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A NEW SPECIES OF TESTATE AMOEBAE OF THE GENUS *DIFFLUGIA* FROM THE FRESHWATERS OF AZERBAIJAN (RHIZOPODA, TESTACEA, DIFFLUGIIDAE)

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A New Species of Testate Amoebae of the Genus *Diffugia* from the Freshwaters of Azerbaijan (Rhizopoda, Testacea, Diffugiidae). Snegovaya, N. Yu., Tahirova, E. N. — A new testate amoebae species *Diffugia alekperovi* sp. n. was found during a faunistic study of inland waters of Lenkoran Region, South-Eastern Azerbaijan. The morphology and biometry of this species was described by LM and SEM investigations.

Key words: testate amoeba, *Diffugia*, South-Eastern Azerbaijan.

Новый вид раковинных амёб рода *Diffugia* из пресных водоёмов Азербайджана (Rhizopoda, Testacea, Diffugiidae). Снеговая Н. Ю., Тагирова Э. Н. — Новый вид раковинных амёб *Diffugia alekperovi* sp. n. был найден при проведении фаунистических исследований внутренних вод в Ленкоранском регионе (юго-восточный Азербайджан). Морфология и биометрия этого вида изучены при помощи световой (LM) и электронной (SEM) микроскопии.

Ключевые слова: раковинные амёбы, *Diffugia*, юго-восточный Азербайджан.

Introduction

The genus *Diffugia* was established by Leclerc in 1815 and now consists of more than 300 nominal species and varieties (Mazei, Tsyganov, 2006; Mazei, Warren, 2012). According to Mazei, Tsyganov (2006) diagnosis of the genus *Diffugia*, its members have agglutinated, acrostomic shells with terminally located aperture, without internal partitions. Aperture rounded, oval, lobate, toothed, but never slit. Shells form pyriform, elongated, cylindrical, spherical, ovoid, some forms are flattened laterally. According to Gauthier-Lièvre and Thomas (1958), the genus *Diffugia* is separated into 10 groups based on shell morphology: lobed, collared, compressed, urceolate, globose, ovoid globose, elongate, acute angled, horned and pyriform (Gauthier-Lièvre and Thomas, 1958; Yang, Shen, Feng, 2005).

In Azerbaijan, 101 species and subspecies of the genus *Diffugia* have been recorded (Snegovaya, 2001; Snegovaya, Alekperov, 2005; Snegovaya, Alekperov, 2009; Snegovaya, Alekperov, 2010 a, b), including 44 species found in Lenkoran region. Lenkoran is located on the South-East of Azerbaijan (fig. 1) and clearly differs from other regions by subtropical climate and very original flora and fauna with many endemic species.

Material and methods

Samples were taken from small forest water reservoir near Azfilial settlement: 38°40'56.5" N; 48°46'58.5" E; 51 m a. s. l. (fig. 2) in October 2013, and from Khanbulanchay water reservoir: 38°40'10.99" N; 48°46'05.87" E; 73 m a. s. l. (fig. 3) in May 2014, both Lenkoran district. Specimens were placed in microcapillary tubes and studied in vivo and in glycerol preparations. For scanning electron microscopy (SEM), the cells were transferred to a cover glass with microcapillary tubes, dried and then coated with gold. The shell morphology was examined using a scanning electron microscope, JEOL JCM-6000 operating at 15 kV. Statistics was performed using the program Sigma Stat 2.0 (X — arithmetic mean; M — median; SD — standard deviation; SE — standard error; CV — coefficient of variation (%); Max — maximum; Min — minimum; N — number of specimens).



Fig. 1. Map showing the location of sampling points on the water reservoir in Azfilial settlement (1) and Khanbulanchay water reservoir (2), Lenkoran District, Azerbaijan.

Рис. 1. Карта расположения точек сбора проб на водоёме в посёлке Азфилиал (1) и Ханбуланчайском водохранилище (2), Ленкоранский район Азербайджана.



Fig. 2–3. Water reservoir in Azfilial settlement (2) and Khanbulanchay water reservoir (3), Lenkoran District, Azerbaijan.

Рис. 2–3. Общий вид водоёма в посёлке Азфилиал (2) и Ханбуланчайского водохранилища (3), Ленкоранский район Азербайджана.

***Diffflugia* Leclerc, 1815**

Type species: *Diffflugia proteiformis* Lamarck, 1816.

***Diffflugia alekperovi* sp. n. (fig. 4–7)**

Type specimens. Holotype on slides N L–14 and paratypes on slides N L–15–17, collection of Protistology Laboratory of the Institute of Zoology, National Academy of Sciences, Baku city, Azerbaijan.

Type location. In the sediments of small forest water reservoir near Azfilial settlement (38°40'56.5" N; 48°46'58.5" E; 51 m a. s. l.) and sediments of Khanbulanchay water reservoir (38°40'10.99" N; 48°46'05.87" E; 73 m a. s. l.) (Lenkoran District, Azerbaijan).

Description. The shell in water samples from light- to dark-brown, in glycerol discolored to transparent. The cell shape is slightly ovoid, almost rounded. Shell length 86–188 µm, width 81–162 µm. Shell surface is rough and covered with irregularly-shaped siliceous plate particles and pieces of diatoms. Terminally located aperture is very small (11–25 µm), circular, not surrounded with particles. Morphological and morphometrical characteristics of *D. alekperovi* sp.n. are shown in figures 4–7 and table 1. Living cells not observed. Very rare species, we found it only in autumn and spring.

Diagnosis. The shell is almost rounded, with very small rounded aperture. *Diffflugia alekperovi* sp.n. is similar to *Diffflugia subaequalis* Penard, 1910, *D. lithoplites* Penard, 1902, *D. lebes sphaerica* Gauthier-Lièvre et Thomas, 1958, *D. lebes masurica* Schönborn, 1965,

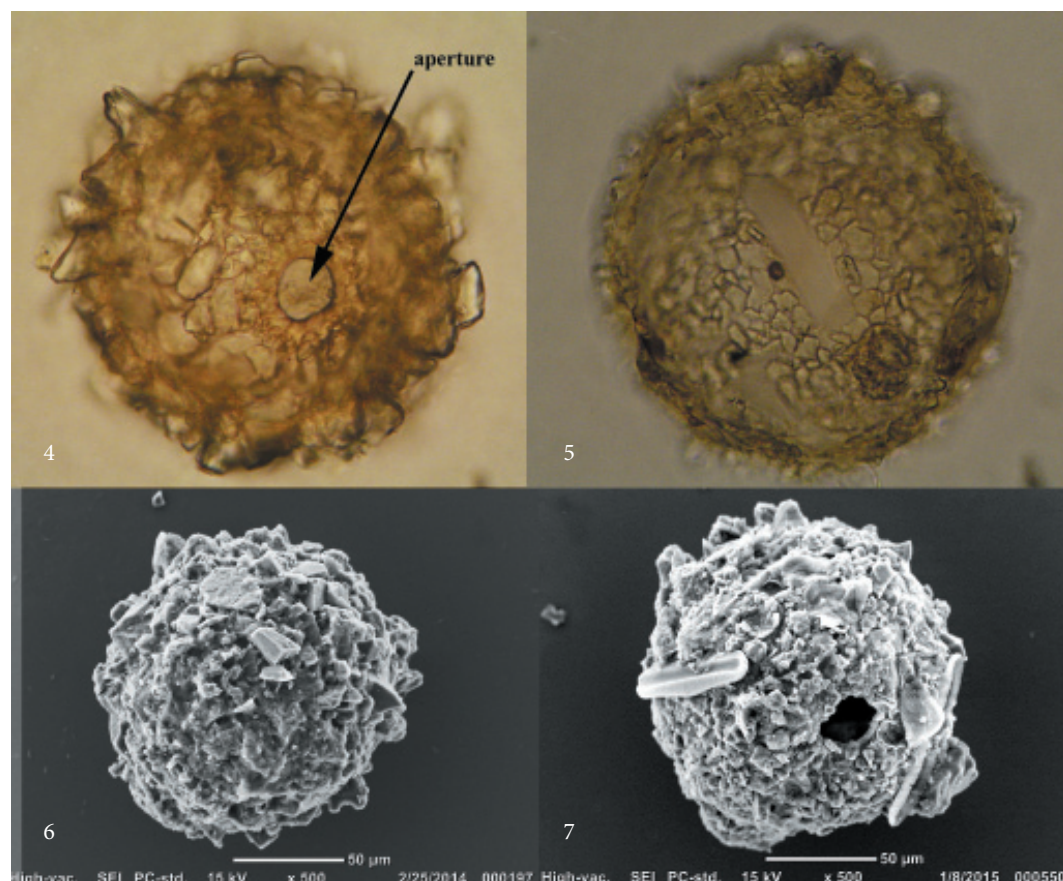


Fig. 4–7. *Diffflugia alekperovi* sp. n. : 4–5 — LM photographs; 6–7 — SEM photographs.

Рис. 4–7. *Diffflugia alekperovi* sp. n. : 4–5 — фотографии, выполненная при помощи световой микроскопии (LM); 6–7 — фотографии, выполненная при помощи электронной микроскопии (SEM).

Table 1. Biometrical characteristic of *Diffflugia alekperovi* sp. n.Таблица 1. Биометрические характеристики *Diffflugia alekperovi* sp. n.

Character	X	M	SD	SE	CV	Min	Max	N
Shell length	134.8	135.5	33.229	10.508	0.247	86	188	10
Shell width	125.5	129.5	27.13	8.579	0.216	81	162	10
Diameter of aperture	19.7	21.5	4.715	1.491	0.239	11	25	10

D. geosphaira Ogden, 1991, *D. globulosa* Dujardin, 1837, *D. globularis* Wallich, 1864, *D. minuta* var. *grandis* Gauthier-Lièvre et Thomas, 1958, but differs: from *Diffflugia subaequalis* by more rounded shell, smaller aperture, different shell covering; from *D. lithoplites* by shape and size of aperture and different shell covering; from *D. lebes sphaerica* and *D. lebes masurica* by more rounded shell, aperture size and shell covering; from *D. geosphaira* by more rounded shell, absence of collar, by aperture shape and size; from *D. globulosa* by more rounded shell, smaller size of the aperture; different shell covering; from *D. globularis* by more rounded shell, much smaller size of the aperture, different shell covering; from *D. minuta* var. *grandis* by more rounded shell form and different shell covering. Diagnostic characters of *Diffflugia* species are given in table 2 and on fig. 8–28.

Etymology. The species was named in honor of the famous Azerbaijani. protistologist, Prof. İlham Alekperov.

Table 2. Diagnostic characters of *Diffflugia* speciesТаблица 2. Диагностические характеристики видов *Diffflugia*

Charac- ters	<i>D. alekpe- rovi</i> sp. n.	<i>Diffflugia</i> <i>subae-</i> <i>qualis</i> Penard, 1910	<i>D. litho- plites</i> Penard, 1902	<i>D. lebes</i> <i>sphaerica</i> Gauthier- Lièvre et Thomas, 1958	<i>D. lebes</i> <i>masurica</i> Schön- born, 1965	<i>D. geos- phaira</i> Ogden, 1991	<i>D.</i> <i>globulosa</i> Dujardin, 1837	<i>D.</i> <i>globularis</i> Wallich, 1864	<i>D. minu- ta</i> var. <i>grandis</i> Gauthier- Lièvre et Thomas, 1958
Shell size, µm	86–88 × 81–83		200–220	270–290	150–200 × 150–180	45–62 × 46–59	70–119 × 79–113	135–155 × 80–100	100–130 × 120–125
Apere- ture form and size, µm	11–12, circular, not surro- unded with particles		65–70, with uneven outline, and three or four sharp grains looking like teeth	130–180, circular	83–98, circular	19–28, circular, surro- unded by sponge of organic cement	33–58, circular, sur- rounded by smaller particles which of- ten appear smooth due to the overlying cement	48–60, circular	20–28, circular
Shell surface	Rough and covered with irregu- larly-shaped siliceous particles and diatoms frustules		Made of mineral grains and diatom frustules	Made of small mineral particles	Made of small mineral particles	Made of mineral particles	Made of large quartz par- ticles but may also include diatom frustules	Made of quartz particles	covered with large grain
Refe- rences			Penard, 1902, http:// www. arcella.nl/ diffflugia- lithoplites	Gauthier- Lièvre et Thomas, 1958; Mazei, Tsyaganov, 2006	Gauthier- Lièvre et Thomas, 1958, Mazei, Tsyaga- nov, 2006	Ogden, 1991, Mazei Tsyaga- nov, 2006	Mazei, Tsyaga- nov, 2006, http:// www. arcella.nl/ Diffflugia- globulosa	Mazei, Tsyaga- nov, 2006	Gauthier- Lièvre et Thomas, 1958, Mazei, Tsyaga- nov, 2006

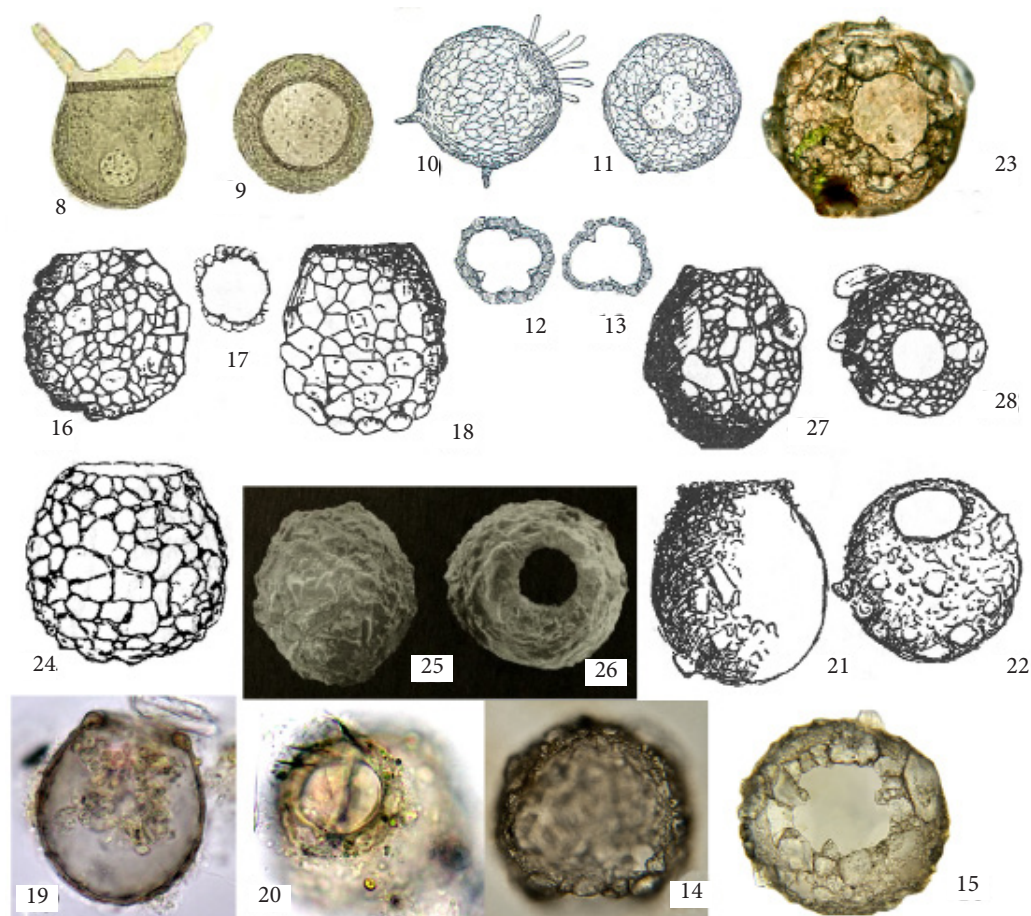


Fig. 8–28. Species of the genus *Diffflugia*: 8 — *Diffflugia subaequalis* Penard, 1910, general view; 9 — *D. subaequalis*, apertural view (5–6 after Penard, 1910); 10 — *D. lithoplites* Penard, 1902, general view; 11 — *D. lithoplites*, apertural view; 12–13 — *D. lithoplites*, aperture (7–10 Penard, 1902); 14–15 — *D. lithoplites*, LM photographs (14–15 after <http://www.arcella.nl/difflugia-lithoplites>); 16 — *D. lebes sphaerica* Gauthier-Lièvre et Thomas, 1958, general view; 17 — *D. lebes sphaerica*, apertural view; 18 — *D. lebes masurica* Schönborn, 1965, general view (16–18 after Gauthier-Lièvre et Thomas, 1958); 19 — *D. geosphaira* Ogden, 1991, LM photographs, general view; 20 — *D. geosphaira*, LM photographs, apertural view (19–20 after <http://www.arcella.nl/difflugia-geosphaira>); 21 — *D. globulosa* Dujardin, 1837, general view; 22 — *D. globulosa*, apertural view (21–22 after Gauthier-Lièvre et Thomas, 1958); 23 — *D. globulosa*, LM photographs (23 after <http://www.arcella.nl/difflugia-globulosa>); 24 — *D. globularis* Wallich, 1864, general view (24 after Beyens, Chardez, 1984); 25 — *D. globularis*, LM photographs, general view; 26 — *D. globularis*, LM photographs, apertural view (25–26 after Zapata, Álvarez, Cea, 2002); 27 — *D. minuta* var. *grandis* Gauthier-Lièvre et Thomas, 1958, general view; 28 — *D. minuta* var. *grandis*, apertural view (27–28 after Gauthier-Lièvre et Thomas, 1958).

Рис. 8–28. Виды рода *Diffflugia*: 8 — *Diffflugia subaequalis* Penard, 1910, общий вид; 9 — *D. subaequalis*, вид устья (8–9 по: Penard, 1910); 10 — *D. lithoplites* Penard, 1902, общий вид; 11 — *D. lithoplites*, вид устья; 12–13 — *D. lithoplites*, устье (10–13 по: Penard, 1902); 14–15 — *D. lithoplites*, LM фотографии (14–15 по: <http://www.arcella.nl/difflugia-lithoplites>); 16 — *D. lebes sphaerica* Gauthier-Lièvre et Thomas, 1958, общий вид; 17 — *D. lebes sphaerica*, апертуральный вид; 18 — *D. lebes masurica* Schönborn, 1965, общий вид (16–18 по: Gauthier-Lièvre et Thomas, 1958); 19 — *D. geosphaira* Ogden, 1991, LM фотографии, общий вид; 20 — *D. geosphaira*, LM фотографии, вид устья (19–20 по: <http://www.arcella.nl/difflugia-geosphaira>); 21 — *D. globulosa* Dujardin, 1837, общий вид; 22 — *D. globulosa*, вид устья (21–22 по: Gauthier-Lièvre et Thomas, 1958); 23 — *D. globulosa*, LM фотографии (23 по: <http://www.arcella.nl/difflugia-globulosa>); 24 — *D. globularis* Wallich, 1864, общий вид (24 по: Beyens, Chardez, 1984); 25 — *D. globularis*, LM фотографии, общий вид; 26 — *D. globularis*, LM фотографии, вид устья (25–26 по: Zapata, Álvarez, Cea, 2002); 27 — *D. minuta* var. *grandis* Gauthier-Lièvre et Thomas, 1958, общий вид; 28 — *D. minuta* var. *grandis*, вид устья (27–28 по: Gauthier-Lièvre et Thomas, 1958).

Discussion

Diffugia alekperovi sp. n., belongs to globose and ovoid globose groups (Gauthier-Lièvre et Thomas, 1958). Those groups are characterized by more or less globular test with or without spines, not compressed. Globose group includes following species: *Diffugia subaequalis* Penard, 1910, *D. lithoplites* Penard, 1902, *D. lebes sphaerica* Gauthier-Lièvre et Thomas, 1958 and *D. lebes masurica* Schönborn, 1965. Ovoid globose group includes *D. geosphaira* Ogden, 1991, *D. globulosa* Dujardin, 1837, *D. globularis* Wallich, 1864, *D. minuta* var. *grandis* Gauthier-Lièvre et Thomas, 1958. The new species *D. alekperovi* sp. n. differs from all known species in these groups by very small mouth size.

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