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A new species of *Exogone* (Syllidae: Exogoninae) from off the state of São Paulo (south-east Brazil)

Marcelo Veronesi Fukuda[1,2,*] (http://zoobank.org/urn:lsid:zoobank.org:author:6BE36A7B-8997-451C-8DE5-35E0ED6F651D) and João Miguel De Matos Nogueira[1] (http://zoobank.org/urn:lsid:zoobank.org:author:C40C8C12-619D-4EC2-8998-253708120D3F)

[1] Laboratório de Poliquetologia (LaPol), Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, Rua do Matão, travessa 14, n. 101, 05508-900, São Paulo, SP, Brazil
[2] Centro de Biologia Marinha, Universidade de São Paulo, Rodovia Manoel Hypólito do Rego, Km 131.5, 11600-000, São Sebastião, SP, Brazil
* To whom correspondence and reprint requests should be addressed. E-mail: mvfukuda@gmail.com

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Abstract Fukuda, M.V. and Nogueira, J.M.M. 2014. A new species of *Exogone* (Syllidae: Exogoninae) from off the State of São Paulo (south-east Brazil). *Memoirs of Museum Victoria* 71: 79–84.

We describe a new species of *Exogone* Örsted, 1845 (Syllidae: Exogoninae) found in dense populations in some areas off the State of São Paulo (south-east Brazil). *Exogone cebimar* sp. nov. has an enlarged median antenna, dorsal cirri present on all chaetigers, a triangular process on each of the shafts of spiniger-like chaetae of segments 1 and 2, and a short proventricle, extending for two segments only. This new species is one of the subjects of ongoing studies dealing with the characterisation of brooding methods found in the subfamily Exogoninae.

Keywords Araçá Bay, polychaete, intertidal, rocky shore, CEBIMar

Introduction

Despite records existing for around 140 species, the syllid fauna along the Brazilian coast is still considered largely unknown, since most of the records come from material collected from shallow waters off the south-eastern region of the country, and mostly from soft bottoms. The northern coast of the State of São Paulo, south-eastern (SE) Brazil, is one of the best-studied regions for the polychaete fauna of the intertidal zone, but even in this area it is not rare to find new occurrences and species new to science in taxonomic studies.

During studies focused on the polychaete fauna occurring off the State of São Paulo and, in particular, a recent research into the diversity and reproductive features of the Syllidae Grube, 1850, a new species of *Exogone* Örsted, 1845 was found.

This new species is abundant in the studied area, to the extent that it has been chosen as one of the target species for an ongoing research into the reproduction of Syllidae, being representative of the ventral brooding of eggs and embryos method found in the subfamily. Characterisation of this reproductive process will be presented in subsequent papers.

Materials and methods

The material analysed came from three projects focused on the biota occurring off the State of São Paulo. The first, 'Biodiversity of intertidal polychaetes on rocky shores off the State of São Paulo' ('BioPol') sampled a range of beaches comprehending most of the shoreline of São Paulo. The other two projects, 'Taxonomic study of the Syllidae (Annelida, Polychaeta) in the Araçá Bay and analysis of the incubation modes in the Exogoninae' and 'Biodiversity and functioning of a subtropical coastal ecosystem: a contribution to integrated management' ('BIOTA – Araçá')', are ongoing studies conducted on the Araçá Bay (São Sebastião, São Paulo). This bay is particularly important because it is very rich in terms of biodiversity, but it is threatened by expansion plans for the neighbouring Port of São Sebastião.

In all projects, collections were made on rocky shores from the intertidal zone at neap tides, mostly by scraping different biological substrates (sponges, ascidians, algae, etc.) from the rocks. In the laboratory, polychaetes were sorted under a stereomicroscope, relaxed in a menthol solution, fixed in 4% formaldehyde and, a few weeks later, rinsed in fresh water and preserved in 70% ethanol.

Identifications were based exclusively on morphological characters. Illustrations were done with the aid of a drawing tube attached to an Olympus® BX-51 microscope. Length of specimens was measured from the tip of the palps to the tip of the pygidium, excluding anal cirri; width was measured at proventricle level, excluding parapodia. Blade lengths for

compound chaetae are provided in dorso-ventral sequence. For scanning electron microscope (SEM) observation, specimens were dehydrated in a series of ethanol solutions with progressively increasing concentrations up to 100%, critical-point dried, covered with a 10–20 nm layer of gold, and then observed under the SEM at the Laboratório de Microscopia Eletrônica, Instituto de Biociências, Universidade de São Paulo.

Abbreviations

Abbreviations for museum names are as follows:

AM — The Australian Museum, Sydney, Australia

MNCN — Museo Nacional de Ciencias Naturales, Madrid, Spain

MZUSP — Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil

ZUEC — Museu de Zoologia da Universidade Estadual de Campinas, Campinas, Brazil

ZMH — Zoologisches Museum Hamburg, Hamburg, Germany

Systematics

Family **Syllidae** Grube, 1850

Subfamily **Exogoninae** Langerhans, 1879

Genus ***Exogone*** Örsted, 1845

Type species. *Exogone naidina* Örsted, 1845.

Diagnosis. Relatively small, thin and slender bodies. Palps well developed, completely fused or with terminal notch. Prostomium ovate, with 2 pairs of eyes in trapezoidal arrangement and, sometimes, 1 pair of anterior eyespots; 3 smooth antennae, all short and ovate, or at least median antenna elongate, digitiform. Peristomium with 1 pair of peristomial cirri. Dorsal cirri present on all chaetigers or absent on chaetiger 2. Peristomial, dorsal and ventral cirri short, papilliform to ovate. Compound chaetae with subdistally inflated and spinulated shafts; in some species, shafts with conspicuous subdistal triangular enlargement ('triangular process') on spiniger-like chaetae of a few anterior parapodia. Blades of falcigers usually spinulated, bidentate, distal tooth smaller than subdistal one; dorsalmost compound chaetae frequently with long and slender spiniger-like blades, with short spinulation. In some species, compound chaetae secondarily simple by fusion of shaft and blade, or by loss of blade. Dorsal simple chaetae present from anterior body, usually sigmoid, progressively stouter posteriorwards; dorsal simple chaetae bayonet-like in some species. Ventral simple chaetae usually present only on posteriormost chaetigers, bidentate, distal tooth smaller than subdistal one. Aciculae distally inflated, apparently hollow, with slightly bent tip. Pygidium with one pair of anal cirri, usually longer than dorsal cirri along body (San Martín, 2005).

Exogone cebimar sp. nov.

Zoobank LSID. http://zoobank.org/urn:lsid:zoobank.org:act:0D7F6ADA-B2A7-469D-8594-E4D6240028C9

Figures 1–2, table 1.

Material examined. Project 'BIOPOL'. São Sebastião – Praia do Araçá (23°48'54"S 45°24'24"W): 1 spec., 17 Apr 2003; 15 specs, 15 Jul 2003; 18 specs, 25 Sep 2003; Praia Preta (23°49'16"S 45°24'35"W): 1 spec., 18 Apr 2003; 8 specs, 18 Jul 2003. São Vicente – Ilha Porchat (23°58'39"S 46°22'08"W): 1 spec., 15 Jun 2003; Praia das Vacas (23°58'55"S 46°22'48"W): 1 spec., 16 May 2003.

Project 'BIOTA-Araçá'. São Sebastião – Praia do Araçá (23°48'54"S 45°24'24"W): 2 specs, 18 May 2011; 16 specs, 25 Sep 2011; 6 specs, 21 Nov 2011; 6 specs, 22 Feb 2012; 72 specs, 7 May 2012; 19 specs, 30 Sep 2012; 75 specs (holotype, MZUSP1966; paratype 1, MZUSP 1967; paratype 2, ZUEC-Pol 14101; paratypes, MZUSP 1968), 1 Oct 2012; 2 specs, 2 Oct 2012.

Type material. Data of the holotype and two selected paratypes are provided in table 1, all specimens collected by Project 'BIOTA-Araçá', 1 Oct 2012.

Comparative material examined. *Exogone lourei* Berkeley and Berkeley, 1938. Pacific Ocean, Australia – Western Australia, Goss Passage, Beacon Island (28°25'30"S 113°47'E): 12 specs (AM W26992), coll. P. Hutchings, 22 May 1994, det. G. San Martín, 2001. Atlantic Ocean, Cuba – Canarreos Archipelago, Isla de la Juventud, Punta del Francés: 3 specs. (MNCN 16.01/630), leg. & det. G. San Martín. Cape Verde – Sal Island, Joaquim Petinha: 3 specs. (MNCN 16.01/6909), coll. & det. G. San Martín, 8 Aug 1985.

Exogone multisetosa Friedrich, 1956. Pacific Ocean, Peru – Lima: 3 specs (ZMH P-15371, holotype; P-15372, paratypes), coll. Remane, 22 Jun 1952, det. Friedrich, 1956.

Description. Body usually orange in colour in live specimens, thin and elongate, holotype largest specimen analysed, 7.78 mm long, 0.23 mm wide, with 46 segments (table 1). Palps ovate, elongate, almost totally fused, with distal notch (figs 1A; 2A–B, D). Prostomium ovate, shorter than palps, with 2 pairs of eyes in trapezoidal arrangement; anterior eyespots absent; median antenna inserted slightly anterior to anterior pair of eyes, elongate, almost reaching tip of palps, subdistally inflated, distally tapering; lateral antennae inserted close to median antenna but slightly anteriorly, ovate, short, almost 1/3 length of median antenna (figs 1A; 2A–B, D). Peristomium slightly shorter than subsequent segments; peristomial cirri ovate, short, smaller than lateral antennae; nuchal organs as 1 pair of dorsolateral short ciliated slits, close to border between prostomium and peristomium (fig. 2E). Dorsal cirri present on all chaetigers, ovate, slightly larger than peristomial cirri but smaller than lateral antennae on anterior body, with slight increase in size and more tapered distally, ovate to pyriform, towards posterior body; ventral cirri similar to dorsal cirri of corresponding parapodium but smaller, ~1/2–2/3 length of corresponding parapodial lobe (fig. 2B–D). Parapodial lobes conical (figs 1A; 2A–D). Shafts of compound chaetae subdistally spinulated, spines arranged in thin rows on midbody chaetae (fig. 1D). Anterior and midbody parapodia with 1, sometimes 2 spiniger-like chaetae each, posterior body parapodia with single spiniger-like chaetae each; spiniger-like chaetae of chaetigers 1 and 2 with subdistal short triangular

Table 1. Morphological variation among selected specimens of the type series of *E. cebimar* sp. nov. All specimens were collected at Praia do Araçá (23°48'54"S 45°24'24"W) on the rocky shore, intertidal zone, 1 Oct 2012.

Exogone cebimar sp. nov.	**Holotype** MZUSP 1966	**Paratype 1** MZUSP 1967	**Paratype 2** ZUEC-Pol 14101
Number of chaetigers	46	42	43
Total length x width at proventricle (mm)	7.78 x 0.23	6.62 x ~0.20	7.00 x ~0.17
Length of blades of spiniger-like chaetae (μm)/number of spiniger-like chaetae per parapodium			
Anterior body	50–37/1	42–31/1	42–36/1
Midbody	45–32/1-2	42–35/1	45–35/1–2
Posterior body	~22/1	22–18/1	22–18/1
Length of blades of falcigers (μm)/number of falcigers per parapodium			
Anterior body	10–7.5/5–6	10–7.5/5–7	10–7.5/5–7
Midbody	~7.5/3–4	~7.5/3–4	~7.5/3–4
Posterior body	~7.5/2–3	7.5–5/2–3	7.5–5/2–3
Length of pharynx (chaetigers)	4	5	4
Length of proventricle (chaetigers); number of muscle cell rows	2; ~20	2; ~20	2; ~21

process on shafts (figs 1B–C; 2F–G); blades spinulated, inconspicuously bifid, 50–31 μm long on anterior body, 45–32 μm on midbody, 22–18 μm on posterior body (table 1). Anterior parapodia with 5–7 falcigers each, midbody with 3–4, posterior parapodia with 2–3 falcigers each; blades of falcigers bidentate and spinulated (figs 1D–E; 2G); slight dorsoventral gradation in length, blades 10–7.5 μm long on anterior body, ~7.5 μm on midbody, 7.5–5 μm long on posterior body (table 1). Dorsal simple chaetae present from anterior body, sigmoid, subdistally spinulated, with thin tip, progressively stouter posteriorwards (figs 1F–G; 2H); ventral simple chaetae only present on posteriormost chaetigers, sigmoid, bidentate, tips resembling those of falciger blades, about as thick as dorsal simple chaeta of corresponding parapodium (figs 1H; 2I). Anterior parapodia with up to 3 aciculae each, 2 of which are distally inflated, apparently hollow, one straight, other distally oblique, remaining acicula straight, distally tapering (fig. 1I); number of aciculae per parapodium decreasing towards posterior body, posterior parapodia with single acicula each, stouter than on anterior body parapodia, distally inflated, with slightly oblique tip (fig. 1J). Pygidium with elongate anal cirri, slightly longer than median antenna (fig. 2C). Pharynx through 4–5 chaetigers, anterior margin surrounded by ~10 soft papillae (fig. 2D), inner margin of pharynx chitinised; large conical tooth close to opening; proventricle through ~2 chaetigers, with ~20 muscle cell rows (fig. 1A; table 1).

Remarks. Exogone cebimar sp. nov. differs from all other species in the genus by the following combination of characters: median antenna longer than lateral ones, almost reaching tip of palps, subdistally inflated, distally tapering; dorsal cirri present on chaetiger 2; shafts of spiniger-like chaetae from chaetigers 1 and 2 subdistally with short triangular process; and proventricle short, through ~2 chaetigers.

Exogone cebimar sp. nov. belongs to a group of species with a triangular process on the shaft of each spiniger-like chaeta of some anterior body chaetigers. This group also includes *E. arenosa* Perkins, 1981, *E. lourei* Berkeley and Berkeley, 1938, *E. multisetosa* Friedrich, 1956, *E. pseudolourei* San Martín, 1991, *E. rostrata* Naville, 1933, and *E. uniformis* Hartman, 1961. Of all these species, however, only *E. lourei* has that process occurring on both chaetigers 1 and 2, as in *E. cebimar* sp. nov., all other species having it on a single chaetiger, either 1 or 2.

Exogone lourei, however, is a larger species, differing from *E. cebimar* sp. nov. in having a longer proventricle, extending for 4–5 chaetigers, instead of ~2 chaetigers, as in *E. cebimar* sp. nov. Furthermore, the triangular processes on the shafts of spiniger-like chaetae of *E. cebimar* sp. nov. are different from those of *E. lourei* and all other species in this group, as in all other species it is a larger structure, frequently larger than the width of the distal part of the shaft, and it is inserted at 90° to the shaft, whereas in *E. cebimar* sp. nov., the triangular processes are smaller, roughly pointed triangles coming out of the shaft.

The chitinised lining of the pharynx in this species frequently forms small fractures in the opening, probably due to abrasion while feeding. In some cases, these fractures resemble small teeth, as found in species that have a trepan, however, in dissected specimens of *Exogone cebimar* sp. nov., we did not see any sign of teeth other than the central pharyngeal tooth.

Etymology. The species is named after the 'Centro de Biologia Marinha da Universidade de São Paulo' ('CEBIMar – USP'), whose facilities are used by many researchers working on different marine-related fields. The existence of this institution on the northern coast of the State of São Paulo can be considered one of the main reasons for it being one of the best-studied regions of the Brazilian coast.

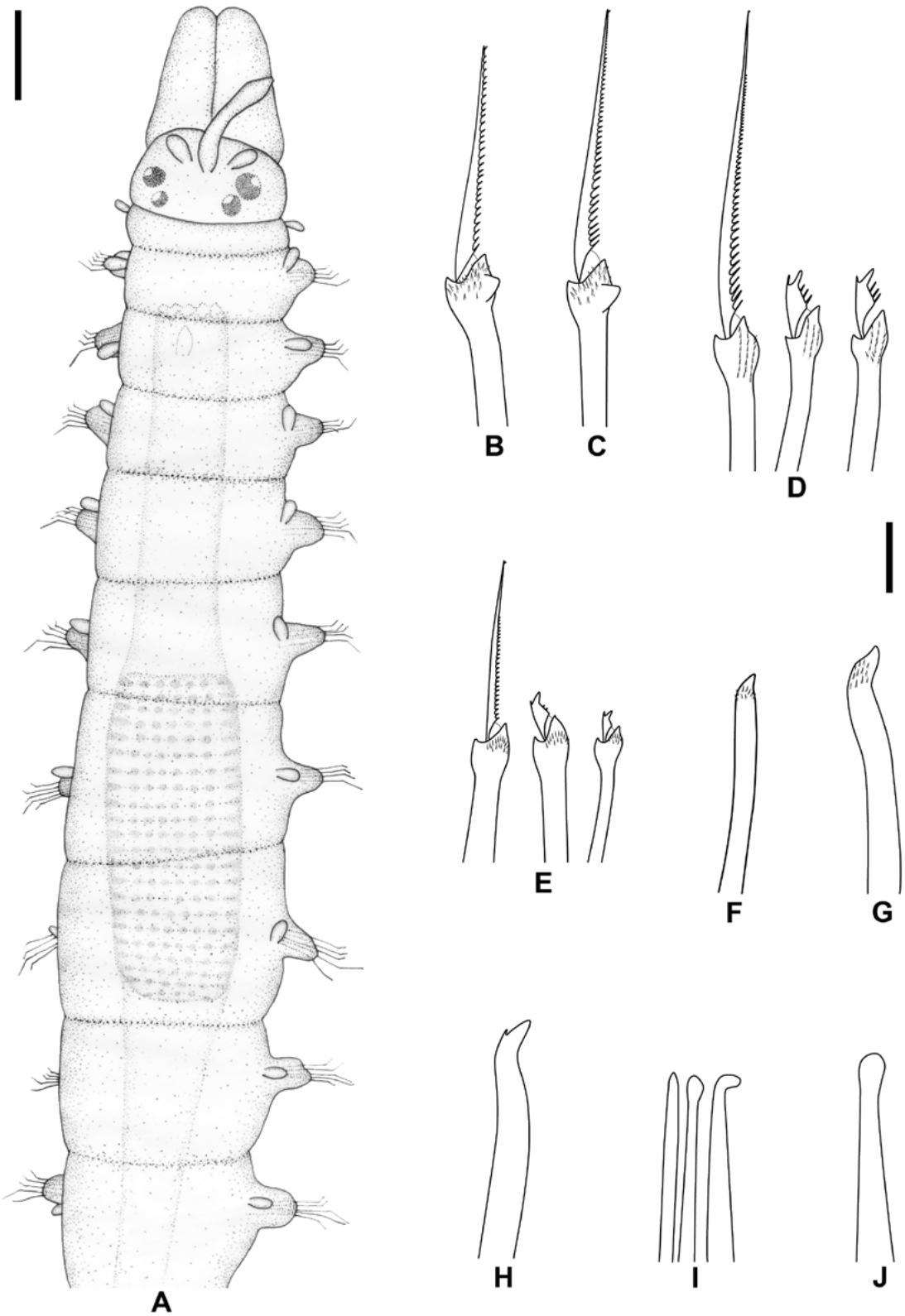

Figure 1. *Exogone cebimar* sp. nov.: A, anterior body, dorsal view; B, spiniger-like chaeta, chaetiger 1; C, spiniger-like chaeta, chaetiger 2; D, compound chaetae, anterior and midbody; E, compound chaetae, posterior body; F, dorsal simple chaeta, anterior body; G, dorsal simple chaeta, posterior body; H, ventral simple chaeta; I, aciculae, anterior body; J, acicula, posterior body. Scale bars: A = 100 μm, B–H = 10 μm.

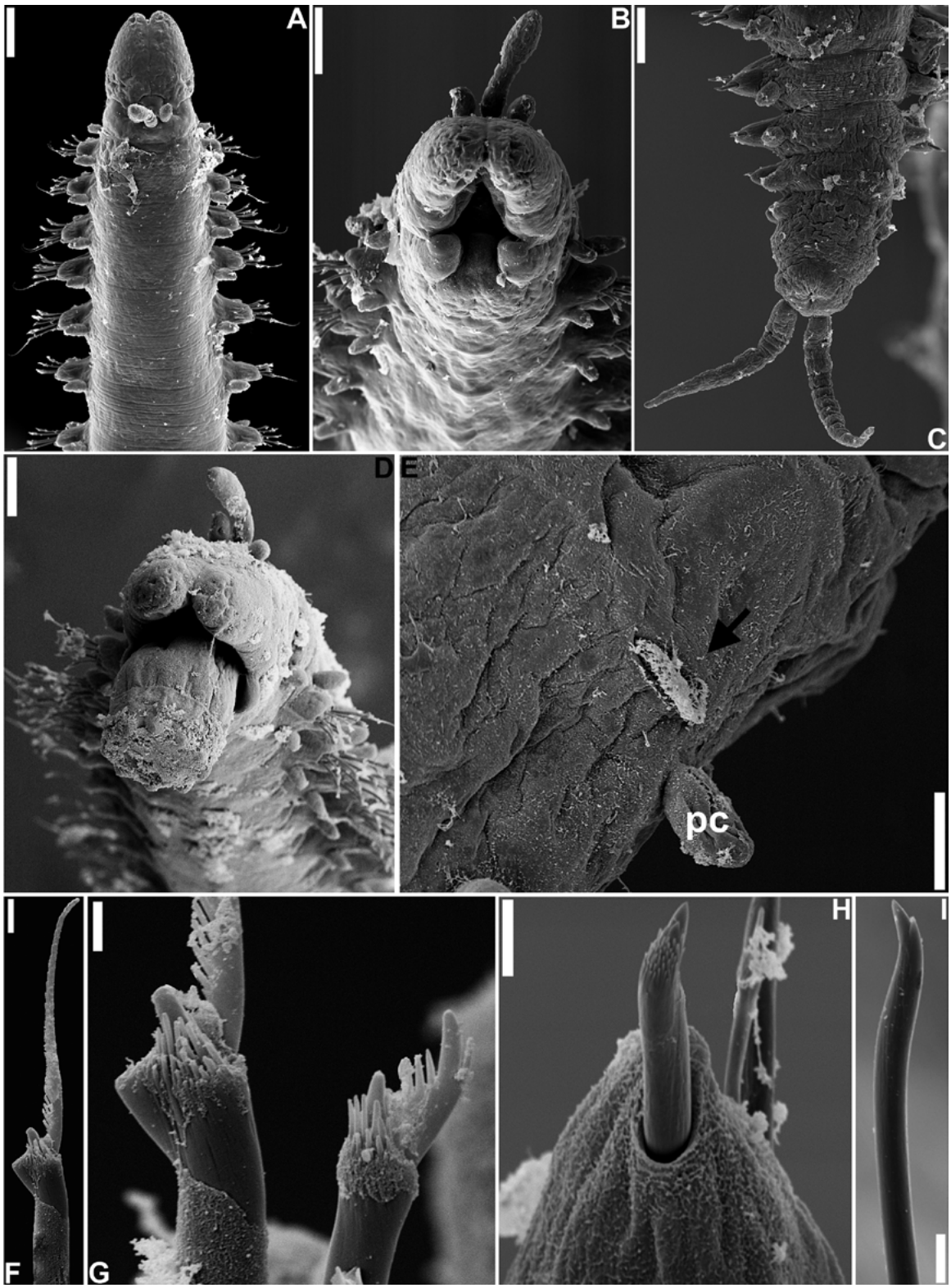

Figure 2. *Exogone cebimar* sp. nov., SEM: A, anterior body, dorsal view; B, anterior body, ventral view; C, posterior body and pygidium, dorsal view; D, anterior body, frontoventral view; E, peristomium, right-hand side dorsolateral view (arrow pointing to nuchal organ; 'pc', peristomial cirrus); F, spiniger-like chaeta, chaetiger 2; G, detail of shafts, spiniger-like chaeta and falciger, chaetiger 2; H, dorsal simple chaeta, posterior body; I, ventral simple chaeta. Scale bars: A = 70 μm, B = 48 μm, C = 42 μm, D = 50 μm, E = 20 μm, F = 3.6 μm, G = 1 μm, H = 5 μm, I = 4 μm.

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