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Spiculammina delicata gen. et sp. n., a new xenophyophore from the eastern Pacific (Psamminidae)

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ABSTRACT: A new genus and new species of xenophyophores is described from the abyssal depths of the eastern Pacific. The presence of external xenophyae arranged in a surface layer and internal xenophyae in the lumen of tubular test allow us to attribute *Spiculammina delicata* **gen. et sp. n.** to Psamminidae. The new genus is distinguished from other genera of the family by tree-like form of the test.

KEYWORDS: abyssal fauna, Protista, xenophyophores, *Spiculammina delicata* **gen. et sp. n.,** taxonomy, Pacific Ocean.

Spiculammina delicata gen. et sp. n., новая ксенофиофория из восточной части Тихого океана (Psamminidae)

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РЕЗЮМЕ: Описан новый род и вид ксенофиофорий с абиссальных глубин в восточной части Тихого океана. Наличие внешних ксенофий, собранных в поверхностный слой и внутренних ксенофий, расположенных в просвете трубчатой раковины позволяют нам отнести *Spiculammina delicata* **gen. et sp. n.** к Psamminidae. Новый род отличается от других родов семейства древовидной формой раковины.

КЛЮЧЕВЫЕ СЛОВА: абиссальная фауна, Protista, ксенофиофории, *Spiculammina delicata* **gen. et sp. n**., таксономия, Тихий океан.

Introduction

Xenophyophores are marine rhizopod protists. The cytoplasmic body is a multinucleate plasmodium (granellare) enclosed in a branched system of tubes composed of a transparent organic substance. Pseudopodia extend through the free ends of tubes, but their form is poorly known. Cytoplasm contains numerous barite crystals (granellae). Fecal pellets (stercomes) are retained outside the cytoplasm and the organic tube system as dark strings or masses (stercomare). A test consists of foreign matter (xenophyae) and stercomare in varying proportions. Agglutinated test usually envelops organic tube system, but sometimes organic tubes are located among xenophyae and stercomare. Xenophyophores range from a few millimeters to 25 cm in size. They occur in the Atlantic, Pacific, Indian and Southern Oceans at the bathyal, abyssal and

hadal depths (Tendal, 1972; 1975; 1994; 1996; Tendal, Gooday, 1981; Tendal, Lewis, 1978; Gooday, 1991; 1996; Gooday, Tendal, 1988; Gooday, Tendal, 2000; Levin, Thomas, 1988; Kamenskaya, 1987; 1988; 1998; 2000) and in the Mediterranean (Soetaert et al., 1991). An unusual, large (up to 40 mm) protist with tree-like form and test consisting of sponge spicules was found at abyssal depth in the eastern Pacific. The description of *Spiculammina delicata* **gen. et sp. n.** from Psamminidae is given here.

Material and Methods

For SEM study fragments of the holotype specimen were mounted on aluminium stubs and coated with Au. Analysis of chemical constituents (Ba) was performed with an energy-dispersive X-ray spectrographic analyzer (EDS) connected to a scanning electron microscope (CamScan). The holotype is deposited in the collection of the Zoological Museum of the Moscow State University.

Results

Class Xenophyophorea Schulze, 1904
Order Psamminida Tendal, 1972
Family Psamminidae Haeckel, 1889
Spiculammina **gen. n.**

Diagnosis. Test of tree-like form, up to 40 mm in height, probably attached. It consists of tubes of different diameters. The central tube is 3–5 times thicker than the peripheral ones. Anastomosing of tubes occur, but very rarely. Xenophyae are sponge spicules, oriented outwards chaotically so that the test has a shaggy appearance. Internal space of the tubes is full of strings and masses of stercomare and granellare, and sparse xenophyae.

Type species. Spiculammina delicata **sp. n.**

Etymology. From Latin "spica" — arrow and "spicula" — main element of sponge skeleton, because the test of this xenophyophore consists of sponge spicules.

Remarks. Tubular form of test occurs usually among members of the xenophyophore family Syringamminidae Tendal, 1972. However the presence of xenophyae in the lumen of tubular test allow us to attribute *Spiculammina* **gen. et sp. n.** to the family Psamminidae Haeckel, 1889. Xenophyophores of this family have tests usually solid, often fragile and varying in form from platy to lumpy, branched or reticulate. External xenophyae arranged in surface layer; occasionally test consists of several layers. There is very little cement (Gooday, Tendal, 2000). Presently there are five genera in Psamminidae. *Psammina* Haeckel, 1889 has a fragile, basically plate-like test. External xenophyae are firmly cemented to form upper and lower plates, internal xenophyae are sparse, commonly forming pillar or bar-like structures between plates. *Semipsammina* Tendal, 1975 has flat attached test, consisting of single fragile layer of xenophyae covering granellare and stercomare which are attached directly to substratum. In *Cerelpemma* Laubenfelds, 1936 a lumpy test consists of numerous thin layers of xenophyae (radiolarian tests), arranged in wafer-like stack. Granellare and stercomare occupy flat spaces between these layers. All described species of *Galatheammina* Tendal, 1972 have different test morphology from three-dimensional star-shaped form to rounded lump with root-like bars at base. Interior consists of loose accumulation of xenophyae with granellare and stercomare between them. Species of *Reticulammina* Tendal, 1972 have friable, free tests, hemispherical or subrectangular in shape and consisting of anastomosing branches and plate-shaped elements which delimit open spaces. Surface xenophyae form more or less firmly cemented layer. Interior contains loose accumulation of xenophyae between which stercomare and granellare interweave (Gooday, Tendal, 2000).

Spiculammina **gen. n.** have external xenophyae arranged in a surface layer, as do other species of Psamminidae. The lumen of the test contains loose mass of xenophyae with granellare and stercomare between them. Very little cement is used. *Spiculammin*a **gen. n.** resembles most to *Reticulammina* which has anastomosing tubes but differs from it by the tree-like form of the test in which the basal tube is thicker than peripheral ones.

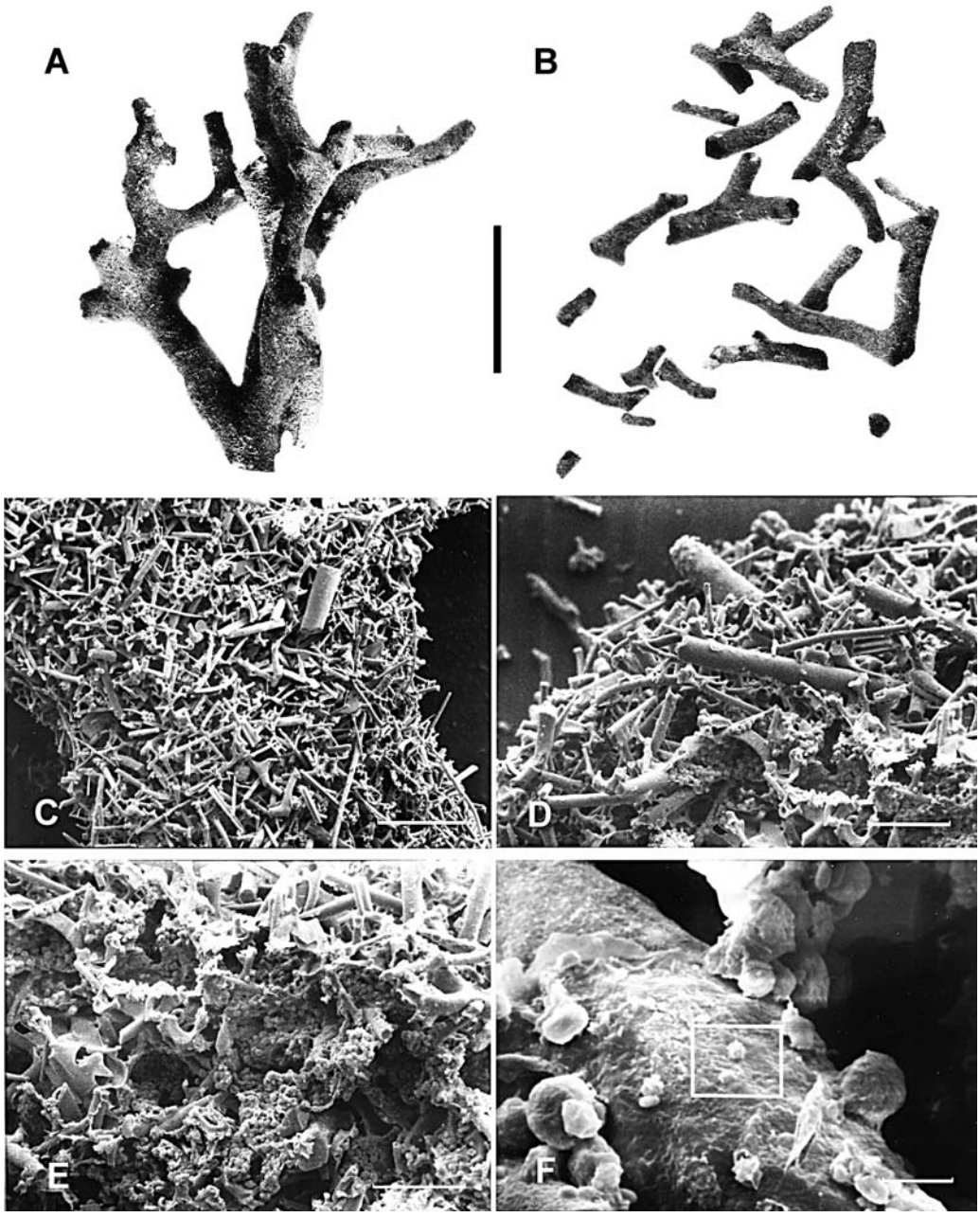

Fig.1. *Spiculammina delicata* **gen. et sp. n**., holotype.
A — lateral view of the test; B — fragments of the test; C — xenophyae (sponge spicules); D — wall of the test, consisting of xenophyae; E — deformed strings of stercomare; F — granellare with granellae (boxed). Scale bars: A — 10 mm, B — 10 mm, C — 300 μm, D — 100 μm, E — 100 μm, F — 10 μm.

Рис.1. *Spiculammina delicata* **gen. et sp. n**., голотип.
A — вид раковины сбоку; B — фрагменты раковины; C — ксенофии (спикулы губок); D — стенка раковины, состоящая из ксенофий; E — деформированные тяжи стеркомар; F — гранелляры с гранеллами (в скобках). Масштаб: A — 10 мм, B — 10 мм, C — 300 мкм, D — 100 мкм, E — 100 мкм, F — 10 мкм.

Spiculammina delicata **sp. n.**

Fig.1A–F.

Material examined. Clipperton Fracture Zone. R/V "Geolog Petr Antropov", St. 5458 (11°52.1'N, 136°06.3'W), depths of about 5400 m. One dry specimen and a lot of fragments of it.

Type material. Specimen of about 40 mm (holotype) and a lot of fragments from 5 to 20 mm. The holotype is deposited in the Zoological Museum of the Moscow State University (No.F-13).

Description. Intact test was tree-like in form, consisting of tubes of different diameter. Tubes pointing in all directions were cylindrical and without any deformations. Diameter of tubes decreased from basal to peripheral parts of test from 5 to 1 mm. The test is very fragile; many peripheral tubes were broken during this study (Fig. 1A,B). On the intact specimen anastomosing tubes seldom occurred; usually tubes divided dichotomously or polychotomously. The only type of xenophyae is presented by fragments of sponge spicules (Fig. 1C). In the wall of test, xenophyae are directed chaotically so that the test has a shaggy appearance. Wall of the large tube is about 100 μm of thickness (Fig. 1D). Interior of the tubes is full of strings of stercomare mixed with xenophyae and granellare (Fig. 1E). Stercomare consist of globular stercomes up to 10 μm in diameter. EDS elemental analysis of a single stercome reveals the presence of Si, Al, Fe, K, Ca, Mg and Ti. Granellae (Fig. 1F) are about 1–2 μm and contain a high concentration of Ba (Fig. 2).

Etymology. From Latin "delicate" — fragile, delicate.

Distribution. The species is found on the abyssal plane near the Clipperton Fracture Zone at the depth of about 5400 m.

Remarks. The test may have been attached to a substratum. There is no bottom sediment between the surface xenophyae, suggesting that the branching part of the test is raised above the surface of the sea bottom sediment or hard substratum.

Unfortunately, the number and dimensions of deformed strings of stercomare and granellare in dry material could not be determined. EDS elemental analysis of a single stercome from stercomare and a single crystal from dried cytoplasm reveals elements typical for stercomes (Riemann et al., 1993; Kamenskaya, 1988; Kamenskaya, Saidova, 1998) and for granellae (Tendal, 1994; Kamenskaya, 2000), respectively.

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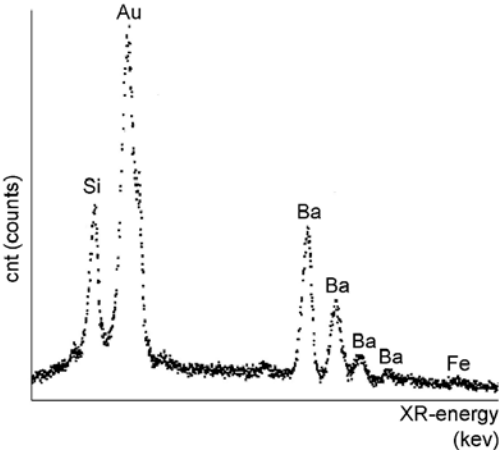

Fig.2. EDS elemental analysis of a single crystal in dried cytoplasm of *Spiculammina delicata* **gen. et sp. n.**

The peaks show the main constituents to be barium (Ba). Absorbtional peak of sulphur (S from SO_4) covered with peak of Au.

Рис. 2. Состав элементов в одном кристалле из сухой цитоплазмы *Spiculammina delicata* **gen. et sp. n.**

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