Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2016; 4(5): 762-765

Received: 15-07-2016
Accepted: 16-08-2016

Vefa Mamedova
Azerbaijan State University of Ganja

Ilham Alekperov
Institute of Zoology ANAS, Baku

Correspondence
Ilham Alekperov
Institute of Zoology ANAS, Baku

Vertical distribution of ciliate pedobionts in the forest and cultivated soils of Samur-Yalama national park

Vefa Mamedova and Ilham Alekperov

Abstract
Vertical distribution of ciliate pedobionts have been investigated (studied) in the forest and cultivated soils in the territory of Samur-Yalama National Park. It has been found that the greatest diversity of species and the total number of ciliates pedobionts occur in the uppermost soil horizons of 0,5-15cm in spring and autumn. Large facultative species which are common for aquatic habitats, and true pedobionts adapted to life in the thickness of the soil are clearly distinguished in the communities of soil ciliates. Determined factors of the distribution of ciliates in the thickness of the soil are its humidity, the presence of food and human impact.

Keywords: Azerbaijan, soil ciliates, vertical distribution

1. Introduction
As mentioned above, as a habitat for protozoa the soil appears in the microaqueous system. The soil is permeated by cavities of different sizes, filled with a mixture of gases and aqueous solutions. Depending on the depth, the most important environmental factors that determine the possibility of existence of animals' pedobionts change dramatically in the deeper soil layers [4]. For example, the composition and density of soil particles determine the humidity and gas conditions in deep layers, i.e. the possibility of settling their Protozoa, including ciliates pathobiont [1, 2]. basis On the bases of the above mentioned, we have studied the fauna and ecology of soil community of free-living ciliates in Samur-Yalama National Park and the vertical distribution of ciliates pedobionts in soils with different strength of anthropogenic impact on them.

2. Materials and methods
Samur-Yalama National Park is the youngest of all the national parks in Azerbaijan. It was founded by decree №2518 of Azerbaijan Republic President Ilham Aliyev on November 5, 2012. 11772.45 hectares of state land fund have been allocated for the establishment of the national park in the administrative territory of Khachmaz region. The area of Samur-Yalama National Park is located on the state border between Azerbaijan and Russia, and runs along the Caspian Sea coast on the Samur-Shabran lowlands. Forest and meadow-forest soils dominate on the territory of the National Park. There are chestnut trees in some places [3]. The temperature of the soil is 23-25 ^{0}C in summer and it is 0.8-2.4 ^{0}C in winter. Humus content is 2.2-2.8, pH -7.5-8.2. The annual rainfall is 300-380 mm, the ground water is close to the soil surface. The moisture of the soil is 15-21% in summer and 45-68% in winter.
The forests are thick-leaved on the territory of the Samur-Yalama National Park and formed by such trees as chestnut oak, Caucasian maple, hedge maple, elm. It should be noted that this region has been actively populated by humans in recent years; as a result many parts of the forest areas have been destroyed and at present is replaced with man-made landscapes, which fully indicates the timeliness and the need to create a national park in the region.
During the period of 2012-2016 870 soil samples have been collected and processed at 9 stationary collection points (Figure 1) located on the areas of the Samur-Yalama National Park with various degrees of human activity impact. In addition to evaluating the impact of human activities on soil fauna - on the pattern of communities of ciliates pedobionts collected and processed 120 soil samples with gardens, orchards and forest soils in the vicinity of settlements.

We carried out collecting soil samples from the surface in small clean plastic bottles. 30 centimeter tube with a diameter of 3 cm was placed in the soil for taking samples from the deeper layers of the soil. Then the cut tube of the soil monolith was examined on layers. Accounting of the ciliates have been carried out in the Bogorov chamber in the 3 or 5 ml of water, which soil sample previously had been flooded in a ratio of 1 part soil to 3 parts distillate. This operation was repeated from 3 to 10 times, and then the average figures for each sort were found and recalculation was done on 1 dm^2 soil.

3. Results and Discussion

Activity of soil Protozoa, mainly free-living ciliates and the process of their excystation is primarily determined by the humidity of the soil environment, because only an optimal for a specific type of soil moisture is possible for all the vital functions of ciliates pedobionts - such as movement, osmoregulation, nutrition and reproduction. The optimum percentage of soil moisture biotopes is different for each species of ciliates. Of course here ecological valence of species should be defined–i.e. as this type can exist with minimal values of soil moisture, and it is clear that the smaller species of ciliates, the lower the moisture content sufficiently for its life. Besides small, true of soil ciliates (genera as *Microthorax, Trochiliopsis, Leptopharinx*, small *Colpoda* and) and others are able to colonize the deeper soil horizons (25-35 cm.). The greatest depth at which we found ciliates pedobionts is 75 cm, in the root zone of chestnut oak.

We have carried out a comparative investigation of the vertical distribution the most typical for the soil fauna species of free-living ciliates pedobionts.

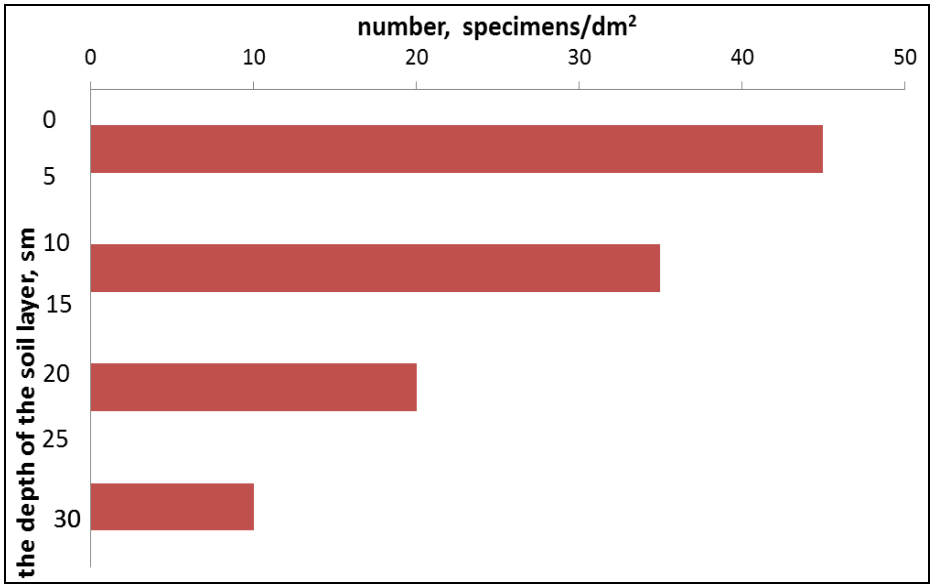

Fig 1: Vertical distribution of the total number of ciliates pedobionts in forest soils in spring 2012-2015)

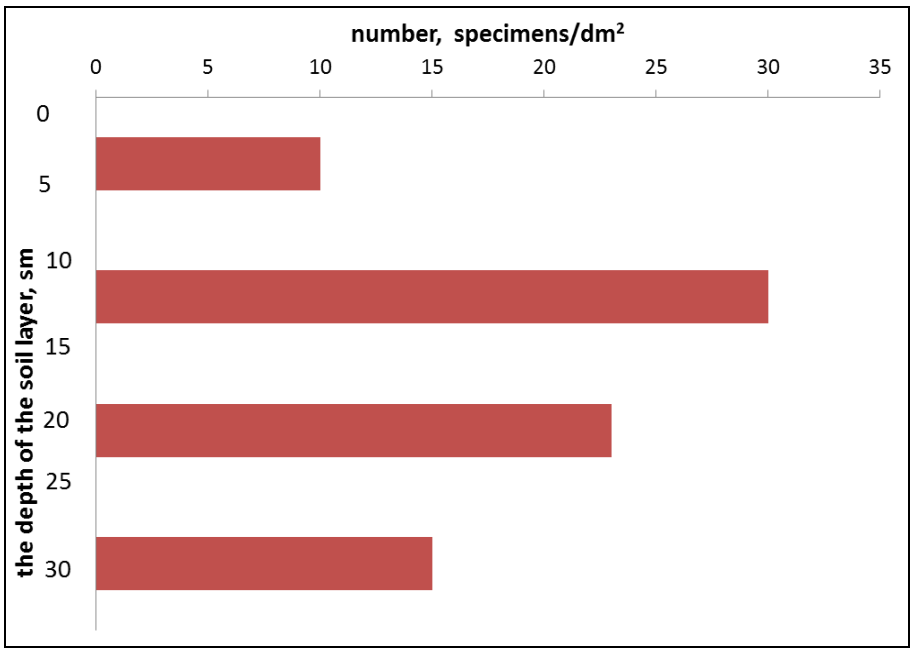

Fig 2: Vertical distribution of the total number of ciliates pedobionts in forest soils in summer 2012-2015)

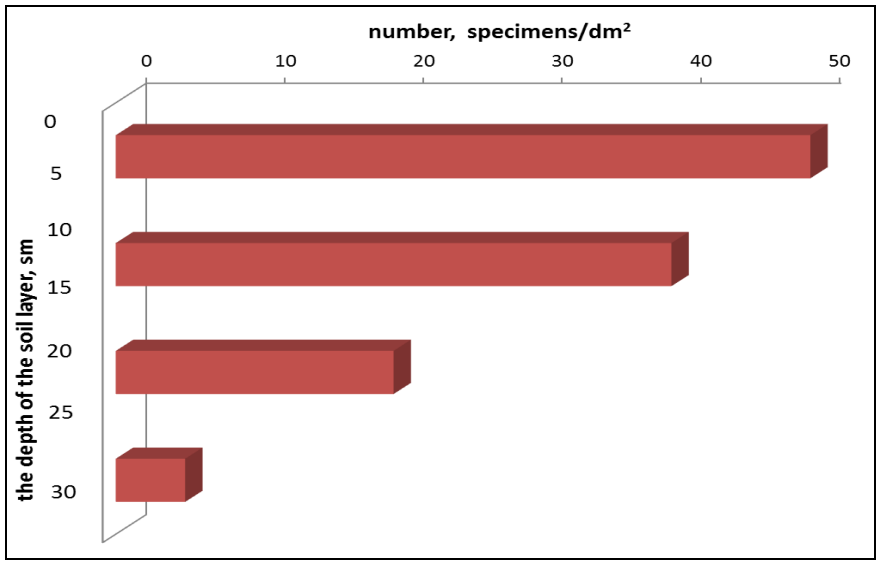

Fig 3: Vertical distribution of the total number of ciliates pedobionts in forest soils in autumn 2012-2015)

Fig. 1 shows the averaged results of the vertical distribution study of species of ciliates pedobionts in forest soils of Samur-Yalama National Park. As it is seen from Fig.1, the maximum total number of ciliates pedobionts was 45 specimen/dm^2 in the horizon of 0-5 cm, i.e., in the forest soil litter in spring. The data show that, the vast majority of optional soil types were observed in the uppermost layers at this time, i.e. ciliates, that in addition to the soil habitat are frequently recorded in the fauna of fresh water. Patterns include the species as *Amphisiella acuta, A. reptans, Oxytricha elegans, O. longa, O. setosa, Chilodontopsis depressa, C. muscorum*.

In the deeper layers of 10-15 cm, the total number of ciliates pedobionts decreased to 35 specimen/dm^2. In these horizons species with most characteristic also can be called representatives of soil fauna as *Colpoda inflata, C. aspera, C elliottii, Bresslaua vorax, Pseudoplatyophrya nana*, which were found in the deeper horizons of 20-25 cm in small quantities.

However, most of the largest species drop out of the community of soil ciliates in the horizon of 20 cm and deeper (30 cm), and most of single individuals of true pedobionts as members of the family Cinetochilidae- *Sathrophilus agitatus, S. ovatum, Platynematum sociale, Cinetochilum margaritaceum* were found in these horizons.

The data presented in fig.2 on the vertical distribution of the total number of ciliates pedobionts in forest soils in the summer season is characterized by extremely low quantitative indicators in the surface layers - where ciliates were met almost as single copies (10 specimen / dm^2). At the same time the total number of soil ciliates rises to 30 specimen/dm^2 in the deeper horizons of 10-15 cm. This is due to drying of soil litter and subsurface soil in summer, which leads to localization of the main mass of the ciliates pedobionts in deeper, preserving 15-25% moisture of soil horizons. It should be noted that facultative species of soil communities of ciliates pedobionts completely fall in the summer, and true species pedobionts as *Spathidium porculus, Epispathidium terricola*, small eurybiont species, as *C. maupasii, C. steini, C. aspera, C. colpidiopsis*, as well as those of true soil ciliates as *Microthorax pusillus, M. costatus, Stammeridium kahli* and *Drepanomonas revoluta* are located in the deeper horizons. The total number of soil ciliates usually fall to 15specimen/dm^2 at a depth of 30 cm and the soil community is represented by only a few instances of minor *Microthorax glaber, M. similans, Drepanomonas sphagni and Trochiliopsis opaca* at these depths.

As it is seen from the data presented in figure 3, the greatest quantitative development of soil ciliates in the forest litter and surface layers of the soil was observed in the autumn (50specimen/ dm^2). A typical feature of the qualitative and quantitative development of ciliates pedobionts in autumn is its presence in the surface layers of optional species that appear due to strong autumn precipitation and, consequently, increase the humidity of the surface layers of soil. At this time, we observed such big species, known primarily as the inhabitants of fresh water as *Urostyla grandis, Uroleptus lepisma, Paraurostyla weissei, P. herbicola, Oxytricha immemorata, Sterkiella guadrinucleata, Australocirrus oscitans, Dileptus gracilis, D. visscheri and Trithigmostoma steini* in the layer -0-5 cm of the forest soil. A particular interest is the finding of the rare species as *Colpoda -. C. orientalis, C. variabilis, C. distincta*, etc in the surface layers in autumn. By the appearance of large facultative species in the forest litter and the surface layers of soil we explain their migration from nearby temporary water bodies due to high humidity soil, which smoothes out the differences between the conditions of existence in fresh water and soil with high humidity.

The total number of ciliates was 40 specimen/dm^2 in the deeper layers of 10-15cm, and despite the high humidity, facultative soil species of ciliates pedobionts fall out the communities and are replaced by typical soil fauna. For example, there are representatives of the species as genera *Cyrtolophosis - C. muscicola, C. minor, C. acuta, Gonostomum - G. minima, G. strenua, G. singhii*, and *Trachelochaeta- Trachelochaeta terrestris* and genera *Microthorax - M. similans, M. glaber* and *Drepanomonas - D. pauciciliata* and *D. revoluta.*

The total number and diversity of species of ciliates pedobionts decreases even more in the soil horizons deeper than 20-25cm. For example, total number of soil ciliates does not exceed to 20cop/dm^2 on the horizon of 20-25 cm and only a few instances actually were met (5cop/dm^2) at a depth of 30 cm. Only a few representatives of the species as *Microthorax childbirth, Drepanomonas and Trochiliopsis* were observed by us in these horizons.

We have also investigated the vertical distribution of ciliates pedobionts in cultivated soils of gardens. The results were very inconsistent and chaotic. For example, establishing any pattern in the distribution of soil ciliates is almost impossible after digging the soil in the spring. Naturally this is due to mechanical mixing of soil layers by human activity, which leads to a digging in those moist deeper horizons of the soil which appear to rise to the surface, where the moisture evaporate quickly, resulting in rapid encystment of most soil ciliates.

Thus, summarizing all the above mentioned results, the following conclusions can be considered:

1. During the period of the qualitative and quantitative development of soil ciliates occur in the spring and autumn seasons, due to sufficient moisture for their livelihoods, as well as optimum in the seasons of the temperature regime, the bulk of soil ciliates is localized in the forest litter and the surface layers. At this time, the species diversity of ciliates pedobionts is closest to their freshwater fauna and many facultative species commonly found in freshwater fauna are observed in soil samples with high humidity.
2. Distribution of soil ciliates decreases in the surface layers of the depth in the spring and autumn seasons, reaching a minimum of species diversity and total number at a depth of 30 cm, where the species composition is represented only by true soil, small species of ciliates pedobionts.
3. Vertical distribution of the total number of ciliates in forest soils is very different in the summer season and is characterized by low total abundance and species diversity in the surface layers. This is due to the dry time, which induces migration of most ciliates pedobionts into the deeper layers of 10-15 cm and deeper than it. However, the general pattern of reduction of qualitative and quantitative composition is stored in the summer season, starting from the soil horizon of 20-25 cm, and, which probably is due to the deterioration of the gas treatment and the presence of food in these layers. Thus, only optimum moisture is not enough in soil horizons of 30 cm for successful colonization of the deep.
4. To find any patterns in the distribution of ciliates pedobionts in cultivated soils of gardens our attempts showed that here the fundamental factor is human activity (digging, watering, fertilizing, etc.).

4. References

1. Alekperov I Kh, Akhmedova NA. Influence of insecticides application on species abundance and distribution of soil ciliates. IV.V. Conference set on soil zoology. Tyumen, Russia, 2005, 27-28.
2. Alekperov I Kh, Sadikhova DA. Species diversity of free-living ciliates of mountain soils in different landscapes, Reserve Ismayilli. International conference. Mountain ecosystems and their components. Nalchik, 2005, 20-23.
3. Mamedov R. (editor-in-chief) The Geography of Azerbaijan Republic. Physical geography. Baku, 2014, 1-530.
4. Nikitina LI. Soil ciliates of some ecosystems of Bolshekhekhcirstkiy reserve. Scientific research in the reserves Priamur: Collected articles. Vladivostok-Khabarovsk, 2000, 150-155.