

## The Ecological Features Ciliates of the Virgin Soils Samur-Yalama National Park and Neighboring Territory

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**The Ecological Features Ciliates of the Virgin Soils Samur-Yalama National Park and Neighboring Territory:** During 2009-2011 the fauna and ecological features of the virgin soils ciliates of Samur-Yalama National Park and neighboring territory (Northern-East Azerbaijan) were researched. Comparative study shown, that the ciliates species diversity soils (especially forest area) of Samur-Yalama Reserve more higher than its neighboring territory with agricultural soils.

**Key words:** ecological features, virgin soils, the fauna, diversity soils

### INTRODUCTION

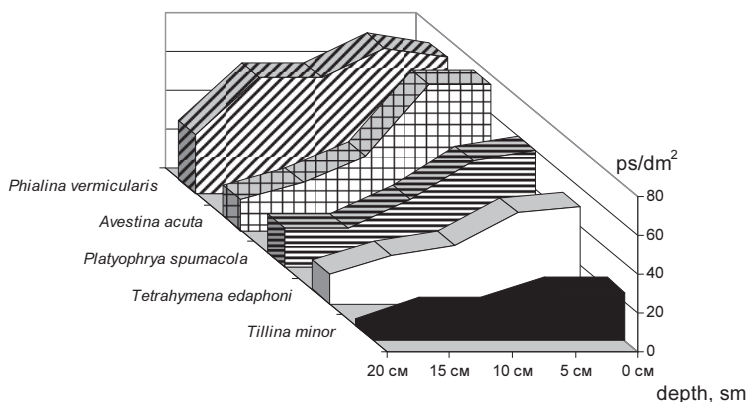
It was already noted that the study of soil ciliates in Azerbaijan started much later than their aquatic marine and freshwater groups, which explains the poor knowledge of the ecology of the soil species (Алекперов, 2005). That is why much attention has been given to the study of ecological characteristics of soil ciliates of the regions we investigated. Below we present our results on some aspects of ecology of this group of soil Protozoa.

vertical direction, because the depth changes dramatically a number of key ecological factors that affect the lives of the inhabitants of the soil: a change in the voids between soil particles, their density, composition of the air - with depth in the lower soil horizons oxygen content decreases, and the concentration of carbon dioxide increases.

In forest soils, the highest species diversity and total number of ciliates were observed in the upper 0-10 cm which is due to the high humidity of the surface layers of forest soil in the shade of plants, which allows ciliates to be here in the active phase - no need in cyst stage. On the other hand, in the superficial layers of the soil there is the highest concentration of decaying organic matter, and hence the abundance of microorganisms, many of which are food objects for a number of ciliates - bacteriophages.

The most of ciliates marked in the forest zone reach the mass development in the soil layer of 0-15 cm, with a consistent decrease in species diversity and total amount to depth. At the same time, some of the repeatedly observed species of ciliates had clear localization in certain soil layers. For example, such background species as *Phialina vermicularis*, *Avestina acuta*, *Platyophrya spumacola*, *Tillina minor*, *Tetrahymena edaphoni* and others for the most part inhabit in the uppermost layers of 0-15 cm of forest soil (Fig. 1).

At the same time, small representatives of the genera *Drepanomonas*, *Microthorax* and *Cyrtophrya* prefer the deeper layers of 10-25 cm and deeper. The maximum depth of penetration into the interior of the soil where ciliates were observed was 52 cm. Generally we noted the general trend - in the surface layers of soil there were more common species of ciliates, which have medium and large sizes. In addition, we noted that in the surface layers of soil there were also facultative soil ciliate species that usually live in fresh water - such as the genera *Zosterodasys*, *Nassula*, *Platynematum*. Apparently this is due to both drift by rainwater of freshwater species, optionally occurring in the surface layers of moist soil and the presence of larger cavities in the surface layers of soil, allowing larger-sized species of protozoa, including ciliates to settle in them.



**Fig. 1. The vertical distribution common ciliates species in the forest soils of Samur-Yalama reserve**

On the other hand, in the deeper soil layers, 10-25 cm, where the size of the cavities is much smaller soil ciliates of the genera *Drepanomonas*, *Microthorax* and *Cyrrhophrya* were found.

Thus, the most important factors influencing the distribution of ciliates in the thick forest soil is its humidity and structure.

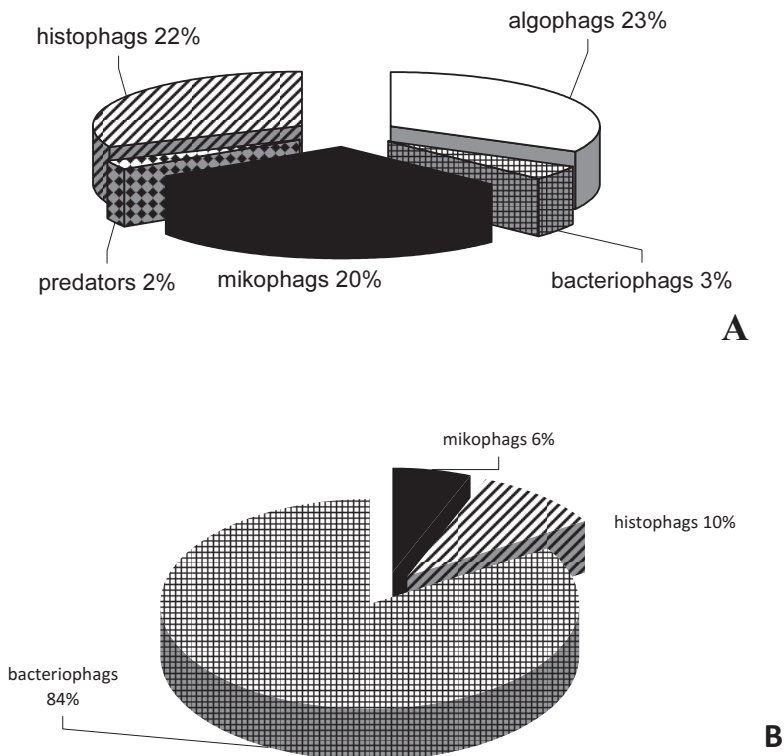
The vertical distribution of ciliates in virgin soils subjected to anthropogenic influence in the buffer zone, especially the cultivated soils of agricultural lands near Samur-Yalama Reserve showed that their qualitative and quantitative development of the soils are very different from the protected area.

The virgin soil of the buffer zone under the influence of human activities, and cultivated soils of agricultural lands are characterized primarily by poor species composition of soil ciliates. Anthropogenic stress (brisk movement of people and domestic cattle and small ruminants) is responsible for degradation of surface soil layers and the strong compaction of deeper horizons. All this leads to severe deterioration of living conditions of the soil fauna - the deterioration of the gas and humidity modes.

A comparison of similar results the buffer zones of reserve has shown that in this cases there is a clear trend of significant increase of the proportion of bacteriophages, constituting in the buffer zone. On the other hand, these zones are characterized by a strong decrease in the proportion of algaphags ciliates constituting. We should also note the lack of ciliate predators in the soil of buffer zones of the reserves.

It is known that the ratio of different trophic groups of ciliates, gives an idea of the quality of the environment, whether water or soil. The more trophic groups are represented in the community, the better is the quality of the environment.

Analysis of data on the ratio of the trophic groups of ciliates in the cultivated soils of agricultural lands in the vicinity of areas of reserves has shown that there was observed even greater increase of ciliate bacteriophages (Fig. 2).



**Fig. 2. The relation trophic ciliates groups in the Samur-Yalama Reserve forest soils (A) and agrocnosis once in buffer zone (B)**

It should be noted that in agricultural soils two trophic groups of ciliates - predators and algae -phages were absent completely displaced by other trophic groups – bacterio-, histo- and mycophages.

Thus the above data indicate a depletion of species composition and trophic groups of ciliates in the ecological row: “ reserve- buffer zone” with growing the proportion of eurybionts, most of which are typical bacteriophages, expelling from the community of soil ciliates most rare and usually stenobiotic species.

It should be noted that many of the rare stenobiotic species were observed exactly in the middle part of the forest zone. For example, two of the four species *Bryometopus* were found here, both species of *Thylakidium*, representatives of the previously unknown in the fauna of the Caucasus rare genera as *Cyrophrya*, *Grossglockneria*, *Drepanomonas*, *Stammeridium* and others were also noted in the middle part of the forest zone of the reserve.

Generally, species diversity in the forest zone of the Samur-Yalama Reserve rather highest. From 80 to 105 species were noted here most of which were representatives of rare stenobiotic genera *Bryometopus*, *Hausmaniella*, *Microdiaphanosoma*, *Sterkiella*, *Tetritricha* and *Australocirrus*. This area is characterized by the presence of stenobiotic species populating the upper horizons, 0-10 cm, and for the middle sections of the forest zone of reserves most characteristic is the presence in the soils of many genera,

representatives of which were previously known only from the water habitat, for example species *Zosterodasys*, *Nassula*, *Furgasonia*, *Aspidisca*, etc. Apparently this is due to the presence in the area of the reserves consistently high humidity, which makes possible the settling of the surface layers of the soil and even bedding of the soil by the ciliate inhabitants of aquatic habitats.

It is also characteristic of these zones the presence in soil habitats rather large species of ciliates - *Tillina magna*, *Bresslaua insidiatrix*, *Gastronauta membranaceus*, *Periholosticha lanceolata*, *Histiculus admirabilis*, *Sterkiella histriomuscorum* and others, which refutes the conclusion of Prof. Nikitina (1997) for mandatory reduction of the size of soil ciliates. Apparently this is true only in part - for soils with sharp fluctuations in humidity and a low content of organic matter. According to our data, with optimal values for these factors in the soil both small and large enough (150-300 microns) ciliates can be found.

Species diversity of ciliates in the meadow soils of Samur-Yalama reserve is represented by 70 species. The basis of the community of ciliates in the meadow soils are typical eurybiontic soil inhabitants of genera *Enchelys*, *Epispathidium*, *Platyophrya*, *Colpoda*, *Drepanomonas* and *Microthorax*, the maximum number of which was observed in the medium and deep soil layers (15-30 cm).

Apart from the study of soil ciliates reserve we also conducted a comparative study of aspects of community structure and distribution of ciliates in soils of agricultural lands subjected to intense human impact, mainly plots.

Species diversity in virgin soils, prone to human impact is slightly higher than in agricultural soils.

It should also be noted that due to various agricultural measures no affinity of soil ciliates to certain horizons of agricultural soils were observed, as in the cultivated soils layers of the soil are artificially mixed.

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**Докладът е рецензиран.**