

Polar terrestrial ecosystems: natural laboratories for studying the evolution, macroecology, and biogeography of photosynthetic microbiomes

Josef Elster¹ and Elie Verleyen²

¹Centre for Polar Ecology, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic

²Protistology and Aquatic Ecology, Department of Biology, Faculty of Science, Ghent University, Ghent, Belgium

Cyanobacteria and eukaryotic microalgae are at the root of plant evolution and possess an enormous biodiversity. In some extreme habitats such as polar terrestrial environments, they are often the only biota that produce visible biomass as soil crusts or microbial mats. This, combined with the fact that the Arctic and Antarctica are geographically isolated and have a different climatic and tectonic history, but share similar environmental conditions, makes the polar regions ideally suited to study biogeographical and macroecological patterns in photosynthetic microalgae. Recent studies are starting to reveal that the incidence of endemism is quite high in some groups, which can in part be explained by long-term survival in glacial refugia and evolution in isolation from the start of the Cenozoic glacial-interglacial cycles. However, this refutes traditional beliefs of unlimited dispersal capacities in microorganisms and that their transportation is aided by various factors such as atmospheric circulation, bird migrations and human activities. The current debate also concerns to what extent polar microbiomes are genetically and physiologically different from the rest of the global microbial genepool. Moreover, the effect that severe ecological constraints have on the direction and speed of evolution in the polar microorganisms is also still unclear.