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Based on the review of Andijan State University associate professor, PhD S.T. Mamasoliyev

COMPARATIVE ANALYSIS OF CYANOPROKARYOTES STUDIED IN THE RESEARCH AREA OF FERGANA VALLEY BY SOIL TYPES

Annotation

The conducted researches are mainly based on the results of works carried out in eroded and non-eroded areas. We saw the presence of eroded and non-eroded soils depending on the topography of our research area. These soils are light gray and light gray, and in areas slightly higher than sea level, they are light brown. The research was carried out on different soil types, and all results were explained on the basis of comparative analysis. In addition to the results of erosion, information about Cyanoprokaryote species found in cultivated and uncultivated fields of the Fergana Valley is presented.
Key words: Erosion, algae, cultivated, uncultivated, Ferghana Valley.

СРАВНИТЕЛЬНЫЙ АНАЛИЗ ЦИАНОПРОКАРИОТ ИЗУЧЕННЫХ В РАЙОНЕ ИССЛЕДОВАНИЙ ФЕРГАНСКОЙ ДОЛИНЫ ПО ТИПАМ ПОЧВ

Аннотация

Проведенные исследования в основном основаны на результатах работ, проведенных на эродированных и неэродированных участках. Мы видели наличие эродированных и неэродированных почв в зависимости от рельефа района наших исследований. Эти почвы светло-серые и светло-серые, а на участках чуть выше уровня моря - светло-коричневые. Исследования проводились на разных типах почв, и все результаты объяснялись на основе сравнительного анализа. Помимо результатов эрозии представлены сведения о видах Cyanoprokaryote, встречающихся на возделываемых и невозделываемых полях Ферганской долины.
Ключевые слова: Эрозия, водоросли, культивируемые, некультивируемые, Ферганская долина.

FARG‘ONA VODIYSI TADQIQOT HUDUDIDA O‘RGANILGAN CYANOPROKARIOTLARNING TUPROQ TURLARI BO‘YICHA QIYOSIY TAHLILI

Annotatsiya

Amalga oshirilgan tadqiqotlar asosan eroziyaga uchragan va eroziyaga uchramagan hududlarda olib borilgan ishlar natijalariga asoslanadi. Biz o‘rganayotgan hududimizning relyefidan kelib chiqib, eroziyaga uchragan va eroziyaga uchramagan tuproqlarning mavjudligini ko‘rdik. Bu tuproqlar och bo‘zdan och bo‘zgacha, dengiz sathidan biroz balandroq hududlarda esa och jigarrang rangga ega. Tadqiqotlar har xil turdagi tuproqlarda olib borildi va barcha natijalar qiyosiy tahlil asosida tushuntirildi. Eroziya natijalari bilan bir qatorda Farg‘ona vodiysining ekin va ishlov berilmagan dalalarida uchraydigan siyanoprokariot turlari haqida ma'lumot berilgan.
Kalit so‘zlar: Eroziya, suvo‘tlar, haydalgan, ekinsiz, Farg‘ona vodiysi.

Introduction. D.A.Davidov Cyanoprokaryotes (Cyanoprokaryota) are photosynthetic prokaryotic organisms with oxygen. For a long time, they belonged to algae, and in the framework of botanical nomenclature, they are called blue-green algae (Cyanophyta). The structure of cells: the prokaryotic type of the genome, the structure of ribosomes, the biochemistry of the cell wall and other features became the basis for introducing the term cyanobacteria (cyanobacteria). Within the modern approach to the study of this unique group, it was considered unreasonable to equate organisms with such an advanced type of metabolism with bacteria, and therefore the name Cyanoprokaryota was proposed (Komárek, 1993; Komárek and Anagnostidis, 1998). Cyanoprokaryotes are among the most complex organized and morphologically differentiated prokaryotic microorganisms. They appeared on Earth about 2.5 billion (according to some reports, even 3.2 billion (Schopf, 1974)) years ago in the Late Archaean, they dominated the Earth's living organisms for 1500 million years. During this period, oxygenic phototrophic cyanoprokaryotes were not only the main producers of organic matter, but also ensured the transition to an oxygenic atmosphere, which caused the Neoproterozoic revolution in the development of the Earth's biosphere (Sergeev et al., 2002). S.T. Mamasoliev studied algae in the gray soils of Central Fergana. As a result, the author noted that cyanoprokaryotes are more abundant than others in the soils of arid regions (2013, p. 127-128).

Material and Methods. Taking soil-algological samples. Soil sampling Soil-algological samples were taken using the methods of Gollerbach and Shtina (1969). The sampling site was taken from eroded and non-eroded soils of Fergana Valley. The obtained soil-algological samples were taken from the bedrock layer of eroded and not-eroded soils. That is, A, B, C are horizons. From a depth of 0-5 cm to 50 cm. Esmarch (1911), Lund (1920), Fritsch and John (1942), Pringsheim (1944),

Gornyunova (1948), Gollerbach and Polyansky (1951), Guseva (1956), Starr (1960), Vladimirova and Semenenko (1962) methods were used.

Isolation and cultivation. In the second method, the green mass was planted in Bristol's liquid nutrient medium (1920), the green mass formed on the wall of the test tube was then cultured in Dryu, BG 11+ nutrient medium with nitrogen (1% agar, pH = 7.0) (blue-green and green modified by Allen media for algae, 1968; Stainer, 1968; Rippka et al., 1979) and a clean sample of algae was obtained. All the obtained isolates were grown in a climatostat under standard conditions (temperature + 22-24, light 65-75 m mol background, photoperiod 102).

Microscope. The study of strain morphology was carried out using light microscopy methods. Model N-300 (UCMOS09000KPB) and Model Kern optics ODC 241. The results of observations are documented with photographs taken with digital cameras (9.0 MP 1/2.4). Strain observation time ranged from 10 hours to 2 months.

Results and discussion.

49 types of Cyanoprokaryotes were identified in soils with varying degrees of erosion. In our research, Cyanoprokaryotes were also recorded in abundance in soils rich in nutrients and trace elements. Dubovik (1995) among the researchers of this situation; Kuzyakhmetov (1991) compared the number of cyanoprokaryote species and their distribution in eroded and non-eroded soils. Kuzyakhmetov (2000) reports that there are many representatives of these two orders in the soil. Dubovik (1998); Kabirov (2004); Sukhanova (1996); Sugachkova (2000); Khaibullina (2004) also stated that in the soils of Central Asia, in particular, in the soils of Uzbekistan, we bring for the first time the number of species of *Oscillatoriaceae* 33, *Anabaena*, *Cylindrospermum* and *Plectonema*.

Cyanoprokaryotes Oscillatoria brevis, *Phormidium angustissimum, Ph. ambiguum, Ph. foveolarum, Ph. molle, Ph. boryanum, Microcoleus vaginatus, Nostoc commune, Anabaena variabilis, Cylindrospermum licheniformis* were more common among the cyanoprokaryotes that are resistant to the erosion processes occurring in the soil, i.e., in all soils of this nature. The similar structure of all these species, the presence of a slimy shell on their body to one degree or another showed their tolerance to the erosion processes occurring in the soils of the research area due to the ability to hold small particles of the soil.

When we analyzed the ecological structure of the species identified from cyanoprokaryotes, it became clear that they consist of 10 life forms. Among the ecobioforms, it was found that the number of species belonging to similar P.CF forms is greater than others. The species belonging to these ecobioforms, along with their morphological structure, physiological characteristics, are often shown to be resistant to the environmental conditions of our arid region.

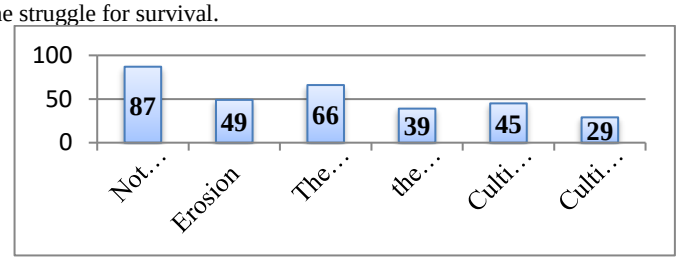
Table 1

Taxonomic structure of Cyanoprokaryotes

Soils	Number of classes	Number of arrangements	Number of family	Number of categories	Number of species
Not eroded	2	4	12	19	87
Eroded soil	2	4	11	16	49
The reserve is not eroded	2	4	11	16	69
The reserve is eroded	2	4	9	12	39
Cultivation not eroded	2	3	9	13	45
Cultivation eroded	2	4	8	12	29
Total	2	5	13	20	95

As a result of soil-algological studies, it was found that the species belonging to 95 species systematically belong to 2 classes, 13 families and 20 species. In the taxonomic structure, 95 species belonging to the three orders of Oscillatoriales, Nostocales, Stigonematales belonging to the plowed soils that are not subject to erosion, representatives of the Tubiellales family were also found. The number of categories in different categories was 12 homogeneous categories from protected eroded and plowed eroded soils. Such a similarity was found in eroded and protected eroded soils - 16 indicators.

Biodiversity by species is the highest. 87 species were recorded in non-eroded soils. We believe that the abundance of cyanoprokaryotes in these soils is due to the fact that species of filamentous, somewhat slimy-coated species have more protection opportunities in the struggle for survival.



1-pic. Changes in the number of species on soils.

Physico-chemical processes in water-eroded soils adversely affected the development of Cyanoprokaryotes, causing the number of species to decrease from 86 to 49 by 43.7%. This indicator was 43.5% in protected non-eroded and eroded soils, 36.5% in plowed non-eroded and eroded soils. The erosion effect on cyanoprokaryotes in plowed soils was 7% different than that in protected soils. In this, the dominance was shown in P and CF ecoforms of Cyanoprokaryotes, stability in non-eroded and eroded soils.

There are also ecological bioforms, which create a unique structure in different soil types.

Algae with a monad type morphological structure actively move with the flgae breeder. In unfavorable conditions, they lose their hyacinths and become surrounded by thick mucus to the palmelloid state, and when favorable conditions arise, they return to their previous structure (Yu.A.To‘xtaboyeva, 2019).

Table 2

Changes in the ecological composition of Cyanoprokaryotes

Soils	Ecobioforms formula
Not eroded soil	P_{29} CF_{24} $Hydr_9$ M_5 C_4 $Amph_6$ X_3 PF_3 Ch_2 NF_2
Eroded soil	P_{20} CF_{15} PF_4 $Hydr_3$ M_2 Ch_2 C_1X_1 NF_1
The reserve is not eroded	P_{25} CF_{16} $Hydr_7$ M_4C_4 $amph_6$ X_2 Ch1 NF_1
The reserve is eroded	P_{18} CF_{10} $hydr_3$ M_2 PF_4 C_1 NF_1
Cultivation not eroded	CF_{17} P_{16} $hydr_2$ M_3 PF_3 X_2 Ch_1 NF_1
Cultivation eroded	CF_{13} P_{11} CH_2 $hydr_1$ M1 X_1

Total	P_{31} CF_{26} $hydr_{10}$ M_5 PF_5 C_4 $amph_6$ Ch_3 X_3 NF_2

In our soil ecological studies, the NF form consisted of one or two species in non-eroded and eroded soils. This form was recorded in plowed eroded soils. Ch-form was found only in non-eroded soils. PF-form was recorded in almost all soils. Its 4th type and 5th type are distributed in protected eroded soil. A total of 4 species from the C-form were identified and not found in plowed soils, and one species participated in the rest. It is known that the M-form has 2-5 species from all soils. There are 10 types of species specific to the aquatic environment, and 7-9 species are present in non-eroded soils. Among the forms belonging to ecobioforms, CF-form consisted of 16-24 species in non-eroded soils and 10-15 species in eroded soils.

The protected non-eroded and eroded soils were characterized by high prevalence of CF-form. These filamentous Cyanoprokaryotes are species of *Phormidium and Plectonema* that are true xerophytes that do not produce much of a slime sheath. Biodiversity decreased when moving from not-eroded to eroded soils. PF forms consist of nitrogen-accumulating *Cyanoprokaryotes Scytonema ocellatum, Tolypotrix tenue, T.distorta, Colothrix elenkini. Microcoleus vaginatus, Phormidium jadiniaum, Ph.ambigium, Ph.molle, Ph.retzii, Oscillatoria brevis, Nostoc linkia f. Calcicala, N.punctiforme* was found a lot. Cyanoprokaryotes also developed in soils with strong erosion effects *Microcoleus vaginatus, Nostoc commune*. It turned out that the species of the genus Phormidium are widespread. These species showed resistance to drought and other extreme conditions with their morphological structures and specific physiological processes. It is these species that form the main composition of "greening" in the soil when they develop in a mass way (Tukhtaboeva, 2019; Mamasoliev, 2019).

CF-form species developed more rapidly in plowed soils, both in non-eroded and eroded soils. This life form consists of the nitrogen-fixing Cyanoprokaryotes species *Anabaena, Cylindrospermum, Nostoc*. In eroded soils, the temperature changes quickly to large values, and the percentage of its moisture content is also large. We have already mentioned that the species of the species distributed in such regions are more resistant to drought conditions. A lot of soils were recorded in plowed soils as well as in dry lands. *Oscillatoria limnetica, Schirothrix calcicola, Plectonema edaphicum, Plectonema phormoides, Nostoc linckia f.muscorum, N.punctiforme, N.sphaeroides, Tolypothrix tenue and Synechococcus sp., Cylindrospermum michailorscoense* were found in non-eroded soils.

Among the listed taxa, *Oscillatoria brevis, O. angustissima, Phormidium amibigum f.ambigum, Ph. angustissima, Plectonema boryanum f.* Among the listed taxa, *Synechococcus elongatus, Nostoc kilmani, Oscillatoria anguina, Oscillatoria pseudogeminata, Lyngbya cryptovaginata* were also found. Among the taxa found in more than 50% of our samples, *Phormidium ambigum, Ph. angurtissimum, Nostoc linkia, Cylindrispermum licheniforme, Plectonema boryanum, Oscillatoria brevis, Phormidium molle, Nostoc contorta, N. linkia, N. punctiforme, Anabaena variabilis* were found in eroded soils. Among the areas where algal research was carried out, many species were identified in Khidircha, Kosonsoy and Khazratishakh sections, and in Arbagish, Ayritom. *Anabaena variabilis f.variabilis* in Khidirchi, *Cylindrospermum licheniforma f.licheniforma, Phormidium angustissima* in Khujabad, *Phormidum jadinianum* in Kosonsoy, *Nostoc linkia f.lincia* in Ayritom, *Nostoc punctiforma f.punctiforma* in Chorkesar, *Plectonema boryanum f.boryanum* in Arbagish, *Phormidum autumnale* in Khazratishok developed rapidly.

Among the number of species, Cyanoprokaryotes of the genus Phormidium took the first place, followed by Nostoc.

When we compared the number of species of Cyanoprokaryotes in non-eroded and eroded soils, we found that their taxonomic and ecological structure is less diverse. The average number of Cyanoprokaryotes in our samples was 8.3 in non-eroded soils and 5.8 in eroded ones. At the same time, we found out that in some eroded areas, species resistant to the influence of nocturnal soil-climatic and agrocenotic regimes, such as Oscillatoria, Phormidium, Plectonema, Anabaena, Nostoc, developed rapidly.

Table 5

Status of species-rich families in not-eroded and eroded soils

Leading families	Total number of species			
	Uneroded soil		Eroded soil	
	a	б	a	б
Oscillatoriaceae	32,5	1	30	1
Anabaenaceae	15	2	12,5	3
Plectonemataceae	10	4	10	4
Nostococae	12,5	3	15	2
Schizothrichaceae	7,5	5	7,5	5
Rivulariaceae	5	6	5	6-7
Scytonemataceae	2,5	7-8	5	6-7
Synechococcaceae	2,5	7-8	0	8

Oscillatoriaceae replaced Nostococeae in first place. Rivulariaceae, Scytonemataceae and Synechococcaceae families were in 6-7-8 places in terms of the number of species.

Applying the Shannon Weaver Index of Biodiversity to the number of species in identified studies produced the following picture.

Table 7

Shannon Weaver index pointers

Soil	1	2	3	4	5	6	7
Not eroded soil	0,9	0,8	0,75	0,67	1,0	1,0	0,9
Eroded soil	0,6	0,8	0,73	0,7	1,1	1,1	1,0

It was found that there was little difference between the values of the Shannon Weaver index in the 7 plots that were not eroded and those that were eroded. It proved numerically that there was a decrease in the development of Cyanoprokaryotes in the soils of non-eroded and eroded plots.

Oscillatoria brevis, Phormidium ambigium f.ambigium, Ph.angustissimum, Ph.boryanum f.boryanum were more common in the soils of all plots.

Conclusion. Eroded and not-eroded soil types were distinguished in the area of the study, and algal genera found in plowed protected lands and non-plowed protected lands were distinguished. From the obtained results, it became clear that some species are flexible even in eroded soils, and all of these species showed tolerance to the erosion processes occurring in the soils of the research area due to the properties of holding small particles of the soil due to the similar structure and the presence of a

slimy shell on the body. The species richness of Cyanoprokaryotes in eroded and not-eroded protected lands was revealed compared to plowed and cultivated soils. In our opinion, this is explained by the lack of influence of anthropogenic factor.

When we analyzed the ecological structure of the species identified from cyanoprokaryotes, it became clear that they consist of ten life forms. We explain that the different forms of life are related to the erosion of the soil and the state of soil cultivation. Bioform changes in eroded soils often occur as a result of soil erosion by wind and water. But even in this case, the preservation of the bioform of algae shows that they are a resistant species for this area.

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