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Short communications

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SOIL CILIATES OF DIFFERENT TROPHIC GROUPS IN SAMUR-YALAMA NATIONAL PARK, AZERBAIJAN

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Soil Ciliates of Different Trophic Groups in Samur-Yalama National Park, Azerbaijan. Alekperov, I. Kh., Mamedova, V. F. — A comparative investigation of the ciliates of separate trophic groups on the areas of Samur-Yalama National Park with different strength of anthropogenic impact was carried out. The ratio of trophic groups in the soil ciliates communities was found to reflect the ecological conditions in soil environment. It is expressed primarily in the reduction of the number of trophic groups caused by deteriorating environmental conditions.
Key words: Azerbaijan, ciliates, soil, trophic groups, bioassay.

Introduction

The ratio of different trophic groups of ciliates may provide an indicator of the quality of the environment, whether it is water or soil. The greater is the range of trophic groups represented in the soil community, the more favorable are the environmental conditions (Kreneva, 2003, Alekperov, 2012).

Materials and methods

In the period of 2012–2016, 870 soil samples have been collected and processed at 9 collecting points (fig. 1) located in the areas of the Samur-Yalama National Park with various degrees of human activity impact. Additionally we collected and processed 120 soil samples from gardens, orchards and forest in the vicinity of settlements. In total, 180 species of free-living ciliates were found in soils. Fifty-eight of them are first reported for the Caucasian fauna (table 1).

On the basis of the above data, we carried out a comparative investigation on the ratio of trophic groups of ciliates that live in different parts of the Samur-Yalama National Park under human impact of differing degree. For this we chose three of 9 total collection points, one of which lacked any anthropogenic influences in the forest, the second one was in the woods near Nabran village, and the third one was located directly on the cultivated soil of gardens. Thus, we created an experimental ecological series: virgin forest soil, forest soil near the village ("buffer zone") and the soil under the total anthropogenic influence ("agrocenosis").

Results

The ratios of ciliates of different trophic groups are presented in fig. 2, *A*. As it is seen from the diagrams, the forest soils without human impact harbor the following trophic groups in the community of free-living soil ciliates: bacteriophages (28 %), algophages (18 %), ciliates feeding both on bacterial and algal food (30 %), histophages feeding on dead organic matter of both animal and plant origin (14 %). The least numerous were predators, i. e. ciliates that feed

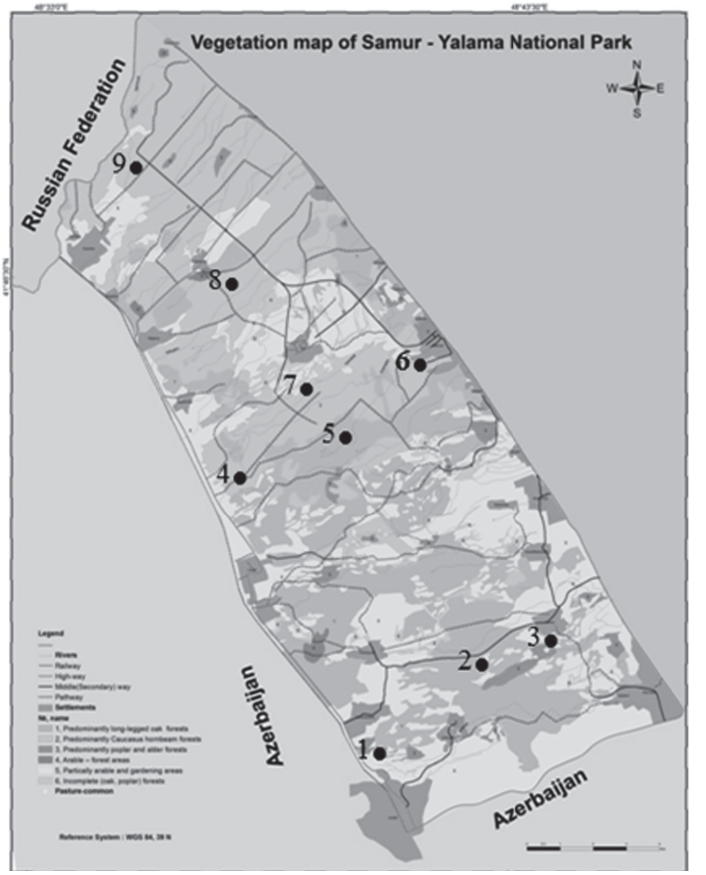

Fig. 1. Points of soil samples collecting in the Samur-Yalama National Park.

on other species of Protozoa, as well as on multicellular Rotatoria, Tardigrada, etc.

The composition of communities of free-living ciliates in the forest soil near settlements ("buffer zone") is presented in fig., 2, *B*. In such communities, the proportion of bacteriophages increased up to 35 %. The group of bacteriophages and algophages constituted 25 % of all ciliates. The proportion of histophages increased up to 35 %, comprising the same percentage as bacteriophages. Based on these data, it can be assumed that in this area in the soil the processes of degradation of organic matter prevail. Here 5 % of ciliates were assigned to the predatory group.

The data on the ratio of different trophic groups of ciliates in the "agrocenosis" with maximum impact of human activity are depicted in fig. 2, *C*.

As it is seen from the diagram, there is a complete dominance of bacteriophages group — 78 % in the cultivated soils. Histophage group composed 18%, and the group of predators was the smallest in the community.

This high percentage of bacteriophages clearly indicates the presence and decomposition of organic matter, which, in our opinion, is primarily due to the application of organic fertilizers on soil gardens. It should be noted that 78 % of bacteriophages does not mean high species diversity. We usually observed 5–8 predominating eurybiontic species of ciliates in cultivated soils, and the Simpson dominance index was 0.65 and even more in the soil agrocenoses.

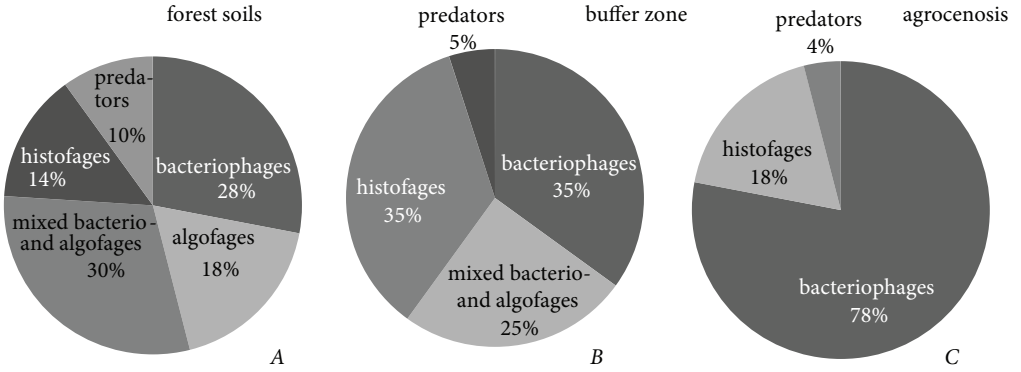

Fig. 2. The ratio of ciliates of different trophic groups in the ecological series of "forest soil" — "buffer zone" — "agrocenosis".

Table 1. New for the fauna of Caucasus soil ciliate species collected in Samur-Yalama National Park

Ciliates species	Sample points								
	1	2	3	4	5	6	7	8	9
Fam. Amphisiellidae Jank., 1979									
Amphisiella acuta Foissner, Agata, Berger, 1982		+			+		+	+	+
A. magnigranulosa Foissner, 1988		+			+		+	+	
Hemiamphisiella granulifera Foissner,1987		+			+		+	+	+
H. terricola Foissner,1988					+	+	+		+
Periholosticha lanceolata Hemberger, 1982		+			+		+	+	
Fam. Oxytrichidae Ehrenberg, 1838									
Oxytricha elegans Foissner, 1999		+		+			+	+	+
O. longa Gelei et Szabados, 1950					+		+	+	+
O. longigranulosa Berger et Foissner, 1989		+		+	+		+	+	
Wallaskia bujorani Lepsi,1951	+	+	+	+	+	+	+	+	+
Australocirrus oscitans Blatterer et Foissner, 1982					+		+		+
A. zechmeisterae Foissner, Berger, Xu and Zechmeister-Boltestern, 2005					+		+	+	+
Fam. Gonostomatidae Small and Lynn,1985									
Gonostomum singhii Kamran, Kumar, Sapra, 2008					+		+	+	
Paragonostomum simplex Foissner, Berger Xu and Zechmeister-Boltestern, 2005		+		+	+	+			
Fam. Urostylidae Bütschli, 1889									
Holostycha australis Blatterer et Foissner, 1988	+				+	+	+		+
H. pullaster Müller, 1773					+		+	+	
Paraurostyla caudata (Stokes), 1886	+	+			+			+	+
Birojimia terricola Berger and Foissner, 1989		+		+	+		+		+
Fam. Spathidiidae Kahl, 1929									
Epispathidium ascendes (Wenzel), 1965	+			+			+		+
E. polynucleatum Foissner, Agatha et Berger, 2002		+				+			+
E. terricola Foissner, 1986	+			+		+	+		+
Latispathidium truncatum Foissner, Berger, Xu Zechmeister-Boltenstern, 2005	+				+			+	+
Fam. Tracheliidae Ehrenberg, 1838									
Dileptus costaricanus Foissner,1995				+			+	+	+
D. visscheri Dragesco, 1963	+			+			+	+	+
Fam. Litonotidae Kent, 1882									
Litonotus triqueter Penard, 1922	+				+			+	
L. muscorum (Kahl, 1931)			+		+			+	
Fam. Chilodonellidae Deroux, 1970									
Trithigmostoma bavariensis (Kahl, 1931)		+		+	+		+		
Alinostoma multivacuolata Alekperov, 1993	+		+						
A. polyvacuolatum (Foissner et Didier, 1981)	+					+	+		+
Fam. Nassulidae Fromentel, 1874									
Nassula terricola Foissner, 1989			+	+				+	+
N. exigua Kahl, 1931		+			+				
Fam. Pseudomicrothoracidae Jankowski, 1967									
Pseudomicrothorax agilis Mermod, 1914		+				+	+	+	+
Fam. Microthoracidae Wrzesniowski, 1870									
Microthorax glaber Kahl, 1926						+	+		+
M. elegans Kahl, 1931	+			+					
Stammeridium kahli Wenzel, 1969		+			+		+	+	
Drepanomonas sphagni Kahl, 1931	+	+	+	+	+	+	+	+	+
D. pauciciliata Foissner, 1986	+	+	+	+	+	+	+	+	+
Fam. Colpodidae Bory de St. Vincent, 1838									
Colpoda ecaudata (Liebmann, 1936)	+	+		+		+	+		+
C. lucida Greeff, 1888		+			+		+	+	+
C. orientalis Foissner, 1993		+			+		+	+	+
C. variabilis Foissner, 1980	+			+			+	+	
Fam. Hausmanniellidae Foissner, 1987									
Hausmanniella patella (Kahl,1931)					+		+		

H. discoidea (Gellert, 1956)				+			+		
Fam. Cyrtolophosididae Stokes, 1888									
Cyrtolophosis acuta Kahl, 1926		+				+		+	+
Fam. Grossglockneriidae Foissner, 1980									
Grossglockneria acuta Foissner, 1980				+	+		+		
G. hyalina Foissner, 1985		+						+	+
Fam. Plagiocampidae Kahl, 1926									
Plagiocampa incisa Kahl, 1933		+			+			+	+
P. multiseta Kahl, 1930	+	+	+	+	+	+	+	+	+
Fam. Urotrichidae Small et Lynn, 1985									
Urotricha striata Penard, 1922				+			+		+
Fam. Frontoniidae Kahl, 1926									
Frontonia disciformis Alekperov, Obolkina, Wilbert, 2012	+	+	+	+	+	+	+	+	+
F. solea Foissner, 1986		+		+	+				+
Fam. Turaniellidae Didier, 1971									
Colpidium singular Vuxanovici, 1962		+			+		+		+
Fam. Tetrahymenidae Corliss, 1952									
Tetrahymena edaphoni Foissner, 1986	+		+	+				+	
Fam. Spirozonidae Kahl, 1926									
Stegochilum smalli Alekperov, 1993	+			+			+		+
Fam. Cinetochilidae Perty, 1852									
Sathrophilus agitates Stokes, 1887	+	+	+	+	+	+	+	+	+
S. mobilis Kahl, 1926		+	+	+			+	+	+
Fam. Cyclidiidae Ehrenberg, 1838									
Cyclidium heptatrichum Schewiakoff, 1893	+	+				+		+	
Fam. Uronematidae Thompson, 1964									
Uronemella filicium (Kahl, 1931)		+			+				+
Cristigera pleuronemoides Roux, 1899		+			+				+

Conclusions:

1. The ratio of trophic groups in the community of soil ciliates reflects the ecological conditions in the environment. It is expressed primarily in the reduction of the number of trophic groups of ciliates following the deterioration of environmental conditions.

2. Comparative studies of the ratio of soil ciliates trophic groups in the line "forest soils" — "buffer zone" — "agrocenosis" showed a consistent reduction in the number of groups: 5 trophic groups were observed in forest soils, 4 trophic groups in the buffer zone and only 3 trophic groups in soil agrogenosis.

3. The ratio of trophic groups in the soil community may be an indicator of the environmental conditions. For example, the total percentage of bacteriophages and hystophages was 70 % in the buffer zone indicating the prevalence of organic matter degradation in the soils of this area.

4. The anthropogenic influence, the strongest in the cultivated soils of gardens, is depressing to communities of ciliates. In our opinion soil digging and too excess of fertilizers is a destabilizing factor for the soil Protozoa, and high percentage of bacteriophages indicates the presence of amplification process of organic decomposition in the soil of this area.

Therefore, the present analysis indicates that the free-living ciliates are indicators of the environmental conditions in soil, and they are actively involved in the process of purification and improvement of soil fertility.

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