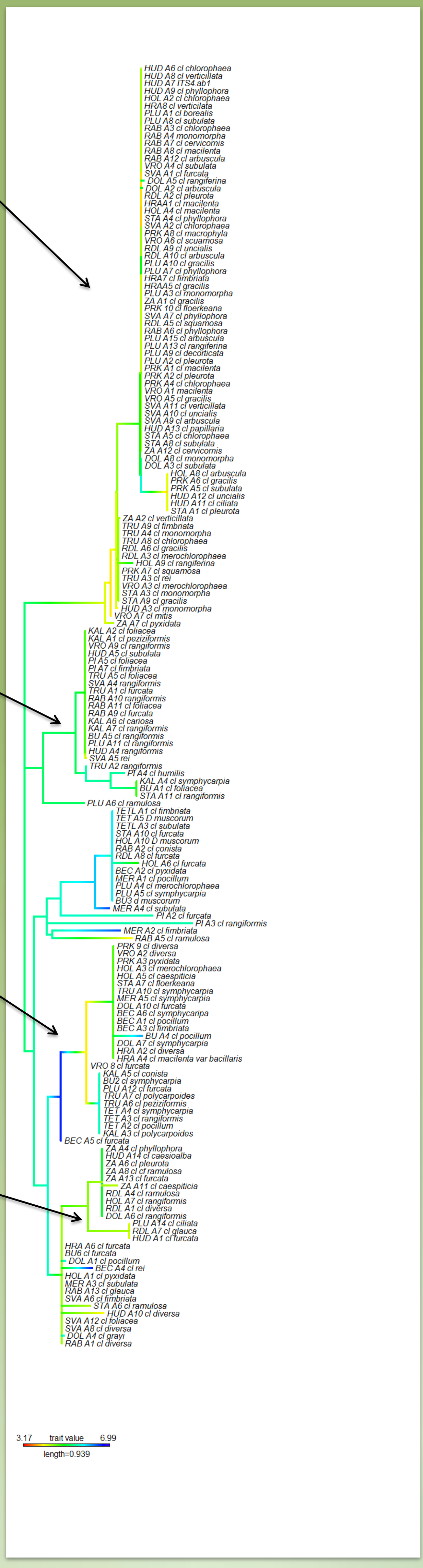


Fig.2. Genetic diversity within the genus *Asterochloris.* ML tree based on the concatenated ITS rDNA + actin alignment (with ML bootstrap).

Fig.3. The phylogenetic photobiont tree with visualized pH value. The topology of the tree corresponds to the topology of the phylogenetic tree in Fig. 2.

Results:

By ITS rDNA genotyping, we found 11 different lineages of green alga *Asterochloris* associating with 42 studied *Cladonia* species.

The pH of the substrate was in the range from 3,17 to 6,99.

The most sequences contains clade *A. glomerata* associating with lichens growing on super acid soils.

There is an interesting result – the richness of photobiont species decreases with higher pH.

Interestingly, the opposite trend was found in free-living algae (see **Fig.4.**)

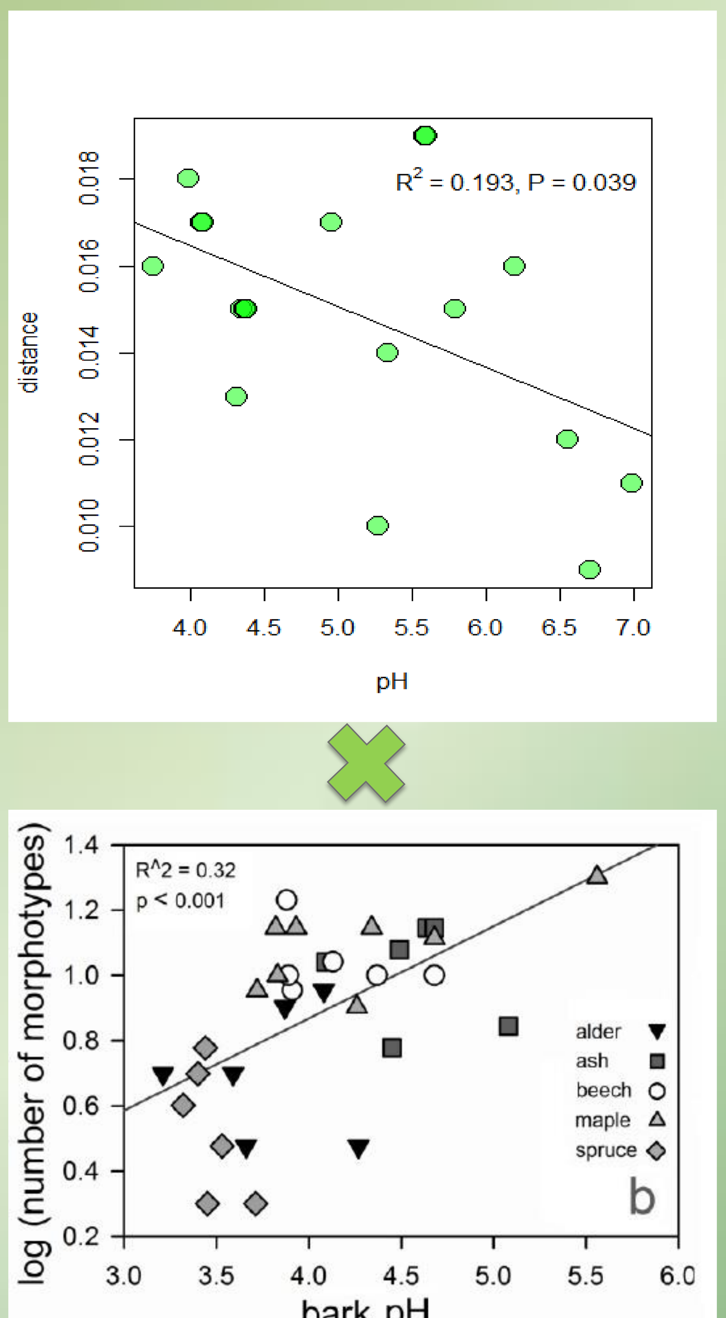


Fig.4. Least square regression of genetic distances and pH *Asterochloris* photobionts from *Cladonia* communities vs. free-living algae (corticolous microalgae) from bark (Štifterová and Neustupa, 2015).

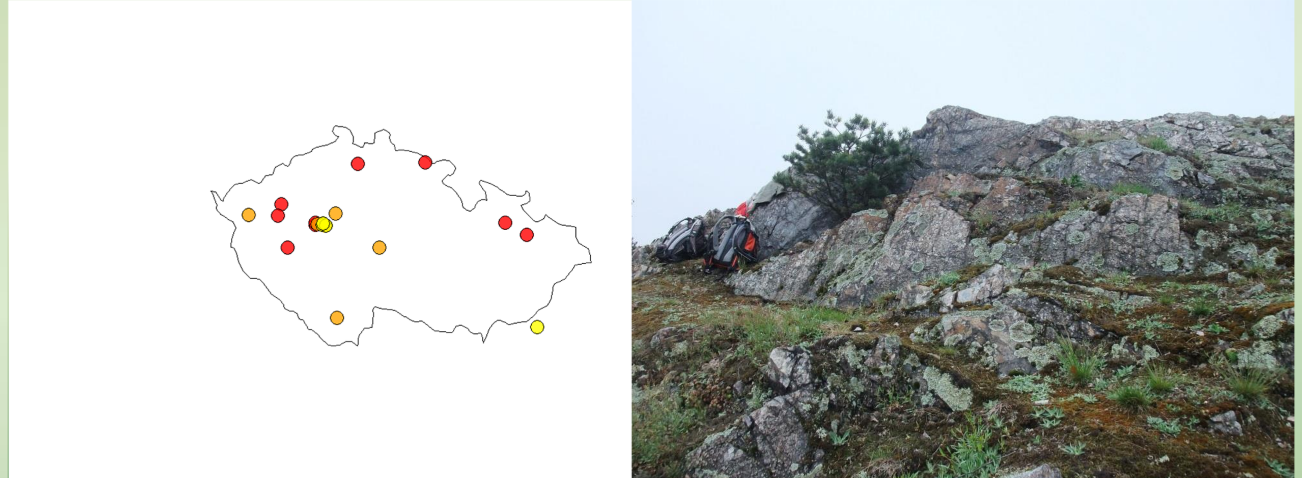


Fig.1. Localities in the Czech Republic and Slovakia.

Conslusions:

In general, the results indicated the intensive sharing of photobionts among fungal taxa with similar ecology, i.e. different environmental requirements of individual photobiont lineages. Substrate pH seemed to be most important factor. Our results clearly showed that particular *Cladonia* communities associate with different combinations of photobionts, forming specific lichen guilds – communities of lichens growing in the same habitat and sharing the same photobiont pool.

Our next study will be focused on experimental ecophysiological research based on cultivating of selected photobionts strains under various pH.

References

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Acknowledgments

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