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HABITAT VERSATILITY OF FREE-LIVING CILIATES COMMUNITIES IN DIFFERENT TYPES OF AGZYBIR LAKE BIOTOPES

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Abstract

Among other groups of hydrobionts, free-living ciliates are the primary consumers of aquatic ecosystems and they play an important role in the processing of organic matter. This group of free living protozoa is actively involved in the production and destruction of organic matter at primary trophic levels. Under favorable environmental conditi\ons, free living ciliates have the ability to multiply intensively and form a high biomass. Studies by a number of authors have shown that due to their abundance of free-living protozoa, their biomass is several grams per liter of water and this, in turn, is comparable with the biomass of multicellular animals living in aquatic biotopes [5].

Keywords: ciliata, biotop, species, Agzybir Lake

1. Introduction

We undertaken the special study aimed to biodiversity hotspots of Agzybir Lake free-living ciliates, including the entire water area and individual biotopes.

Within the timeframe of our study 169 species of free-living ciliates were registered. Moreover, 34 species of them were registered by us in a scientific first for the Caspian Sea fauna. In the scientific work we provided an illustrated description of 50 species, which cover specific and rare ciliates. Throughout time span of study the bare minimum of species diversity (46 species) was detected in plankton. As for the benthos, 58 species were observed in the sandy biotope and 80 species in the silty sand. We further recorded the presence of 72 species in the gray silt biotope on muddy soils and the maximum species diversity, consisting of 84 species, in the biotope rich in plant remains. In addition, 66 species of free-living ciliates were discovered in black mud with sapropel deposits. Finally, we managed to identify 71 species of free-living ciliates in the periphyton biotope and 79 species in phytosiliocenoses. It goes without saying that own specific benthic ciliates community inhabits in each of these biotopes.

2. Materials and Methods

Within bounds of the study, samples were collected in various biotopes of Agzybir Lake. The total number of samples taken from 8 stationary points is 380 units.

A certain number of the collected samples were processed at the sampling site, and the rest were quickly

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delivered to the laboratory. Accordingly, the following were carried out in the laboratory, including observations of the feeding habits of different species, counting their numbers, making of general purpose preparations using various methods, and impregnation process with silver nitrate and proteinate.

In order to carry out a quantitative assessment of the number of free-living ciliates an universal method of direct counting of non-concentrated samples were use by us.

The principle of this method is explicit, the number of ciliates is calculated in the same Bogorov chamber in vivo in a volume of water of 3 or 5 ml. A similar process is repeated 3-10 times, then the average value is derived for each species, and the total number in the reservoir is calculated based on the number in 1 dm^2 of soil for benthic species and in 1 liter of water for planktonic species.

As a rule, in protozoological studies it is necessary to calculate the biomass of a certain ciliates species or the total biomass of an entire community in aquatic ecosystems. For such calculations, it is necessary to know the individual mass of an individual particular species, which is equal to the product of the body animal's volume by its specific gravity. In relation to ciliates, the conventionally accepted specific gravity is 1 (this means that it is equal to the specific gravity of water, but in fact the specific gravity of a living cell is slightly higher). Based on this, in order to calculate the biomass, it is necessary to know the body volume of each individual animal species [1].

Methods of ecological analysis applicable to communities of free-living ciliates.

We conducted a double comparison of the commonality of species composition of ciliate communities in different water areas according to the Chekanovsky-Serensen formula, where a-b is the number of species in comparable areas, and c is the number of species common to both areas [1, 2].

We accomplished a Bray-Curtis cluster analysis in order to obtain more accurate information regarding the determination of the compatibility level of the species composition of free-living ciliate communities in the being investigated biotopes of Agzybir Lake.

The development and calculation of all ecological parameters made in dissertation were implemented using the modern computer program "Biodiversity Professional". This program makes it possible to obtain exact outcomes in a short space of time.

Results and discussion

The seasons of the year determine seasonal quantitative changes occurring in the communities of free-living ciliates of various biotopes of Agzybir Lake, which results in a consistent change in species diversity in a specific biotope of the reservoir.

We compared the total species diversity of ciliates in silty sands and sandy biotopes and found that it constitutes 48% of the total (Table) [3].

Table. Indicators of compatibility of species diversity of free-living ciliates from different biotopes of Lake Agzibir (% according to Chekanoski-Sorensen)

Biotopes	Sand	Silty sand	Gray silt	Silt with plant residues	Black silt	Plancton	Periphyton	Phytociliocenosis
Sand	-	48	35	42	32	25	40	39
Silty sand	48	-	50	52	55	17	34	34
Gray silt	35	50		57	52	23	33	35
Silt with plant residues	42	52	57	-	50	14	25	33
Black silt	32	55	52	50	-	25	32	25
Plankton	25	17	23	14	25	-	37	59
Periphyton	40	34	33	25	32	37	-	49
Phytociliocenosis	39	34	35	33	25	59	49	-

It is of interest to note that species such as *E.pseudoraikovi, A. turrita, L.viride, L. Olor; Paraspathidium, Chlamydodon, Coleps* and others form the basis of the species diversity of free-living ciliates in the sandy biotope community. The sandy biotope community is complemented by such species of ciliates as *Loxodes, Blepharisma,* which are considered typical representatives of silty soils, a number of eurybiont bacteriophages, as well as most representatives of the species *Cyclidium* and *Uronema*.

The benthic biotope of gray silt is represented by 72 species and is one of the largest biotopes of Agzybir Lake in terms of area.

Ciliates of the species *Loxodes, Blepharisma, Condylostoma* are typical representatives of the fauna of silty soils and form the basis of this community. Beyond that, we noted facultative species of the genus *Halteria*, which are usually found in planktonic communities of ciliates, as well as representatives of eurybiont bacteriophages such as *Cyclidium* and *Uronema*.

Having compared the communities of species diversity of free-living ciliates of silt-sand and gray-silt communities, we found that this community is quite numerous and makes up 50% of the total number. However, the greatest similarity in the overall diversity of species variety was revealed in the benthos of gray silt and in communities of free-living ciliates of silt rich in plant residues (57%).

The basis of free-living ciliates in these biotopes are *Blepharisma, Spirostomum*, and the order *Hypotricha* is represented by *Hystriculus, Urostyla, Euplotes, Paramecium, Ophryoglenava*, etc. and representatives of other species.

The biotope of black silt, as well as the sandy biotope, is sometimes inferior in area to other benthos of Agzybir Lake. At the same time, the free-living ciliates communities of black silt are quite specific and include many species that are resistant to low hydrogen sulfide content in water, as well as to dissolved oxygen.

It stands to mention that only 66 species represent the species diversity of free-living ciliates of the biotope of black silt. It indicates that it is significantly less than in other benthic biotopes of Agzybir Lake. However, despite this fact, we determined that the total species diversity of free-living ciliates of the black silt biotope and other silt-benthic biotopes of Agzybir Lake is not less than 50% of the total.

The ratio of this result is 55% compared to another silt sand biotope, 52% compared to the gray silt biotope and 50% compared to silt rich in plant remains.

Further, 46 species represent free-living ciliate communities of the plankton of Agzybir Lake. Among them there are representatives of species typical for oligotrix plankton - *Pelagohalteria, Halteria, Heterostrombidim and Limnostrombidium.*

Our double comparison of the total species diversity of free-living ciliates of planktonic and benthic biotopes showed minimal similarity between them.

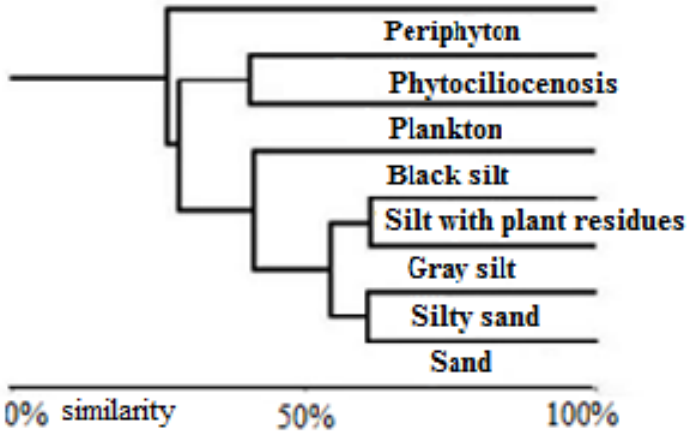
That's why, the similarity between the planktonic biotope and the species diversity of ciliates from different benthic biotopes is minimal and ranges from 14% (silt rich in plant remains) to 25% (black silt).

By double comparing the similarity of the species variety of ciliates in the periphyton and phytosiliocenosis biotopes with the planktonic biotope, it was concluded that in this case the ratio of the total species composition was 37% to 59%, respectively. Hence it follows that it was significantly higher than in benthic biotopes.

With the view of determining the degree of similarity of the species variety of ciliates in all the studied communities of Agzybir Lake, we carried out a Bray-Curtis cluster analysis.

From graph 1 it will be obvious that we have registered the greatest similarity in species diversity in the cluster uniting communities of free-living ciliates of the benthic biotope, which have the lowest values of ciliates communities of black silt. As previously stated this can be attributed to the specificity of the ecological conditions of the benthic biotope [4].

The next cluster is the cluster that unites in species diversity of free-living ciliates biotopes, plankton, periphyton and phytosiliocenoses, which have little similarity.



Graph. Sameness of species diversity of free-living ciliates communities in explored biotopes according to Bray-Curtis cluster analysis data.

Now it can be seen that based on the data obtained as a result of the analysis, the similarity of the species diversity of free-living ciliates of the benthic biotope is at the highest level despite the specificity of each studied biotope. As consistent with the species diversity between communities, free-living ciliates of plankton, periphyton and phytocilliocoenosis constitute the second largest group based on the similarity criterion.

Our long-term observations suggest that representatives of typical planktonic genera such as *Pelagohalteria, Monodinium, Didinium, Askenasia, Mesodinium* and *Linostomatella, Vorticella* form the core of planktonic ciliate communities and this is typical for freshwater and mesohalobiotic waterbody. On the other hand, as previously described, the planktonic communities of ciliates of Lake Agzybir, characterized by a wealth of shallow and aquatic vegetation, are often additionally enriched with numerous facultative species. Such enrichment occurs inter alia due to mixing in windy weather with representatives of the genera *Longifragma, Paramecium cins*, as well as with eurybiont representatives of the genera *Cylidium, Uronema*, which can be found in approximately all biotopes, with round-ciliated ciliates *Zoothamnium*, torn off from the substrate and with peritrich species, traditionally considered representatives of periphyton. Ciliate communities of periphyton have unique character traits that relate only to this biotope. This primarily concerns the presence of representatives of typical ciliates from such genera as *Chlamydodon, Dysteria and Zosterodasys*, which reproduce in water. Such ciliates inhabit primary periphyton ciliate communities along with many representatives of such genera of peritrichous as *Epistylis, Vorticella, Carchesium and Zoothamnium.*

The difference between periphyton ciliates and free-living ciliates of planktonic communities and phytocillium communities is the fact that they inhabit a hard surface covered with biopollution of both plant and animal origin. With that in mind, slowly crawling phytophages and various peritrichs that attach to the substrate dominate in periphyton ciliate communities

Even as only 46 species have been recorded in planktonic communities and only 80 species in phytocillium communities - both communities have many common species.

For example, species of *Pelagohalteria, Limnostrombidium, Monodinium, Didinium, Askenasia, Mesodinium* and representatives of other genera are common to both communities.

We compared the degree of similarity of communities of free-living ciliates of periphyton and phytosiliocenoses and found that the similarity of their species diversity is 49% of the total indicator.

There are extremely few common ciliates in these two biotopes. These are predominantly representatives of the genera Cyclidium, Uronema, Vorticella and other species. These include both species living on contaminated surfaces and species living among thalli of algae or higher aquatic plants.

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