Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

STUDY OF SOIL ALGAE IN UZBEKISTAN AND RESEARCH METHODS

Sheraliyeva Dildora Nodir qizi
Researcher at Namangan State University
E-mail:dildora.sheraliyeva@mail.ru

Abstract
This article discusses the distribution of soil algae in Uzbekistan, their study by research scientists, and research methods.

Keywords: Algae, nostoc commune, clarifier, algoflora, brackish soil, hyperhalobic, cyanoprokaryote.

Introduction

The taxonomic composition of algae distributed in the desert and steppe regions of Uzbekistan was first studied by B.A. Kellar (1926, 223 p.). He reported that Nostoc commune, belonging to the Hormogoniophyceae class, Nostocaceae family, and the Cyanoprocariota division, distributed on the soil surface, constitute a component of various desert and steppe flora.
N.N. Bolishev and T.N. Yevdokimova were the first to identify the algae of barren soils distributed in our republic (1944, 7-8 c.). The coatings on the surface of the barrens were formed by taxa of the order Oscillatoriales of the department Cyanoprocariota, taxa of the genera Oscillatoria, Pharmidium, and Microcoleus.
K.Yu. Musayev's scientific research is devoted to the gray soil and Mirzachul in the Samarkand region. The first work provides detailed information on the taxonomic composition of algae identified from the gray soil, typical gray soil and tokboz soils, their distribution in relation to ecological factors (1965. 27-39). As a result, 97 taxa were identified, and taxa belonging to the Cyanoprocariota division were dominant according to their taxonomic composition. The second work is ecological in nature, and it presents data on the distribution of algal taxa

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

depending on soil salinity, which leads to changes in the composition of dominant species. It is noted that the number of species in the soil is higher in spring and autumn than in others.

K.Yu. Musayev, V.P. But's works are devoted to the study of the patterns of distribution of algae species across steep regions.

In the loamy soils at an altitude of 1300 m above sea level, filamentous taxa from the family Oscillatoria of the Cyanoprocariota division are distinguished from others by the large number of species. It was noted that in soils at altitudes of 200 m and above in the mountainous region, taxa of the heterocystous order Nostocales, which can absorb molecular nitrogen from the soil atmosphere, and taxa of the yellow-green division Hanthophyta are abundant (1966, pp. 48-54).

When studying the composition of algae taxa distributed in soils in mountainous areas, differences in the taxa composition of different slopes were revealed. The number of algae taxa on humid northern slopes was found to be higher than on dry southern areas.

As a result of the joint research work of K.Yu. Musayev and U.N. Toshmukhomedov, it was found that species of the Chlorococeales and Cyanoprocariota orders of the Chlorophyta department are widespread in undeveloped and protected lands. In cotton fields, where the soil has been developed for a long time, the biological diversity of the Cyanoprocariota orders has been found to be high (1971; p. 82-84).

K.Yu. Musayev and Sh. U. Umarova recorded that the diversity of algal taxa in cotton-planted soils consisted of 212 species. (1967, pp. 129-133).

Sh.J. Tojiboev, K.Yu. Musaev identified 67 species of higher plants and 67 species of grasses belonging to 14 families in the rhizosphere of the soil: 23 blue-green, 27 green, 7 diatom, 7 yellow-green, and 3 euglena algae. 41 taxa were recorded from the rhizosphere of plants of the Apiaceae family, 37 from the Cucurbitaceae family, and 35 from the rhizosphere of the Ascomycota family. The presence of 21-27 taxa in the rhizosphere of plants from the families of Tomataceae, Solanaceae, and Labiatae, and 7-14 taxa of algae were detected in the rhizosphere of plants from the families of Apiaceae and Solanaceae. In all cases, filamentous algae outnumbered unicellular algae. The distribution of algae in the rhizosphere

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

is influenced by the vegetation period of plants (1987; pp. 128-129). The authors did not provide data on the rhizoplane.

When studying and analyzing the systematic composition of algae taxa in the Uzbek part of the southwestern Tien Shan mountain range, taxa belonging to the Cyanoprocariota division were found to be most abundant in gray soils in areas up to 500 meters deep, including species of the Phormidium, Oscillatoria, and Bozia genera belonging to the Oscillatoriales order with a filamentous structure and no heterocysts. They noted the dominance of species from the Chlorophyta, Hanthophyta, and Cyanoprocariota divisions in soils between 1300 and 2000 m in the mountain region. In the soils of the pasture region at 2500 m above sea level and above, the Cyanoprocariota divisions decreased, and algae from the Chlorophyta and Hanthophyta divisions were widespread.

The taxonomic composition of algae distributed in the soils of Mirzachul, where crops have been cultivated for many years on newly developed lands, was studied by K.Yu. Musayev. K.Yu. Musayev provided information on the distribution of algae taxa in the soils of cultivated areas in the Karakul district of the Bukhara region (1972, pp. 94-97).

K.Yu. Musayev, Sh.J. Tojiboyev presented data on some ecological and biochemical properties of the bark of the cyanoprokaryote Nostoc commune Vauch., which is distributed on the surface of some soils of the Tashkent region. (1984, p. 24-29).

E.K. Troitskaya studied the flora of algae distributed in the soils of the southern part of the Kyzylkum in Uzbekistan. 224 species and varieties were identified from the soils of the region, 126 species (56.25%) of which belonged to the Cyanoprocariota department. Among the families, Oscillatoriaseae and Schizothrichaceae were the leaders in the number of species (1961, 271 p.).

P.M. Masharipov, M.A. Kuchkarova, Z.A. Ormonov identified 87 species and varieties of blue-green algae in cotton, wheat, alfalfa and uncultivated gray lands. Of these, 19 species were considered nitrogen-fixing. 48 species of algae were identified from cotton fields, and 34 species from the order Oscillatoriales were identified in wheat soils. 32 species were identified from gray soils, among which

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

representatives of Chlorococcales and Nostocales were reported to have the most species (1987, pp. 176-178).

Sh.J. Tojiboev, in his article on algae and cyanoprokaryo in the gray soils of Kashkadarya, wrote that unicellular and filamentous cyanoprokaryotes are more abundant in soils of warmer regions than unicellular and other bioforms (1971, pp. 47-50).

Sh.J. Tojibayev studied cyanoprokaryotes and algae in the studied soils in the article "Algae in some protected land soils in the Tashkent region and their comparative study" (1974, pp. 106-107). This researcher also provided a number of scientific data on soil algae in the southwestern part of the Tien Shan (1974, pp. 36-39). Sh.J. Tojiboev's subsequent research was devoted to the ecological and biochemistry of the cyanoprokaryote Nostoc commune Vauch. (1974, pp. 46-47). The article "Algae of typical brown soils of the Chatkal Range" provides systematic and taxonomic information on the algae of the soils of the northern and southern slopes at an altitude of 1600 m above sea level (1976, p. 112). Sh.J. Tojiboyev's study on the distribution of the cyanoprokaryotic Nostoc in Uzbekistan provides information on the occurrence of this species in various soils in our Republic.

S.T. Mamasoliev studied algae in the gray soils of Central Fergana. As a result, the author also noted that cyanoprokaryotes are more abundant in the soils of the arid region than in others (2013, pp. 127-128).

S.T. Mamasoliev's research investigated cyanoprokaryotes and algae in the soils of the seliteb areas of Andijan city. In this case, cyanoprokaryotes and green algae stood out from the others in terms of the number of species and biological diversity (2018, pp. 43-46).

On the systematics and taxonomy of algae distributed on gray soils in the Fergana Valley S.T. Mamasoliyev (2013 p. 48-50). On the role and significance of soil algae in anthropogenic ecosystems S.T. Mamasoliyev, M.Sh. Qosimov (2016, p. 710-730, 2016, p. 87-88, 2016, p. 76-82).

There is information about studies on the morphology and anatomy of the green unicellular genus Chlamydomonas, which is widespread in soils in our republic (S.T. Mamasoliyev, 2016, pp. 166-168).

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

Yu.A. Tokhtaboyeva, in her article "Comparative analysis of the taxonomic composition of algae by soil" using the example of the Fergana Valley, provided information on the presence of specific species in the soils of the studied region (2018, pp. 167-175).

Methods used in the study. In studying the flora of cyanoprokaryotes and algae distributed in the soils of the region, we began by taking soil samples. We followed the following:

1. We focused on the correct selection of the sample;
2. Sterility;
3. Labeling and storage rules;
4. Additional soil analysis and plant cover.

We looked at the surface of the soil sampled for blue-green, green, and brown dust produced by cyanoprokaryotes and algae. We took a 1 cm thick sample of the current state. We recorded the location of the samples, moisture content, and mechanical composition of the soil on the label, averaging 10-50 cm2 of the surface. In places where cyanoprokaryotic Nostoc Commune L crusts were found on the soil surface, we determined and recorded their mass per 1 m2 or 10 m2 of the surface.

To identify algae and cyanoprokaryotes in the soil, we dug a hole in what we thought would be a favorable, average condition. We shook off the soil from the plant roots. We dug the cut to a depth of 20-30 cm from the beginning of the parent soil C layer and removed the crushed layer with the tip of a knife, starting from the upper part of the place where it was erected. As a result, the color of the soil profile was clearly expressed. We paid attention to the sterile nature of the knife and bags used to take soil samples. We took samples every 10 cm. After taking the samples from the lowest part, we cleaned the knife with ethyl alcohol and lit it with a match before taking the sample from the upper layer. Then we took the soil sample from the upper layer. We took a sample of about 50 g each time from the top 0-2 cm of the surface and recorded the soil name and the layer (cm) from which the sample was taken on the label. We ensured that the soil was dry under atmospheric conditions. We followed the method of M.M. Gollerbach and E.A. Shtina (1969) when taking samples.

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

To study the species composition of cyanoprokaryotes and algae, we took a small amount of the sample and examined it under a microscope in a drop of water. We did this on the day the sample was brought to the laboratory, or at least the next day. Under the microscope, blue-green, green, yellow-green, and brown algae cells were visible in some samples. To determine their species composition, we used the culture method. First, we placed a small sample of soil in a Petri dish (previously sterilized) and poured a nutrient solution with a humidity of about 80%. In this case, we placed the Petri dish in front of a window in a place where sunlight falls. The cyanoprokaryotes and algae in the sample began to form bubbles at the edges of the dish due to sufficient humidity, nutrition, and light. We prepared preparations from these dusts and observed them under a microscope. When we slightly inserted the edge of the coverslip into the moist soil in a Petri dish and ensured that the coverslip was moistened with the nutrient medium, algae dusts began to appear on it. We observed such a dusty coverslip under a microscope. We placed 5-6 coverslips in one Petri dish. This:

1. The soil surface is compacted.
2. The cover glass is inserted about halfway into the soil, creating a moist space between the glass and the soil.
3. When the soil moisture decreased, nutrients were added, and each coverslip was examined under a microscope, not all at once, but every 2-3 days. During this time, the coverslip had a slightly grayish color and thickness.

We also used the soil samples obtained in the water culture method. For this, we prepared Bristol nutrient medium: NaNo3-0.25 g, K2Po4-0.25 MgSO4-0.15, CaCl-0.05 g NaCl-0.05 g, Fe2Cl6-3 drops of 1% solution, 1 liter of water. Distilled water was made up to 900 ml., 0-2 cm. Thickness, 20-30 g. of the obtained soil sample was taken, it was thoroughly shaken in 100 ml. distilled water, and after the soil particles settled, we added it to the solution. This enriched the nutrient.

We poured the prepared nutrient medium into 50-100 ml., 30-60 ml., and sterilized it in flat-bottomed flasks. We wrapped the mouth of the flasks with cotton cloth and made a lid. We put about 5-10 g. of the soil on the label in each flask, shook it a little, and placed it near a window where sunlight would fall.

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

Visible spores began to appear in the flasks in less than 2 weeks. Visible, fine spores were formed at first. We picked them up with a hook and examined them under a microscope. Each sample was re-examined for 2, even 3 months. We determined the species composition of algae and cyanoprokaryotes together with our scientific supervisor using the appropriate available "Detectors". We listed the detectors in the bibliography.

Conclusion. Under salt stress, cyanoprokaryotes have been observed to form solutes and lipids (Allakhverdiev et al., 2000), accumulate inorganic ions and organic compounds (sugars, polyols, quaternary amines) and osmoregulators (Rao and Burns, 1991), and enrich such soils with local cyanoprokaryotes over a period of time, improving soil quality and making it suitable for cultivation, reducing pH, increasing exchangeable sodium Na/Ca, and increasing the overall capacity of soil N, P, K, organic matter and water retention. This ultimately reduces the adsorption ratio of sodium, an indicator of alkalinity, and improves the hydraulic conductivity of sodic soils (Allakhverdiev et al., 2000; Singh et al., 2002). Enhancing salt tolerance of cyanoprokaryotes with fixed nitrogen (Apte et al., 1987; Reddy et al., 1989). Studying all of these mechanisms will help to better understand salt tolerance in cyanoprokaryotes. Cyanoprokaryotes can improve the properties of saline soils, and salt tolerance mechanisms by cyanoprokaryotes are being developed and are intended for use in the fields of nature and soil conservation.

Such studies have not been carried out in the territory of the Republic of Uzbekistan within the Commonwealth of Independent States. The task of the research work that has been initiated is to identify soil algal flora that is resistant to soil salinity and develop technologies for biomonitoring the ecological state of the soil by cultivating algae strains that have a beneficial effect on them.

REVIEW ARTICLES:

1. Bhatnagar A and Roychoudhury P (1992). Dissolution of limestone by cyanobacteria. Proceedings of the National Symposium on Cyanobacterial Nitrogen Fixation, edited by Kaushik BD, IARI, New Delhi (Today & Tomorrow"s Printers and Publishers) P. 331-335.

Modern American Journal of Biological and Environmental Sciences
ISSN (E): 3067-7920
Volume 01, Issue 03, June, 2025
Website: usajournals.org

2. Apte SK and Thomas J (1997). Possible amelioration of coastal soil salinity using halo tolerant nitrogen fixing cyanobacteria. Plant Soil - 189 P. 205-211
3. Hashem MA (2001). Role of blue-green algal inoculum for improving soil fertility and reclaiming salinity of soil. Dhaka, Bangladesh, BARC.
4. Allakhverdiev SI et al., (2001). Unsaturated fatty acids in membrane lipids protect the photosynthetic machinery against salt induced damage in Synechococcus. Plant Physiology - 125. P. 1842-1853.
5. L.S. Khaibullina and L. A.Gaisina (2008) Effect of Salinization on the Species Composition and Morphological Features of Soil Algae. ISSN 1064-2293, Eurasian Soil Science, 2008, Vol. 41, No. 2, pp. P. 215–221.