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GOODAYIA ROSTELLATUM GEN. N., SP. N. (PROTOZOA) — A MONOTHALAMOUS FORAMINIFERAN FROM THE BLACK SEA

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***Goodayia rostellatum* gen. n., sp. n. (Protozoa) — a Monothalamous Foraminifera from the Black Sea.** Sergeeva N. G., Anikeeva O. V. — *Goodayia rostellatum* gen. n., sp. n. is described from the open slope of the Black Sea along the northwestern part of the Crimean Peninsula (160 m water depth). The test of this very delicate, organic-walled, monothalamous (single-chambered) foraminifer is elongated and becomes wider from the middle to the apertural end. Test wall consists of two layers, and the protoplasm is separated from the inner layer by a more or less distinct space. The protoplasm is finely granular, homogeneous, without foreign inclusions. The single terminal apertural structure has an asymmetric, beak-like shape with the aperture located under the beak. The nucleus is situated more or less in the middle of the test. The shape and size of the test, the presence of two membranes, and the single terminal aperture are the features reminiscent of the genera *Gloiogullmia* and *Rhynchogromia*. However, the new genus has significant differences from these taxa, notably the absence of any foreign mineral or organic particles adhering to the test wall, and the beak-shaped apertural structure.

Key words: allogromiids, meiobenthos, coastal and upper anaerobic zones, the Black Sea.

***Goodayia rostellatum* gen. n., sp. n. (Protozoa) — однокамерная фораминифера из Черного моря.** Сергеева Н. Г., Аникеева О. В. — Описан новый вид фораминифер с мягкой эластичной раковинной *Goodayia rostellatum* gen. n., sp. n. из Черного моря, с северо-западного склона Крымского полуострова (глубина 160 м). Фораминифера с нежной однокамерной органической раковинной, удлинённой формы, расширяющейся от середины тела к устьевому концу. Стенка раковины двухслойная. Мелкогранулированная, гомогенная (без посторонних включений) протоплазма отделена от раковины более или менее четким пространством. Единственное устьевое отверстие (апертура) расположено асимметрично и представляет собой клювовидное образование с отверстием под «клювом». Ядро клетки находится ближе к середине раковины. Форма и размеры раковины, двухслойная стенка и единственное терминальное единичное конечное устье (апертура) — отличительные признаки родов *Gloiogullmia* и *Rhynchogromia*. Однако отсутствие посторонних агглютинированных минеральных и органических частиц на поверхности раковины и своеобразное клювовидное устьевое отверстие отличают новый род от родов *Gloiogullmia* и *Rhynchogromia*.

Ключевые слова: аллогромииды, мейобентос, прибрежная и верхняя анаэробная зоны, Черное море.

Introduction

Although Black Sea foraminifera are generally fairly well studied, information about the single-chambered (monothalamous) soft-shelled species is rather limited. The first mention of these protists in the Black Sea dates from the end of the 20th century (Sergeeva, Kolesnikova, 1996). However, it is becoming increasingly clear that soft-shelled foraminifera are a conspicuous and diverse element of Black Sea coastal and deep-water benthic communities (Anikeeva, 2003; Anikeeva, Sergeeva, 2001; Sergeeva, 2003; Revkov, Sergeeva 2004; Gooday et al, 2006). Our previous data have shown that these assemblages include at least 20–25 species. However, at present only five species (*Psammophaga simplora* Arnold, 1982, *Vellaria pellucidus* Gooday, 1992, *V. sacculus* Gooday, 1992, *Lagynis pontica* Golemansky, 1999, *Tinogullmia lukyanovae* Good.,

Anik. & Serg., 2006) can be assigned to named species. Other organic-walled taxa have been referred only to the genus or family level (Sergeeva, Anikeeva, 2006).

In an earlier publication, the species described here was reported from bays near Sevastopol and in the Caucasus region as *Allogromiidae* gen. n. sp. B (Sergeeva, Anikeeva, 2006). Here, we describe it as a new species and genus on the basis of morphological data. The present material originates from sediment samples taken on the open slope NW of the Crimean Peninsula.

Material and methods

Samples were collected on the 2nd of February 2007 during RV *Meteor* cruise 72–2 on the open slope north-west of the Crimea Peninsula (44°17.03' N, 34° 58. 88' E; 160 m depth, 44°16.88' N, 34° 58. 73' E; 150 m). Stations were chosen along a transect from the oxic into the anoxic zone, crossing the shelf and the NW Crimea slope in an area characterized by methane seeps. Samples for micro- and meiobenthos were collected at 10-m intervals between 120 m and 240 m water depth using a modified version of the Barnett multiple corer (Barnett et al., 1984) that obtains virtually undisturbed sediment samples. Bottom sediments were fine silt with broken mollusks and foraminiferal shells.

The sediment cores (surface area 63,6 cm²) were sectioned into the following horizontal layers: 0–1, 1–2, 2–3, 3–4 cm. In addition, surface detritus was removed and studied separately. All samples were preserved in 75% alcohol. In the laboratory the sediment was carefully washed with filtered sterile water on sieves with mesh sizes of 1 mm and 64 µm. The fraction retained on the sieves was stained in rose Bengal solution before being sorted in water under a binocular microscope for “live” (stained) organisms, which were identified to higher taxa in the IBSS laboratory. Stained foraminifera and other meiofauna were extracted from the 1000–64 µm size fraction using a Bogorov chamber. The foraminifera were picked out using a glass pipette and placed in cavity slides with a mixture of glycerol (50%) and water (50%).

The photographs were taken using a Canon A 630 & A 620 digital camera combined with either a XSP–XY or a Mikmed-6 compound microscope.

Results

Our suprageneric classification follows A. R. Loeblich and H. Tappan (1992). We refer the new genus to the *Allogromiidae*. This family includes 3 subfamilies: *Allogromiinae* Rhumbler, 1904, *Shepherdellinae* Loeblich and Tappan, 1984 and *Argillotubinae* Avnimelech, 1952. The presence of a single aperture excludes it from the subfamily *Shepherdellinae* which is characterized by two terminal apertures. There are also clear differences between the new genus and members of the subfamily *Argillotubinae* in the test structure and location of the aperture. On the basis of morphological characteristics, the Black Sea species is closer to the *Allogromiinae*. This subfamily has the following characteristics. The monothalamous test has a rounded, oval or elongated form. The wall is proteinaceous, thin, transparent and flexible, without agglutination. The aperture is terminal and often associated with an entosolenian tube. Some specimens of the new genus lack a well-defined entosolenian tube, but all other features are consistent with a placement in this subfamily.

Systematic account

Class Foraminifera D'Orbigny, 1826

Order Allogromiida Furszenko, 1958

Family Allogromiidae Rhumbler, 1904

Subfamily Allogromiinae Rhumbler, 1904

Genus *Goodayia* Sergeeva & Anikeeva, gen. n.

Type species: *Goodayia rostellatum* Sergeeva & Anikeeva, sp. n.

Diagnosis of genus: Test 210–465 µm long and 50–150 µm wide, thin-walled, flexible. It is elongate in form and expands from middle to apertural end. Test wall has two transparent proteinaceous membranes, and the cytoplasm is more or less separated from the inner layer of the wall. The cytoplasm is finely granular, homogeneous, usually without foreign inclusions. Single terminal apertural structure has asymmetrical, beak-like shape with apertural opening under beak. Single nucleus situated more or less in the middle of the test.

Derivation of genus name. The genus was named in honour of Professor Andrew Gooday (National Oceanography Centre, Southampton, UK), a famous specialist on foraminifera.

Derivation of specific name. Latin *rostellum* – small beak.

***Goodayia rostellatum* Sergeeva & Anikeeva, sp. n.**

Syn. Allogromiidae gen n., sp. n. (Sergeeva & Anikeeva, 2006)

Type material. The holotype (№. FAG—001) and five paratypes (№ FAP—002 to FAP—006) are mounted in water-glycerol preparations and housed in the Institute of Biology of the Southern Seas NASU (Sevastopol, Ukraine). Previous experience has shown that specimens of this species are too delicate to be mounted in either Canada balsam or a gelatin-glycerol mixture.

Type Locality. The holotype (44°17.03' N – 34°58.88' E, 160 m depth) and the paratypes are from the Black Sea (44°17.03' N – 34°58.88' E, 160 m depth and 44°16.88' N – 34°58.73' E; 150 m). They were picked from multiple corer samples collected during the RV *Meteor* cruise 72/2 in February 2007.

Description of the type specimens. The holotype is elongate in form, more or less circular in cross section, and increases in width from the middle to the apertural end. The test is 325 µm long including the apertural projection, 315 µm long without this structure, and ranges in width from 75 to 115 µm. L : W ratio is 2.5 without the aperture and 3.0 with the aperture. The single terminal apertural projection is asymmetrical, 15 µm long and 25 µm wide. The structure has a beak-like appearance in lateral view with the aperture located on the underside of the beak (fig. 1, A). It is important to note that the apertural structure has a different appearance depending on the orientation of the test; the shape can range from crest-like when viewed from a sub-lateral angle (fig. 1, D) to rounded when viewed from the dorsal side (fig. 1, B)

The test wall is transparent and organic. The wall consists of two layers, and the cytoplasm is separated from the wall by a more or less distinct space. The cytoplasm is finely granular, homogeneous, without foreign inclusions. The nucleus is situated close to apertural end or in the middle of the test (fig. 1, A, B); the diameter is 22,5 µm.

The paratypes range from rounded, oval to elongate in form. Paratype № 002 is 262 µm long including the apertural projection, 250 µm excluding this structure, and

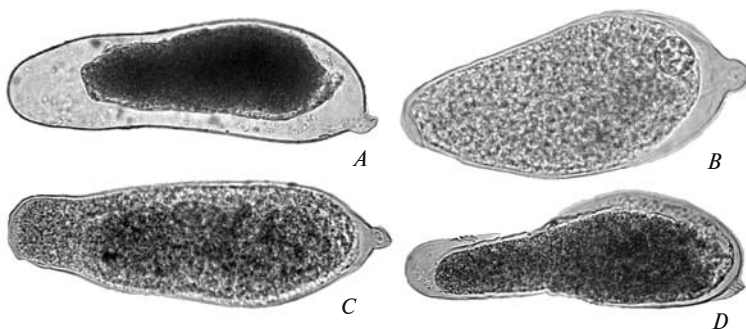


Fig. 1. *Goodayia rostellatum*: A – the holotype FAG – 001 (size – 325 x 115 µm), general view; B – the paratype FAP – 002 (size – 262 x 102 µm), the aperture looks rounded (dorsal side); C – rounded view of the aperture with the opening inside (ventral side of the paratype FAP – 004 (size – 347 x 122 µm)); D – the paratype FAP – 003 (size – 428 x 150 µm), with “beak-shaped” view of aperture (lateral side).

Рис. 1. *Goodayia rostellatum*: A – голотип FAG – 001 (размер – 325 x 115 мкм), общий вид; B – паратип FAP – 002 (размер – 262 x 102 мкм), апертюра (устье) выглядит округлой (дорзальная сторона); C – округлый вид апертюры паратипа FAP – 004 (размер – 347 x 122 мкм) видно отверстие внутри апертюры (вентральная сторона); D – клювообразный вид апертюры (= устья) паратипа FAP – 003 (размер – 428 x 150 мкм), латеральная сторона.

52–102 μm wide with a length: width (L : W) ratio of 2.5–5 (including projections), 2.4–4.8 (excluding projection). The apertural projection is 12.5 μm long and 20 μm wide. The nucleus is 25 μm in diameter and located at a point where the test width is 75 μm . The other 16 specimens (including the 4 remaining paratypes) vary from 210 to 465 μm in length, 50 to 150 μm in width, with a L : W ratio ranging from 2.1 to 5.8.

Differential diagnosis. The form and size of the test of *Goodayia*, the presence of two membranes inside the outer wall, and the one terminal aperture, are features reminiscent of *Gloiogullmia* Nyholm, 1974. However, there are significant differences between the two genera. The outer wall is clear and devoid of adhering foreign mineral or organic particles in *Goodayia* and the cytoplasm is homogeneous, without exotic inclusions. The most notable difference, however, is the presence of a wide, fairly simple aperture in *Gloiogullmia* compared to the relatively small aperture hidden under a beak-shape apertural structure in the new genus.

The shape and size of the test of *Goodayia* is also rather similar to that of allogromiids in the genus *Rhynchogromia* Rhumbler, 1894. In both cases, there is also one aperture and a single nucleus. However, specimens of *Rhynchogromia* commonly occur in the empty tests of other foraminifers. In addition, the test wall is a single-layered structure that contains numerous plate-like or elongate secreted bodies, compared to the clear, transparent wall of the new genus.

Distribution. *Goodayia rostellatum* is an eurybiont species, that inhabits a wide range of water depths as well as different regions of the Black Sea. It occurs both in coastal sediments (4–19 m depth) of the Sevastopol area (Kazach'ya, Kruglaya, Balaklavskaya, Uchkuevka, Laspi Bays), and the Crimean, Caucasian and Bulgarian shelf in the depth range 105–160 m. The oxygen concentration in the investigated depths of the Crimean shelf decreased with increasing depth. The sulfide concentration started to increase below 157-m water depth (Sergeeva et al., 2008). *G. rostellatum* inhabits biotopes ranging from fine-granular sands to fine silts.

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