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# Specific Composition and Number of Testaceous Amoebae (Testacea Lobosia, Protozoa) of Ganli-Gol Lake

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**Abstract:** Testaceous amoebae in plankton peryphithon and benthos of the Ganli-Gol lake in the Baku suburbs were investigated with respect to specific composition and number. Twenty-four of 64 species were recognized as a new faunal assemblage for the Caucasus. The largest diversity and number of species df testaceous amoebae occurred in benthos in silty deposits. Representatives of *Difflugiidae, Centropyxidae* and *Arcellidae* families appear to be dominant on the basis of the abundance of species.

**Key Words:** Testaceous amoebae, plankton, benthos, peryphithon.

### Ganlı-Gol Testacea'nın Tür Terkibi ve Miktarı

**Özet:** Bu çalışma Bakü yakınındaki Ganlı-Gol su havzasında bentos, perifiton ve planktonda yaşayan Testecea'nın tür bileşimi ve sayısını konu eder. Bulunan 64 türden 24 türü Kafkasya faunası için yenidir. Sayıca pek fazla ve tür çoğunluğuna göre çamurdaki bentosda yerleşmiş Testacea bulunmuştur. Tür çoğunluğuna göre *Difflugiidae, Centropyxidae* ve *Arcellidae* familyası egemen görülmektedir.

**Anahtar Sözcükler**: Kabuklu amib, plankton, bentos, perifiton.

## Introduction

Testaceous amoebae are one of the basic groups of free-living protozoan residentially present in water bioceoses. Testaceous amoebae, as far as mastigophoran is concerned, especially ciliates, take an active part in the very diverse biological processes which occur in water ecosystems.

At the end of the 1960's it was shown that testaceous amoebae feed on protococcal and diatomaceous bacterias. Testaceous amoebae are used as food by bigger hydrobionts, in particular by free-living ciliate, oligochaetes, nematodes and larvae and fry as well [1]. Thereby, it is clear from study of mutual relations in biocenoses on the basis of initial links of nutritive chains that testaceous amoebae are considered to be an active participant of the processes of producing and reducing the organic matter in basins.

It could be remarked that the freshwater testaceous amoebae of Azerbaijan and the whole Caucasus, contrary to ground testaceous amoebae, are practically unknown Available findings on this group are recorded in the time interval of 1930-1940. They have been taken from general hydrobiological collection mostly of lost temporary basins. Taking into account the above remarks we made the first survey on the qualitative and quantitative composition of testaceous amoebae of the fauna of Baku suburban Ganli-Gol lake.

## Materials and Methods

Materials were collected in 1995-1997. More than 850 samples of plankton, peryphithone and benthos were collected and processed. The material was processed by methods involving expansion in methodical aid [2]. To define the specific composition of testaceous amoebae we used the method of impregnation by argenic nitrate which allows to elicit completely all necessary taxonomic features using a common microscope (without using an electron microscope) [3].

Number-tabs of scattered species of testaceous amoebae were kept by multiple accounting under the microscope in separate portions of water (5 ml) or on certain surfaces (1 sq cm) followed by transfer into 11 or 1sq dm of ground sediment.

Detachment of the dominant species of testaceous amoebae was made through counting the frequency of

occurrence and dominance index. Frequency of occurrence (V) revealed 3 groups of species: constant (V>50%), secondary (V = from 25 to 50%), eventual (V<25%). The values were calculated from the following formula:

V = a*100/A,

where a shows number of samples contaning individuals of the species; A shows the general number of samples [4].

Index of dominance was formulated as

id = qi*ni*100/QN

where qi and ni show the frequency of occurrence and average number of i-species respectively; Q and N show the whole group, respectively [5].

**Results**

Sixty-four species and subspecies of testaceous amoebae were found during the period of research, among which representatives of *Difflugiidae* (25), *Centropyxidae* (19) and *Arcellidae* (11) families are dominant. Twenty-four of all the species found are first recognized the fauna of Caucasus.

The composition of species of testaceous amoebae of Ganli-Gol lake and their biotope allocation are shown in Table 1.

The maximal diversity of species of testaceous amoebae were noticed in the benthos, in silty deposits (40 species in the grey silt and 39 in the black silt (Fig.1). The number of species of testaceous amoebae in the sand-grade deposits was much lower, 26 species in the fine sand and 31 species in the silty sand. A large majority of testaceous amobae were detected only in these biocenoses, and only 8 of them were recorded in plankton and 6 in peryphithone.

Representatives of the *Difflugia* family stand out by the frequency of occurrence in the benthos samples (up to 52%) while for other testaceous amoebae this index ranges between 0.04 and 41%.

It should be noted that the occurrence substantially depends on various factors including season, depth of the basin and other, which allow a very general notion about the dominant taxa of testaceous amoebae.

To get more objective information the index of dominance was calculated. This not only reveals the presence of the species but also the condition of populations, which is necessary for the delineation of the

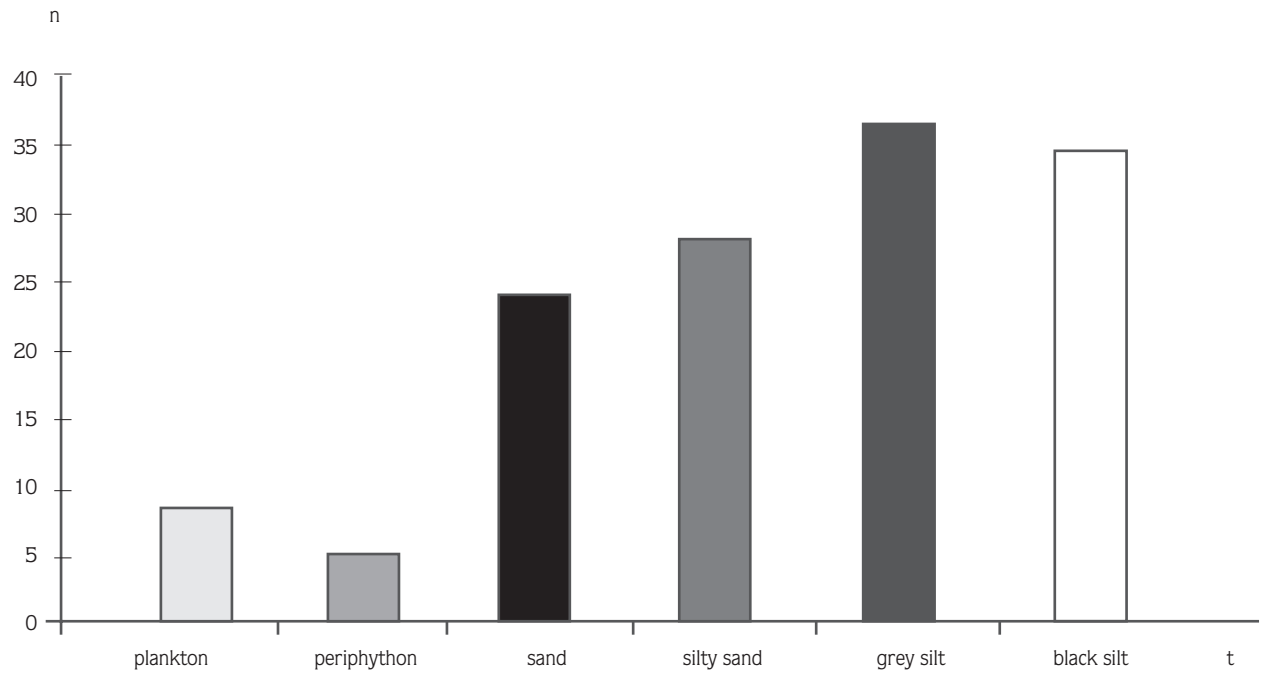


Figure 1. Specific diversity of Testaceous Amoebae in various biotopes of the Ganli-Gol lake (n-number of species, t-biot, pes)

Table 1. Species composition and biotope allocation of Testaceous Amoebae of the Ganli-Gol lake

| SPECIES | BIOTOPE ALLOCATION | | | | | |
|---|---|---|---|---|---|---|
| | Plankton | Peryphithon | Benthos | | | |
| | | | fine sand | silty sand | grey silt | black silt |
| Class ***Lobosia*** Carpenter, P et J, 1862 | | | | | | |
| Order ***Arcellinida*** Kent, 1880 | | | | | | |
| Family ***Microcoryciidae*** De Saedeleer, 1934 | | | | | | |
| 1.***Amphizonella violacea*** Greef, 1886 | - | - | - | - | + | - |
| Fam. ***Arcellidae*** Ehrenberg, 1830 | | | | | | |
| 2. ***Arcella hemispherica*** Perty, 1852 | + | - | - | + | - | - |
| 3. ***A. rotundata*** Playfair, 1918 | - | - | + | - | - | - |
| 4. ***A. vulgaris*** Ehrenberg, 1832 | + | - | - | + | - | - |
| 5. ***A. vulgaris V. fundulata*** Deflandre 1928* | - | - | - | - | - | + |
| 6. ***A. conica*** (Playfair, 1918)* | - | - | - | - | - | + |
| 7. ***A. catinus*** Penard, 1890* | - | - | - | + | - | + |
| 8. ***A. dentata*** Ehrenberg, 1838 | - | - | + | - | + | - |
| 9. ***A. brasiliensis*** DaCanha, 1913* | - | - | - | - | - | + |
| 10. ***A. discoides*** Ehrenberg, 1872 | + | - | - | + | - | - |
| 11. ***A. exavata*** Cunningham, 1919 | - | - | - | - | + | - |
| 12. ***A. polypora*** Penard, 1902 | - | - | - | - | + | - |
| Fam. ***Centropyxidae*** Deflandre, 1953 | | | | | | |
| 13. ***Cyclopyxis arcelloides*** Penard, 1902* | + | - | - | - | + | + |
| 14. ***C. euristoma*** Deflandre, 1929 | + | - | + | + | + | - |
| 15. ***C. kahli*** Deflandre, 1929* | - | - | - | + | + | - |
| 16. ***C. penardi*** Deflandre, 1929* | - | - | - | + | + | + |
| 17. ***Trigonopyxis arcula*** (Leidly, 1879) | - | - | - | - | + | + |
| 18. ***Centropyxis aculeata*** (Ehrenberg, 1838) | - | + | - | - | - | + |
| 19. ***C. aculeata v. oblonga*** Deflandre, 1929 | - | - | - | - | - | + |
| 20. ***C. aerophila*** Deflandre, 1929 | - | - | + | - | + | + |
| 21. ***C. constricta*** (Ehrenberg, 1838)* | - | - | + | - | + | + |
| 22. ***C. discoides*** (Penard, 1902) | - | - | + | + | + | + |
| 23. ***C. ecornis*** (Ehrenberg, 1838)* | - | - | - | + | + | + |
| 24. ***C. gibba*** Deflandre, 1929* | - | - | - | + | + | + |
| 25. ***C. hemisphaerica*** (Bernard, 1879) | - | - | + | + | + | - |
| 26. ***C. hirsuta*** Deflandre, 1929 | - | - | + | + | + | + |
| 27. ***C. laevigata*** Penard, 1890* | - | - | + | + | + | + |
| 28. ***C. marsupiformis*** (Wall, 1864) | - | - | - | - | + | + |
| 29. ***C. minuta*** Deflandre, 1929 | - | + | - | - | + | + |
| 30. ***C. plagiostoma*** Bonnet, Thomas, 1956* | - | + | - | + | + | - |
| 31. ***C. silvatica*** (Deflandre, 1929) | - | - | - | - | + | + |
| Fam. ***Difflugiidae*** Awerinzev, 1906 | | | | | | |
| 32. ***Difflugia acuminata*** Ehrenberg, 1838 | - | - | - | + | + | - |
| 33. ***D. acuminata v. magna*** Deflandre, 1926 | - | - | + | + | - | - |
| 34. ***D. acuminata*** v. curvata Cash, 1909 | + | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 35. ***D. acuminata v. infata*** Penard, 1899 | - | - | + | + | - | + |
| 36. ***D. curvicanlis*** Penard, 1899* | - | - | - | + | + | + |
| 37. ***D. corona*** Wallich, 1864* | - | - | - | - | - | + |
| 38. ***D. difficilis*** Thomas, 1954 | - | - | - | - | + | + |
| 39. ***D. elegans*** Penard, 1890 | - | - | - | - | - | + |
| 40. ***D. varians*** Penard, 1902 | - | - | - | + | + | + |
| 41. ***D. ventricolosa*** Deflandre, 1926* | - | - | + | - | - | - |
| 42. ***D. elongata*** Penard, 1905 | - | - | + | - | + | + |
| 43. ***D. lanceolata*** Penard, 1902* | - | - | - | + | + | + |
| 44. ***D. oblonga*** Ehrenberg, 1838 | - | - | - | - | - | + |
| 45. ***D. oblonga v. acuminata*** Ehrenberg, 1838 | - | - | - | - | - | + |
| 46. ***D. oblonga v. nodosa*** Leidy, 1879 | - | - | - | - | + | + |
| 47. ***D. oblonga v. parva*** Thomas, 1954 | - | - | - | + | - | + |
| 48. ***D. penardi*** (Penard, 1902)* | + | + | + | + | + | + |
| 49. ***D. pristis*** Penard, 1902* | - | - | + | + | + | + |
| 50. ***D. rubescens*** Penard, 1902* | - | - | + | + | + | + |
| 51. ***D. globulosa*** Dujardin, 1837 | - | - | + | - | + | + |
| 52. ***D. globularis*** Wallich, 1864* | + | - | - | - | - | - |
| 53. ***D. gramen*** Penard, 1902 | - | - | + | + | + | + |
| 54. ***D. lobostoma*** Leidly, 1879 | - | - | + | + | + | + |
| 55. ***Pontigulasia bigibbosa*** Penard, 1902 | - | - | + | + | + | + |
| 56. ***P. spectabilis*** Penard, 1902* | + | - | + | + | - | - |
| Class ***Filosea*** Leidy, 1879 | | | | | | |
| Order ***Gromida*** Clap. et L., 1859 | | | | | | |
| Fam. ***Euglyphidae*** Wailis, 1919 | | | | | | |
| 57. ***Euglypha acanthophora*** Ehrenberg 1843 | - | - | + | + | + | - |
| 58. ***E. aspera*** Penard, 1899 | - | - | + | + | - | - |
| 59. ***E. laevis*** (Ehrenberg, 1832) | - | - | - | - | + | + |
| 60. ***Trinema enchelys*** (Ehrenberg, 1838) | - | - | - | - | + | + |
| Fam. ***Cyphoderiide*** Deflandre, 1953 | | | | | | |
| 61. ***Cyphoderia ampulla*** (Ehrenberg, 1840) | - | - | + | - | - | - |
| 62. ***C. laevis*** Penard, 1902* | - | + | + | - | - | - |
| Fam. ***Gromiidae*** Clap. et. L., 1861 | | | | | | |
| 63. ***Pseudodifflugia gracilis*** Schlumberger, 1849* | - | - | - | + | + | - |
| 64. ***Gromia fluviatilis*** Dujardin, 1855* | - | - | - | + | + | - |

**ANNOTATION.** Species marked by asterik are adduced for Caucasus fauna for the first time.

specific ecological characteristics. The results show that by this index 39.6% of the general number of species are to be included in the category of dominants, 45.4% in the category of subdominants and 15% in the category of dependents. Overwhelming domination of the representatives of *Arcella, Centropyxis* and *Difflugia* families in the fauna of testaceous amoebae of Ganli-Gol lake is characteristically the same for faunas in many other continental basins [6-8]. This indicates a high level of activity potential and wide ecological plasticity.

It is known that differences in temperature diapasons within which testaceous amoebae exist determine consistent pattern of allocation of their specific composition and number by seasons.

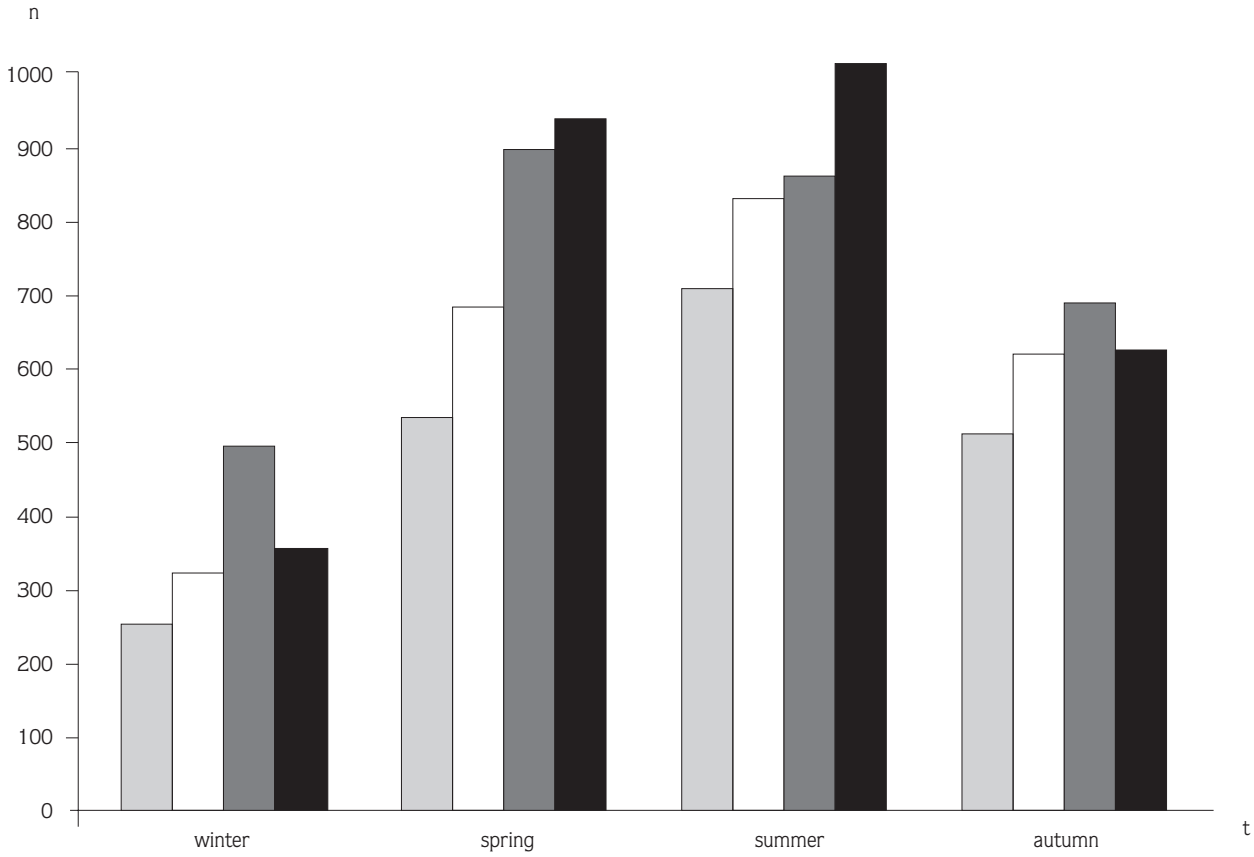


Figure 2. Seasonal dynamic of overall number of Testaceous Amoebae of different deposits in the benthos of the Ganli-Gol lake (n-number of specimens per $dm^2$, t-months).

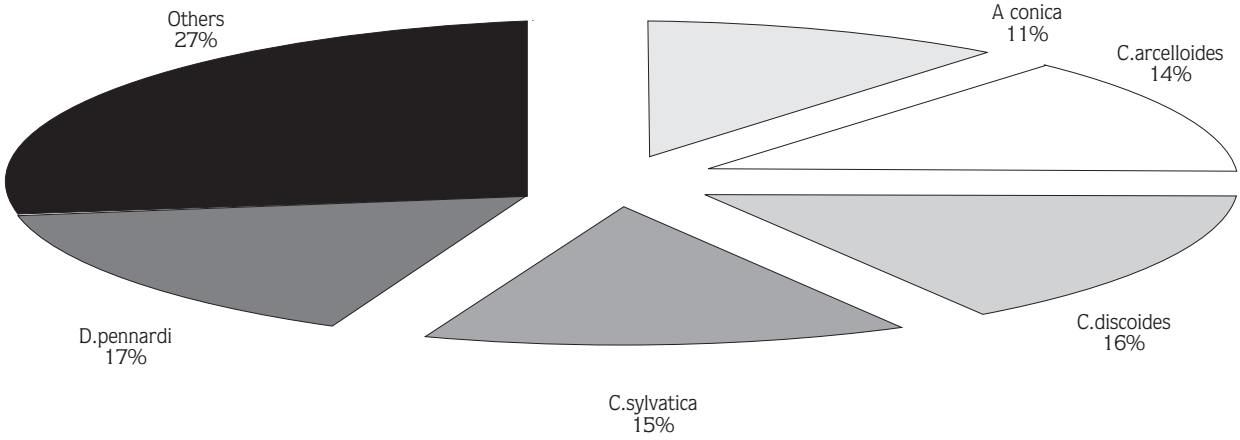


Figure 3. Percentage of dominanting species of Testaceous Amoebae (by biomass) in the silty deposit.

The largest specific diversity and number of testaceous amoebae of Ganli-Gol lake are noticed in warm seasons. For example, there were 42 species and subspecies in spring, and 38 in summer. The specific diversity of testaceos amoebae is distinctly less in autumn and especially in winter-26 and 18 species respectively.

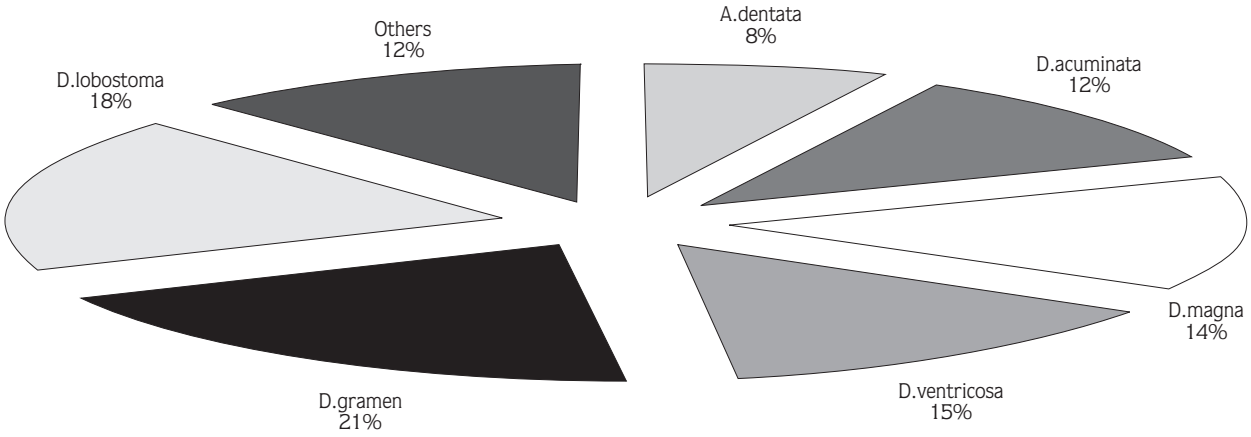


Figure 4. Percentage of dominanting species of Testaceous Amoebae (by biomass) in the sandy deposit.

The general number of testaceous amoebae in benthos in different deposits had 2 expressed maximus-in spring and in summer and 2 minimums-in winter and in autumn (Fig 2). The majority of testaceous amoebae were found in silty deposits. *Arcella conica, Cyclopyxis arcelloides, Centropyxis discoides, C. sylvativa* and *Difflugia penardi* were prodominant by an abudance corresponding to 73% of the general biomass of testaceous amoebae in silty deposits (Fig. 3). *Arcella dentata, Difflugia acuminata v. magna, D. ventricosa, D. gramen* and *D. lobostoma* occurred in the largest numbers in sandy deposits and made up 76-88% of the total biomass of these biotopes (Fig. 4.).

In conclussion, an important feature of the relations between testaceous amoebae and the temperature factor of the environment is the presence of more or less registered temperature optimum within which mass reproduction of populations is registered. This fact was first noticed by Vang during his survey of seasonal allocation of Protozoan in freshwater ponds [9]. It is to be noted that the basic mass of testaceous amoebae of the Ganli-Gol lake is characterized by high stability of the changes in water temperature. These eurithermic species are *A. vulgaris, A. conica, A. discoides, Centropyxis aculeata, Difflugia oblonga v. acuminata, Cyphoderia ampula,* and a number of others. Temperature spectrum of the occurrence of *Arcella megasoma, Centropyxis gibba, Difflugia lobostoma* and some other species, in contrary to eurithermic species, is much narrower (16.1-27.2°C). This allows us to assign them to the group of stenothermic thermophilic species.

Real cryophilic species of testaceous amoebae living only in water of low temperature were not found. This fact may possibly be explained by the quite high temperature of the water of the Ganli-Gol lake (5-8° C) in winter. Fauna of testaceous amoebae of the Ganli-Gol lake can be thereby divided into 2 ecological complexes:

1. Group of eurithermic species which mainly occur throughout the year, but having maximums of growth in warm seasons. This group includes the majority of species found (75.2 %);

2. Group of stenothermic thermophiles occurring in water of high temperature from the beginning of the summer and until the mid-autumn. This group includes the minority of the general number of species (24.8 %).

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