Surviving nitrogen excess: in search of physiological and biochemical responses of lichens to nitrate-related stress conditions.

Nitrogen is one of the most important chemical elements on Earth. It constitutes a key element of many important chemical compounds, such asproteins or nucleic acids. Although it accounts for 75% of Earth's atmosphere, it is not available to most organisms until it is converted into biologically accessible molecules. Nowadays, the nitrogen excess is one of the most important challenges for the humanity. Both deficiency and excess of nitrogen in the environment leads to certain profound damage in the ecosystems through eutrophication, or on a broader scale, global warming. The given project focuses on the barely studied problem of the effect of nitrates on lichenized fungi –lichens. It is known that the reduced form of nitrogen (ammonia), originating from crops and livestock breeding, leads to serious disturbances in the physiological activity of these organisms.However, little is known about the impact of nitrates on lichen physiology and biochemistry, especially since this compound is not readily taken up and assimilated. For lichens living in urban environments, it posses a serious problem due to high levels of nitrates.

We plan to carry out two experiments: short- and long-term. During these experiments selected lichen species will be exposed to different nitrate concentrations. Then, several parameters will be studied to help answer the question of how lichens cope with excess oxidized forms of nitrogen and whether they can assimilate them from the environment. The following analyses will be performed: determination of photosynthetic efficiency, level of cell membrane damage, content of photosynthetic pigments, NADH dehydrogenase activity, level of peroxidation of cell membrane lipids, hydrogen peroxide content, catalase activity, extracellular and intracellular accumulation of ammonium and nitrate ions, activity of nitrogen assimilation enzymes: nitrate reductase and glutamine synthetase.

The obtained results will help us to understand the effect of nitrate-related environmental stress on lichen physiology. Moreover, it will expand our knowledge about these organisms and bring us closer to understanding the basis of lichen nitrophily.