The Use of Soil Algae in Agriculture

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ANNOTATION

Under the general name "algae" (Algae) combine very diverse lower chlorophyll-bearing organisms. It is customary to refer to soil algae as algae, for which typical habitats are the surface and thickness of the soil layer. The vast majority of algae inhabiting the soil have microscopic forms. About 2000 species of microscopic soil algae are known, presumably less than 10% of the species existing in nature. Every year, algologists reveal more and more new species. Algae of four divisions predominantly develop in the soil: Chlorophyta (green), Xanthophyta (yellow-green), Bacillariophyta (diatoms) and Cyanophyta (blue-green). Red (Rodophyta) and Euglenophyta (Euglenophyta) algae are much less common. Unlike all other algae, blue-green algae are prokaryotes, since their cells do not have a morphologically distinct nucleus. Therefore, recently this group has been referred to bacteria and is considered as cyanobacteria (Cyanobacteria). Developing mainly in the upper soil horizons (up to 200 thousand cells per 1 cm3). In contrast to abundance, algae biomass rarely reaches high values. On average, it varies between 30-200 kg / ha. The synthesis and transformation of organic matter in algae is a very dynamic process.

KEYWORDS: *Chlorophyta (green), Xanthophyta (yellow-green), Bacillariophyta (diatoms) and Cyanophyta (blue-green), Cyanobacteria.*

Soil algae are a combination of various ecological groups of algae: terrestrial, aquatic-terrestrial, and soil proper, inhabiting the thickness of the soil layer.

The taxonomy of soil algae can be considered from different angles: phylogenetic taxonomy, taxonomy by mode of nutrition, taxonomy of soil algae for ecological analysis and life forms.

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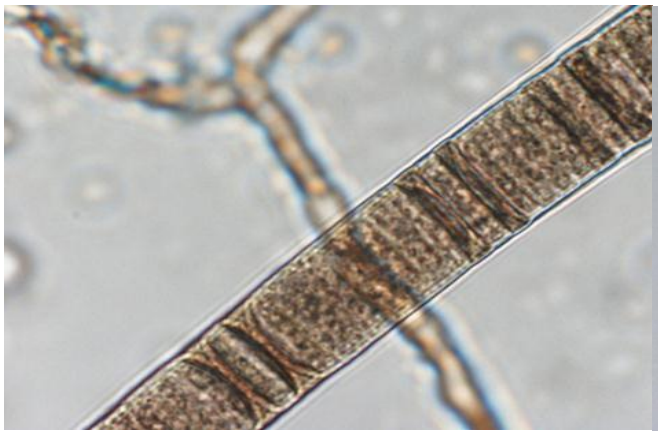
Soil algae are also heterogeneous in terms of nutrition. There are both photoautotrophic and heterotrophic and mixotrophic soil algae. When taxonomy of out-of-water algocenoses , the following classification is used: aerophilic cenoses , edafophilic cenoses , and lithophilic cenoses .

For the ecological analysis of algosynusia of soil algae, Komaromi proposed a classification of soil algae according to “growth forms”, which distinguished: dispersal - unicellular green and yellow-green algae, stratose - filamentous green and yellow-green algae, glutinose - diatoms , microcoleus - Microcoleus and Phormidium , ramose - Tolypothrix , mucose - Nostoc commune, N. microscopicum .

At the same time, EA Shtin and MM Hollerbach developed a similar classification of soil algae according to their life forms. It is applicable only to edafophilic algae, and nitrogen-fixing algae are

isolated in a special life form. In this regard, there are forms:

1) Ch-form - unicellular and colonial green and partially yellow-green algae that live in the thickness of the soil, but with favorable moisture, give growth on the soil surface;
2) C-form - includes unicellular, colonial or filamentous forms that can form abundant mucus;
3) X-form - most unicellular yellow-greens and many greens, preferring shady conditions among soil particles, shade-tolerant, but not resistant to drought and extreme temperatures;
4) B-form - mobile cells of diatoms living in the most superficial layers of moist soil or in the mucus of other algae;



5) P-form - filamentous blue-green (Phormidium , Oscillatoria, Plectonema), which do not form significant mucus [6];
6) M-form - blue-green in the form of more or less mucous threads, forming macroscopically noticeable crusts or tufts on the soil surface;
7) H-form - live scattered among soil particles, with sufficient moisture and shading, form surface raids, not resistant to drought and strong light;
8) N-form - terrestrial microscopic thalli of N. commune, N. microscopicum , N. flagelliforme , N. sphaeroides ; light-tolerant and drought-resistant species, poikiloxerophytes ;
9) V-form - filamentous algae that form felt-like deposits on the surface of moist soils.

Thus, soil algae are classified depending on the goals (for example, for ecological analysis), life forms, mode of nutrition and phylogeny.

Oscillatoria sp. (x 1000) Anabaena sp. (x 1000)

The existence of algae in the soil, at first glance incompatible with the basic features of these organisms, is in fact as common as their habitat in water bodies.

On the surface of the soil, one can often see with the naked eye various growths - leathery or felt-like films or mucous thalli of blue-green algae. Often there is also a general greening of the soil, due to the mass development of microscopic forms scattered among the soil particles. The biomass of algae is capable of being renewed within 3-5 days; therefore, the real contribution of algae to the primary production of the ecosystem is hundreds and thousands of times greater than the value of biomass. Soil algae are the first plants to settle on lifeless substrates: rocky surfaces of high mountains, industrial dumps, in areas subjected to catastrophic impacts (volcanic eruptions, atomic explosions, fires, etc.) and thereby facilitate the settlement of other organisms. At the same time, algae are the

last of the plants to "retreat" under the pressure of unfavorable factors of natural and anthropogenic origin. Under these conditions, the death of the algae community (algocenosis) leads to the destruction of the entire biocenosis. With the weakening of the development of higher vegetation under the influence of industrial development of territories, the role of soil algae as an integral part of the autotrophic block of the ecosystem increases. This finds its expression in an increase in their species diversity and quantitative development.

Therefore, to survive on the soil surface, algae must be able to tolerate drought, temperature fluctuations, and bright light.

Algae that inhabit the thickness of the soil can only be detected under a microscope. Algae are especially clearly visible when viewing a soil sample or soil suspension in a fluorescent microscope, where their chlorophyll-bearing cells stand out with a red glow. In addition, they can be detected by crops, placing the soil in a favorable environment for the growth of algae and thus contributing to the rapid increase in the number of algal primordia present in the soil. To identify soil algae, two types of cultures are used: water, when a small amount of soil is brought into a flask with a sterile nutrient medium, and soil, when the soil is placed in Petri dishes, moistened and sterile coverslips are placed on its surface, on which algae grow well. Cultures are kept in the light at room temperature and, as algae grow, they are viewed and their composition determined. The total number of algal species found in the soil is already approaching 2000 species, varieties and forms, mainly related to blue-green (438), green (473), yellow-green (146) and diatoms (324) algae.

The soil as a habitat is characterized by a number of ecological features. It is similar to both water and air habitats: there is air in the soil, but saturated with water vapor, which ensures breathing of atmospheric air without the threat of drying out. As an intermediate medium, soil is widely used by many organisms during the transition from an aquatic to a terrestrial lifestyle. The soil is also characterized by the relative constancy of its properties. At the same time, the soil environment is extremely heterogeneous in the horizontal and vertical directions. It simultaneously contains solid, liquid and gaseous substances, as well as a variety of living creatures - bacteria, fungi, actinomycetes, representatives of micro- and macrofauna, as a result of which microzones are formed. In the soil, temperature fluctuations are more significant and sharper in comparison with the aquatic environment, and its surface is characterized by unstable humidity and strong insolation (lighting by sunlight).

Conclusion: The participation of algae in the process of weathering of rocks and in the creation of primary humus on purely mineral substrates is most significant. The ability of various algae to destroy rocks has long been known; the blue-green ones show especially intensive corrosivity, showing an erosive effect to a depth of 1.5 m. Destroying the mineral substrate, algae obtain the necessary mineral salts from it. But along with the destruction of primary minerals, the formation of secondary ones occurs, and at the same time, algae carry out the process of accumulation of organic matter, due to which lower heterotrophic organisms develop. Due to the unique properties of soil algae (wide distribution, easy identification, quick response to changes in soil conditions, similarity with higher plants in response to soil conditions, cheap cultivation), the question of using them as biological indicators has recently become relevant not not only for assessing soil fertility, but also to monitor. Methods are being developed to characterize the ecological state of soils, qualitative and quantitative assessment of various types of its pollution.

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