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ABSTRACT

Microalgal community composition and ecophysiological processes in Arctic soil crusts at different stages of development

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Arctic soil crusts are known to be highly diverse, hosting complex microbial communities. However, microalgal abundance and diversity in polar soil crusts may be restricted due to low water availability, high solar radiation, temperature fluctuations and frequent freeze-thawing cycles. The aim of this study was to describe ecophysiological processes, occurring in Arctic soil crusts, such as photosynthetic and nitrogenase activities as proxies of primary production and nitrogen fixation, with respect to diurnal cycles, and to find out how individual environmental parameters (soil temperature, irradiance, soil water content and nutrients availability) influence the rate of these processes. Four soil crusts in different development stages (ranging from frequently disturbed and less developed to well-developed and stable soil crusts) were collected in Petunia Bay, Svalbard. Multiple samples were taken from four sites at different development stages, to take into consideration any patchiness of the cyanobacterial communities and the influence of the environmental conditions. A linear relationship between chemical parameters and the level of soil crust development was observed in the studied sites. Microalgal abundance increased from poorly developed to more developed with low presence of lichens soil crust. However, it slightly decreased in well-developed lichenized soil crust, likely due to competition. Cyanobacteria were the most abundant microalgal group found there. Moreover, 454 pyrosequencing of the 16S rRNA gene revealed a dominance of OTUs belonging to the orders Synechococcales, Oscillatoriales, and Nostocales which are common cyanobacteria in Arctic soil crusts. Furthermore, pH, ammonium and organic carbon concentrations significantly correlated with microalgal abundance and structure.