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Gymnocyclidium nabranicum gen. et sp. nov. (Gymnocyclidiidae fam. nov.) (Scuticociliatida, Ciliophora), a new freshwater ciliate from North-Eastern Azerbaijan

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Summary

Freshwater ciliate fauna of North-Eastern Azerbaijan was studied in 2003–2006. A new scuticociliatid species, *Gymnocyclidium nabranicum* gen. et sp. nov., is described. The newly established family Gymnocyclidiidae clearly differs from the other Scuticociliatida by reduction of bipolar somatic kineties to two or three short longitudinal crowns. It comprises three monotypic genera: the type genus *Gymnocyclidium* gen. nov., the genus *Paurotricha* Dragesco et Dragesco-Kerneis, 1991 and the genus *Paracyclidium* Grolière, de Puytorac, Grain, 1980.

Key words. *Gymnocyclidium nabranicum* gen. et sp. nov., Scuticociliatida, Gymnocyclidiidae fam. nov., freshwater ciliates, systematics, ciliate fauna of Azerbaijan

Introduction

In spite of long-term research, free-living ciliates of Azerbaijan are still insufficiently studied. First of all, this concerns the North-Eastern Azerbaijan, a region with numerous clean small rivers and springs. There are no investigations of its freshwater ciliate fauna, except one general hydrobiological research, which mentioned, alongside with other groups of hydrobionts, 9 ciliates species (Veysig, 1940).

Free-living ciliate fauna of North-Eastern Azerbaijan was studied in 2003–2006. The present paper reports a new freshwater scuticociliatid ciliate from this region.

Material and methods

Freshwater ciliates were sampled in several small rivers and springs of North-Eastern Azerbaijan, mainly near Russian state border. Altogether, 140 samples of plankton, periphyton and benthos were collected and processed. The ciliates were caught by microcapillars and studied both *in vivo* and after silver nitrate (Chatton and Lwoff, 1930) and protargol (Alekperov, 1992) impregnation. Impregnated cells were drawn using a camera lucida. Cell length and width were measured both on living and impregnated ciliates. All measurements were made on not less than 10 specimens. The type material

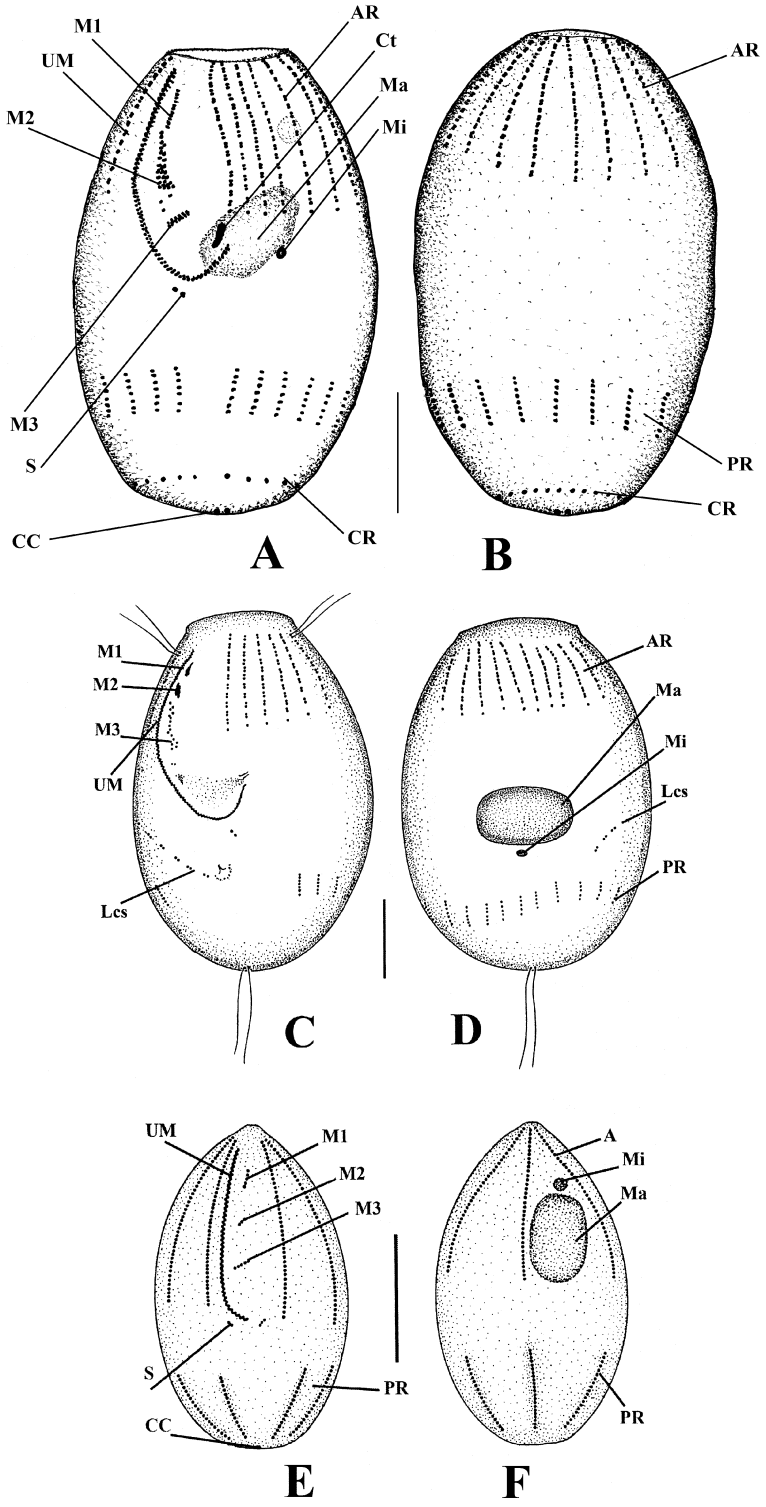

Fig. 1. Members of the Gymnocyclidiidae fam. nov. (representatives of the three monotypic genera). **A-B** – *Gymnocyclidium nabranicum* gen. et sp. nov.; **C-D** – *Paurotricha cyclidiformis* Dragesco et Dragesco-Kerneis, 1991 (according to Dragesco and Dragesco-Kerneis, 1991); **E-F** – *Paracyclidium rhabdotectum* (Powers, 1935) Grolière, de Puytorac, Grain, 1980 (according to Grolière, de Puytorac, Grain, 1980). *Abbreviations*: UM – undulating membrane, M1, M2, M3 – oral membranelles, Ct – cytostome, S – scutica, CC – caudal cilia, AR – anterior somatic crown, PR – posterior somatic crown, CR – caudal somatic crown, Lcs – lateral ciliary scarf, Ma – macronucleus, Mi – micronucleus. Scale bars: **A-B** – 20 μm, **C-F** – 10 μm.

was deposited with the collection of the laboratory of Protistology in the Institute of Zoology of NAS of Azerbaijan, Baku.

Morphometric data are based on randomly selected, protargol impregnated and mounted non-dividers. Statistics was performed using the program SigmaStat 2.0.

Results

FAMILY GYMNOCYCLIDIIDAE FAM. NOV. (Fig. 1).

Diagnosis. Free-living (freshwater species) or endocommensals of sea urchins (marine species). Buccal infraciliature typical of the Scuticociliatida Small, 1967.

Somatic ciliature reduced to a longer apical crown bearing double kinetosomes and a shorter posterior crown or crowns bearing simple kinetosomes; their is one posterior crown in *Paurotricha* and *Paracyclidium* and two posterior crowns in *Gymnocyclidium*. Anterior crown separated from posterior crown or crowns by a wide non-ciliated equatorial area. Two caudal cilia and two post-oral scutica present.

Gymnocyclidiidae fam. nov. comprises three monotypic genera: the type genus *Gymnocyclidium* gen. nov., *Paurotricha* Dragesco et Dragesco-Kerneis, 1991 (Dragesco and Dragesco-Kerneis, 1991) and *Paracyclidium* Grolière, de Puytorac, Grain, 1980. The former two genera are free-living, while the latter is endocommensal of sea urchins (Grolière et al., 1980).

The newly established family Gymnocyclidiidae clearly differs from the other representatives of Scuticociliatida Small, 1967 by strong reduction of somatic ciliature.

GENUS *GYMNOCYCLIDIUM* GEN. NOV.

Diagnosis. Freshwater. Ciliates of middle size (*in vivo* 55–70 μm × 35–40 μm) with buccal ciliature typical of Scuticociliatida: undulating membrane and three oral membranelles (M_1, M_2, M_3). Outline oval, with truncated anterior and posterior poles. Somatic ciliature reduced to three ciliary crowns of different width; a longer anterior one consisting of dikinetids, a shorter posterior one consisting of simple kinetosomes and the caudal one consisting of a single kinetosome. There are two caudal cilia and two post-oral scutica.

Type species *Gymnocyclidium nabranicum* gen. et sp. nov.

Fig. 2. *Gymnocyclidium nabranicum* gen. et sp. nov. (protargol impregnation). **A** – ventral side, **B** – dorsal side. Scale bar: 20 μm

Comparison with related genera. *Gymnocyclidium* gen. nov. resembles the genus *Paurotricha*: both have the outline with truncated anterior and posterior poles, double kinetosomes in the anterior crown and single kinetosomes in the posterior one. However, *Gymnocyclidium* is clearly different from *Paurotricha*. First, it lacks the characteristic oblique ciliary scarf of the latter. Second, it has three crowns of somatic ciliature, while *Paurotricha* has two crowns.

The new genus differs from the genus *Paracyclidium* in the number of somatic ciliature crowns – three instead of two, and the arrangement and structure of oral membranelles – it has longer cone-shaped membranelles M_2 and a wider non-ciliated equatorial area. The ecology of these two genera is also different: *Gymnocyclidium* comprises free-living freshwater ciliates, while *Paracyclidium*, marine endocommensals of sea urchins.

***GYMNOCYCLIDIUM NABRANICUM* GEN. ET SP. NOV. (Figs 1 A, B; 2)**

Diagnosis. Outline oval, with truncated anterior and posterior poles. Somatic ciliature reduced to three ciliary crowns of different width. The anterior crown consisting of 17–20 rows of dikinetids, with 16–18 dikenetids in a row. The posterior crown consisting of 17–18 rows, with 7–8 simple kinetosomes in a row. The caudal crown consisting of a single kinetosome. Two caudal cilia and two post-oral scutica present.

Type location. Sandy bottom of a shallow spring near Nabran village.

Type specimens. One holotype as a slide (N–2) of protargol impregnated cells.

Table 1. Morphometric characteristics of *Gymnocyclidium nabranicum* gen. et sp. nov.

Character	$\bar{X}$	*M*	*SD*	*SE*	*CV*	*Min*	*Max*	*n*
Body length	48.7	48.0	3.401	1.075	6.984	45.0	55.0	10
Body width	26.6	26.5	2.951	0.933	11.094	22.0	30.0	10
Adoral membranelle M_1 length	43.0	4.50	0.823	0.260	1.914	3.0	5.0	10
Adoral membranelle M_2 length	7.791	7.90	0.336	0.101	4.313	7.0	8.10	11
Adoral membranelle M_3 length	3.460	3.50	0.259	0.0819	7.486	3.10	4.0	10
Undulating (paroral) membrane length	31.6	33.0	3.658	1.157	11.576	27.0	35.0	10
Number of somatic kineties in the anterior crown	18.5	18.0	1.179	0.373	6.373	17.0	20.0	10
Number of somatic kineties in the posterior crown	17.5	17.5	0.527	0.167	3.400	17.0	18.0	10
Number of somatic kineties in the caudal crown	17.750	18.0	0.463	0.164	2.608	17.0	18.0	8
Caudal cilia number	2.0	2.0	0	0	0	2.0	2.0	10
Postoral scutica number	2.4	2.0	0.516	0.163	21.5	2.0	3.0	10
Number of kinetosomes (dikinetids) in each row of anterior crown	16.9	17.0	0.738	0.233	4.367	16.0	18.0	10
Number of kinetosomes in each row of posterior crown	7.5	7.5	0.527	0.167	7.027	7.0	8.0	10
Number of kinetosomes number in caudal crown	1.0	1.0	0	0	0	1.0	1.0	10
Macronucleus length	12.420	12.5	0.377	0.119	3.035	12.0	13.0	10
Macronucleus width	7.540	7.5	0.331	0.105	4.390	7.0	8.0	10
Micronucleus diameter	2.850	3.0	0.435	0.138	15.263	2.0	3.5	10

Abbreviations: $\bar{X}$ – arithmetic mean, *M* – median, *SD* – standart deviation, *SE* – standart error, *CV* – coefficient of variance (in %), *Max* – maximum, *Min* – minimum, *n* – number of specimens.

Description. Living cells 55–70 μm × 35–40 μm, cells after fixation 45–55 μm × 22–30 μm. Body shape oval, with truncated anterior and posterior ends. Buccal infraciliature typical of the Scuticociliatida: large buccal area includes, on the left, 3 adoral membranelles: M_1 – a double row of 10-11 dikinetids, M_2 — a more voluminous cone-like membranelle of 21–24 kinetosomes and M_3 – a

double row of 5–6 dikinetids. On the right, there is an enclosing paroral undulating membrane, with double kinetosomes joined in a zigzag pattern. A fine cytostome is located at the upper left margin of the undulating membrane. Below the undulating membrane, there are 2 or 3 post-oral scutica. Somatic ciliature is composed of three ciliary crowns of different width. The anterior crown consists of 17–20 rows of dikinetids, with 16-18 dikenetids in a row. The posterior crown consists of 17–18 rows, with 7–8 simple kinetosomes in a row. The caudal crown consists of a single kinetosome. Two caudal cilia are present at the caudal end. There is a wide non-ciliated zone between anterior and posterior crowns.

Endoplasm transparent, with dark spherical inclusions in the anterior part. Usually there are 3–7 food vacuoles with bacteria. Macronucleus oval to spherical (13 μm), with a single micronucleus (2–3,5 μm), located usually in mid body or anterior part. Contractile vacuole located posteriorly. Cytoproct unknown (not seen in protargol impregnated slides).

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