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ALGOFLORA OF THE MAIN SOIL TYPES OF THE FERGANA VALLEY

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Annotation

In this article, the species of algae (algoflora)that live in the main soil types distributed in the Fergana Valley area (peat soils, grassland, grassland, brackish, and irrigated hydromorphic soils) are studied. Dominant microalgaflora species, their ecological requirements and bioindicatory properties have been analyzed for each soil type. It has also been compared to algoflora studies conducted in Uzbekistan, Russia, and foreign countries.

Keywords

Algoflora, soil species, microalgaflora, Fergana Valley, environmental factors, bioindication.

1. Introduction. The Fergana Valley is one of the most serunum regions of Uzbekistan and includes various agroecological regions. Their microbiocenoses, especially algofloras, are also diverse due to the variety of composition and physico-chemical properties of the peat, grassland, brackish and gravelly soils in the area. Soil algae-as photosynthetic microorganisms play an important role in shaping soil fertility and balancing the ecological environment (Akhmedov, 2019; Lukin, 1986; Round, 1981) (Berdikulov et al., 2020; Karimova, 2009).

2. Fergana Valley Main soil types and their environmental conditions

Soil Type	Distribution Areas	pH	Moisture Condition	Salinity Level
Grey soils	Margilan, Kuva, Rishtan	Neutral	Moderate	Low
Meadow sierozem soils	Bagdad, Yazyovan, Buvayda	Slightly acidic	High	Moderate
Solonchak (saline) soils	Kokand, Toshloq, Dangara	Alkaline	Low	High
Irrigated hydromorphic soils	Lowland areas of Fergana district	Neutral–alkaline	High	Moderate–high

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3. Distribution and Ecological Analysis of Algoflora species.

In individual agroecological zones of Fergana Valley soils, the composition of microalgafloras and their activity level directly depend on the physico-chemical condition of the soil, especially pH, humidity, salinity and hydromorphic conditions. Each soil type is characterized by its own microalgaflora species, and the composition of this species is formed on the basis of their environmental requirements.

3.1. Algoflora on bad soils: bad soils are common in the areas of the Central and Mountain foothills of the Fergana Valley, where they are formed in conditions of neutral or light alkaline pH (6.5–7.5) and moderate humidity. These soils are microbiologically active and are dominated by the following microalgaflora species:

Chlorella vulgaris – a unicellular green algaloid, it has strong photosynthetic activity. It is involved in the decomposition of organic matter in the soil and has the property of absorbing nitrogen.

Nostoc commune – cyanobacteria are resistant to arid conditions. Moving to an active state in the presence of moisture, it is involved in nitrogen fixation.

Oscillatoria limosa – thread-shaped cyanobacteria. It forms colonies on the soil surface and plays an important role in photosynthesis and oxygen production processes.

These algaloids are particularly common in biologically active soils and are important in ensuring nitrogen cycle, humus formation and microbiocenosis stability (Shirshova, 2011).

3.2. Algaloflora in gravelly soils: gravelly soils are distributed in irrigated, hydromorphic zones characterized by high humidity and oxygen deficiency. These conditions are dominated by microalgaloid species adapted to anaerobic conditions:

Anabaena azollae – a cyanobacterium, it lives in aqueous conditions and fixates nitrogen by symbiosis with a plant (Azolla).

Phormidium tenue – thoracic cyanobacteria. Predominates in hydromorphic conditions, forming colonies on aqueous surfaces.

Scenedesmus obliquus – the four-celled green algaloid, active in oxygen production, is commonly found in irrigated soils.

These species are important indicators that determine the biological activity of grassland soils. Their density and activity directly depends on the state of irrigation, and as the degree of irrigation increases, so does their reproduction (Rashidov et al., 2022).

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3.3. Typical algae for brackish soils: brackish soils are formed in areas of the Fergana Valley where water evaporation is strong and there is a high concentration of salts. In this environment, only halophyte (salt-resistant) algaloid species develop:

Dunaliella salina – a green algaloid resistant to high salinity, it is often used as a β-carotene producer. Can live in environments ranging from 3-15% NaCl.

Aphanothece halophytica – is a cyanobacterium and is resistant to high osmotic pressure. It is used in the bioindication of salinity in the soil.

Chroococcus minutus – microscopic cyanobacteria dominate microenvironments on saline surfaces, saturated with chlorophyll.

As a salt-resistant algaloid, these species are considered important not only for ecological indicator, but also for biotechnological research. Based on them, methods for biological assessment of the salinity of the soil have been developed (Round, 1981; Lukin, 1986).

Of general ecological importance; algaloids found in various ecological zones - serve as bioindicators that indicate the overall health of the soil, the active continuation of biochemical cycles and signs of pollution or degradation in the environment.

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4. Comparative analysis with international studies; scientific studies carried out in the last decades in various agroecological zones of the world indicate that the composition of algoflora in the soil and the main factors affecting its formation are pH, salinity, humidity and anthropogenic effects. The types of soil microalgaloids and their distribution vary significantly depending on global climatic conditions, geochemical stock and hydrological regime.

According to research by Lukin (1986) and Kiseleva (1993) of Russia (Caucasus, Astrakhan region), the types Chlorella, Scenedesmus, Nostoc are dominant in semi-arid bad soils in the southern regions of Russia, the abundance of which is associated with the amount of carbonate in the soil and the temperature regime. And in the Caucasian mountain steppe zones, Phormidium and Oscillatoria species, adapted to hydromorphic conditions, predominate.

India (Punjab, Gujarat states).

Observations by Mahajan and Ramteke (2003) in the Punjab region of India have shown that Dunaliella, Anabaena, Aphanothece species are common in irrigated salt-soils, adapted to salt concentrations in irrigation waters. It has also been shown that high plant biomass is actively involved in the nitrogen cycle of these algaloids.

China (Xinjiang – arid and saline region).

In semi-desert and saline soils in Xinjiang, Sun et al. (2010) observed galophyte algaloids – Dunaliella salina, Spirulina platensis, Chroococcus minutus. These microorganisms are resistant to high osmotic pressure and have the property of living stably and photosynthesizing in precisely saline environments.

USA (California, Arizona-semi-arid regions)

American Scientists (Graham & Wilcox, 2000) have argued in their research that algaloids such as Chlorella, Scenedesmus, Nostoc, Anabaena have universal Ecological flexibility. In particular, the occurrence of Chlorella species in various agrobiogeocenoses (brackish, hydromorphous, carbonate) proves its high ecological importance.

Algaloid species according to their level of environmental adaptability

Microalgae Species	**Distribution Zone**	**Ecological Requirement**	**Adaptability Level**
Chlorella vulgaris	Global (Uzbekistan, Russia, USA)	pH 6.0–8.0, moderate moisture	High

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Scenedesmus obliquus	India, USA, Fergana Valley	Irrigated and organically rich environments	High
Dunaliella salina	China, India, Karakalpakstan	Saline, hot, dry; resistant to high salinity	Low (only in saline conditions)
Nostoc commune	Russia, USA, Fergana Valley	Dry and moderately humid conditions	Moderate
Phormidium tenue	Russia, Uzbekistan	Humid, hydromorphic environment	Moderate

Conclusion: international experience shows that the Chlorella and Scenedesmus species have high ecological flexibility and are found in almost all types of soils. In contrast, Dunaliella, Aphanothece, and Spirulina species are only adapted to saline, high osmotic pressure environments and are widely used for bioindication purposes. This provides the basis for their recognition as an important tool in soil environmental monitoring and melioration efficiency assessment.

Algoflora of Fergana Valley soils are very diverse and their composition varies depending on the soil type, moisture, pH and salinity level. Microalgaloids are of great importance as bioindicators in assessing soil ecological status. In the future, the use of modern molecular-genetic methods in this area will allow a deeper analysis of algalogical diversity.

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