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A STUDY OF THE WHOLE YEAR CYCLES OF CYANOBACTERIA / MICROALGAE IN POLAR HYDROTERRESTRIAL ENVIRONMENTS

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Cyanobacteria and eukaryotic algae are dominant components in hydro-terrestrial habitats in Polar Regions. *Phormidium*, a genus of filamentous cyanobacteria, and *Zygnema*, a green filamentous algae, are among the most common microalgae, which produce macroscopic mats in shallow streams and ponds. In these unstable habitats, microalgae are exposed to wide diurnal variations of temperature, drying-rewetting cycles and continuous light during summers, freezing-melting episodes during and autumn, and permanent freezing for at least a half of the year.

Here, we describe our observations on seasonal development of two *Phormidium* and three *Zygnema* communities. We monitored macroscopic community structure, morphology of cells and filaments, and viability of cells during the whole-year cycle.

We found that *Phormidium* populations were constantly metabolically active during the entire vegetative season, and quickly resumed respiration after spring melting. During vegetative season, they contained very low number of dead or injured cells. Unlike akinete-forming cyanobacteria, they do not produce any morphologically distinct spore-like resting cells for survival of winter period, and cell morphology does not notably change during the vegetative season. Instead, a high proportion of cells from frozen samples remains viable, indicating that vegetative cells acquired resistance to stresses related to freezing. Apparently, polysaccharide sheaths, which are produced during summer, play a key role in protection of cells from damages by ice crystals in winter, and from desiccation in late summer—autumn.

In contrast to cyanobacteria, populations of *Zygnema* develop from a few cells, however new biomass is produced rapidly and within a few weeks the whole pools are filled with *Zygnema* mats. *Zygnema* populations also markedly change their cell morphology during vegetative season. In early summer, the cells have typical vegetative morphology with two clear stellate chloroplasts each, which later gradually accumulate storage material, and change towards mature, stationary-phase-like cells, or pre-akinetes. The over-wintering pre-akinetes are markedly stress resistant being able to survive not just freezing but desiccation. They preserve viability during winter, however easily lose their resistance during spring melt become sensitive to probable freeze-thaw during spring.