

LICHEN SYMBIOSES IN THE LIGHT OF RELATIONSHIPS BETWEEN MYCOBIONTS AND FOTOBIONTS

Summary

Nature of lichen symbioses involving fungi, green algae or/and cyanobacteria is varied. It has been worked out during the evolution lasting at least 600 million years and its beginnings had place in water environment. Ability of fungi to the lichenization was probably a current phenomenon, lost however by some of them after land colonization. The lichen-forming fungi (ca 15 000 species) are contemporarily present in phylogenetically distant groups, for the most part within Lecanoromycetes, Ascomycota. Common two-biont symbioses lead to classical lichens, defined as a stable, self-supporting association of a mycobiont and a photobiont in which the mycobiont plays the role of an exhabitant. In opposite situation, when the 'green' component is the exhabitant such endosymbiosis is named 'mycophycobiosis' and excluded from lichens. In some instances, there is no clear exhabitant function, but the role of fungus (e.g. *Bryophagus*, *Collema*, *Lempholemma*) in forming of thallus morphology remains unquestionable. Symbioses involving one mycobiont and two green components concern at least ca. 500 species of lichenized fungi. They appear in lichen thalli with external or internal cefalodia containing cyanobacteria, that fix only nitrogen. Carbon fixation and its transformation to sugar alcohols (sorbitol, mannitol and erytritol), available for fungus, becomes then the domain of the alga component. In few cases separate parts of lichen thalli containing cyano- and

green algal fotobionts have various fototypes distinct in their morphology. Epibryophytic and epiphyllic lichens may represent also such associations in which the mycobiont use fotosynthetic products from two autotrophic sources. Three-biont long-term relationships between lichens and additional commensalic or pathogenic fungus are diverse and numerously represented (ca 1500–2000 species of lichenicolous fungi). The classical reflection of four-biont symbioses are associations of lichens and lichenicolous lichens (at least 100 species) displaying in distinct lichen thallus over the thallus of the lichen host. Such relationships have usually a commensalistic character. There are also trofic units between three mycobionts and one fotobiont when additional fungal pathogen infects another one, existing yet on two-biont lichen thallus. In many cases the real number of involving lichen bionts is larger than we may infer from morphology of a single structure. Many questions about this phenomenon are still unresolved, it is known, however, that similar morphotypes could be formed by one mycobiont and different species or strains of green components. One may speculate that at least sometimes, multi-bionts symbioses are present at some stages of lichen ontogeny. Another multi-bionts associations are known as 'mechanical hybrids' which may arise from different propagules growing together to form a single thallus.