

Lichens as one of the most important component of monitoring studies in terrestrial ecosystems of the Russian Arctic and Svalbard

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Abstract: Since 2009, lichen communities have been studied in the Russian Arctic, as well as on the Svalbard archipelago. It is presented that lichens are the most important component of the Arctic communities and the wide possibilities of their use as monitoring objects. The main directions of the use of lichens in monitoring studies are determined.

Key words: lichens, Russian Arctic, Franz-Josef Land, Sakha Republic (Yakutia), Svalbard, monitoring, terrestrial ecosystems, extreme conditions

Lichens are the most common component of plant communities in the Arctic, especially in the polar deserts. 321 species of terrestrial lichens, 270 species of mosses, 98 species of liverworts and 122 species of vascular plants were recorded in the polar deserts of the Russian Arctic (Matveeva et al., 2015). The number of lichen species will grow by about 2.5 times if we take into account the epilithic lichens, which in the Russian Arctic are currently studied unevenly throughout the territory. This is due to low competition from other organisms in the Arctic communities due to harsh conditions, the slow growth of lichen thalli, and their ability to fall into an anabiotic state to survive adverse conditions. All this happens due to the structural

features of lichen thalli, which are a whole system of organisms interconnected by close relationships. This system may include several fungal organisms, algae, cyanobacteria. This system has a number of metabolic features that provide, on the one hand, the ability to inhabit the most adverse conditions. On the other hand, these same features will provide an opportunity for lichens to respond to changes in the natural environment, both microclimatic and anthropogenic.

It has long time been known that lichens can accumulate heavy metals and radionuclides in thalli. (Ohmura et al., 2013; Pescott et al., 2019; etc.). Studying the content of certain chemical elements in thalli, as well as their amount over a time period, allows you to track possible contamination of the soil (or air) with heavy metals and long-lived radionuclides. Changes in conditions (light, temperature, humidity) also affect the state of lichen communities.

Since 2009, we studied lichens in the Arctic (Svalbard archipelago, Murmansk region, Franz Josef Land, the Arctic and subarctic part of the Republic of Sakha (Yakutia), and also a number of collections by other authors from the Novaya Zemlya archipelago, Gydansky and Yamal Peninsula. We have identified the main directions of monitoring lichenological studies that will allow us to obtain data on the state of the communities in which the species live and their transformations.

1. Analysis of the modern lichen biota of separate territories well studied in the past (mainly these are the neighborhoods of polar stations, such as, for example, on Alexandra Land and Guker Island (Tikhaya Bay) of the Franz Josef Land archipelago.
2. Analysis of the ranges of lichen species (we can find out how the range changes over time, and suggest what factors influence).
3. Study of the distribution of lichens in the landscape and the dependence of individual species on specific parameters of the habitat (proximity to the coast, altitude, degree of moisture, etc.)
4. Identification of rare species, analysis of the reasons for their rarity, preparation of lists of rare and valuable habitats and excluding these territories from economic activity.

5. Identification of the chemical composition of lichen thalli, including accumulated heavy metals and radionuclides; comparison with thalli from background areas.

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