

Cyanobacterial diversity and distribution on the Svalbard Archipelago

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In the extreme Arctic environments, cyanobacteria make up an important component. They are of fundamental ecological importance as contributing to both carbon and nitrogen fixation and are often regarded as dominant primary producers in polar ecosystems. The exploration of the Svalbard Archipelago Cyanobacteria began in the 19th century. Almost all of these studies were based on the classic algological determination approach when used light microscopy observations. The first check-list of Svalbard's algae including cyanobacteria was published by O. Borge (1911). He unified previous records and added original data. The most current checklist of algae and cyanobacteria of Svalbard Archipelago was published by O. M. Skulberg (1996) and it included 89 cyanobacterial species, the author didn't conduct nomenclature revision. Moreover, this list was not comprehensive since it did not include the important Russian article by Perminova (1990). The aim of the current study is to make a compilation of the data about Svalbard's cyanobacterial diversity.

We studied cyanobacteria in different areas of the Svalbard archipelago from 2004 to 2016. A total of 753 samples of cyanobacteria from 290 locations were collected and deposited at the Herbarium of Polar-Alpine Botanical Garden-Institute (KPABG), Kirovsk, Russia. The morphological identification performed following Komárek & Anagnostidis (1998, 2005), Komárek (2013) manuals.

Before analysis, we combined our findings and literature records. For accumulates primary biodiversity information about biological specimens we used Cryptogamic Russian Information System (<http://kpabg.ru/cris>) (Melekhin et al. 2019). As a result of the analyzes annotated list of cyanobacteria of Svalbard was compiled. A total of 320 taxa, 291 species, 3 infra species taxa have been recorded in the archipelago. Eighty-four species are reported for Svalbard's flora for the first time, 73 taxa are confirmed by their own collections.

According to Chao's (1984) formula the number of the estimated number of species in Svalbard's flora could be 396 taxa. Thus, the current state of biodiversity could be considered as 73% of the potential one. To obtain a reasonably complete list it is necessary to investigate northern and eastern parts of the archipelago.

The comparison with all known species of cyanobacteria (a total of ~ 4600 species on the worldwide flora (Guiry & Guiry 2020)) has shown that Svalbard's flora accounts for 7% of total cyanobacterial species. Also, the compare Svalbard's flora with the list of Eurasian Arctic cyanobacteria (Davydov & Patova 2018) is shown that the flora of archipelago includes 61% of species diversity this sector. Hence cyanobacterial flora of Svalbard could be characterized as being high in the species diversity. The potential reasons for richness flora are resulting from the combination factors. First of all, relatively warm climate, the diversified geological, hydrological and edaphic conditions of the archipelago, change the gradient of vegetation, and low competition for resources.

The climate of the Svalbard Archipelago is corresponding the high latitude's Arctic but in contradiction of the territories at the same latitude in the Canadian Arctic or eastern part of Russian Arctic the average temperatures of air are distinctly higher (Przybylak et al. 2014).

The genesis of the cyanobacterial flora of Svalbard apparently links with floras of nearby continental regions. The same species are living in similar habitats (wet rocks soil's biocrust in mountain areas and other) on the Murmansk region, Polar Urals and North Scandinavia. It could be revealed in a floristic similarity of different areas. The studied flora of Svalbard is most similar to the flora of Subarctic part of Murmansk region (similarity coefficient 55%). The potential explanation of that fact could be in common ways of the spatial distribution of propagules cyanobacteria and also some similarities of conditions in these regions.

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