

TWO NEW SPECIES OF *THAUMASTODERMA* (GASTROTRICHA, MACRODASYIDA) FROM KOREA

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SARSIA



CHANG, CHEON YOUNG, JI MIN LEE & CLAUS CLAUSEN 1998 10 09. Two new species of *Thaumastoderma* (Gastrotricha, Macrodasysida) from Korea. – *Sarsia* 83:329-336. Bergen. ISSN 0036-4827.

Two new marine gastrotrichs of the genus *Thaumastoderma* are described from South Korea. *T. coronarium* sp. nov. was collected from the intertidal zones of Manripo beach and Sopori, Tokchok Island in the Yellow Sea. This species seems to be most closely related to *T. bifurcatum* CLAUSEN, 1991 or *T. truncatum* CLAUSEN, 1991 in that they share the following characteristics: one pair of simple, spatulate tentacles; six pairs of dorsal cirri; and absence of eye spots. It differs from these species in having four conspicuous head papillae and a different arrangement of dorsal cirri. *T. appendiculatum* sp. nov. was collected from the intertidal and shallow sublittoral zones of Pongpo beach, Sokcho in the East Sea of Korea, and is easily distinguished from its congeners in having a pair of stout adhesive tubes on the posterior trunk margin, and in that it frequently possesses accessory dorsal cirri. This is the first report on marine gastrotrichs from Korea, and the first record of the genus *Thaumastoderma* in East Asia.

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KEYWORDS: Systematics; marine meiofauna; Gastrotricha; Macrodasysida; Thaumastodermatidae; *Thaumastoderma*; new species; Korea.

INTRODUCTION

The genus *Thaumastoderma* REMANE, 1926 comprises nine species: *T. heideri* REMANE, 1926, *T. mediterraneum* REMANE, 1927, *T. swedmarki* LÉVI, 1950, *T. cantacuzeni* LÉVI, 1958, *T. arcassonense* d'HONDT, 1965, *T. ramuliferum* CLAUSEN, 1965, *T. renaudae* KISIELEWSKI, 1987, *T. bifurcatum* CLAUSEN, 1991, and *T. truncatum* CLAUSEN, 1991. Reports on one or more of these species have been made from the Baltic (REMANE 1926, 1927a, 1936; FORNERIS 1961), north-east Atlantic (REMANE 1926, 1927a, 1936; LÉVI 1950, 1958; SWEDMARK 1950, 1956; SCHULZ 1953; BOADEN 1963a, b; RENAUD-MORNANT & JOUIN 1965; d'HONDT 1965, 1967; CLAUSEN 1967, 1991, 1996; SCHMIDT & TEUCHERT 1969; KISIELEWSKI 1987; POTEL & REISE 1987; HUMMON & WARWICK 1990), north-west Atlantic (RENAUD-DEBYSER 1963; HUMMON 1974; HOGUE 1978), the Mediterranean Sea (REMANE 1927a, b; WILKE 1954; SWEDMARK 1956; CLAUSEN 1965; LUPORINI & al. 1970; SCHROM 1972; TODARO & BALSAMO 1990; TODARO 1992; TODARO & al. 1992; BALSAMO & al. 1994, 1995, 1996), and the Indian Ocean (GERLACH 1961; GANAPATI & RAO 1967; RAO & GANAPATI 1968; RAO 1975, 1980; RAO & MISRA 1983).

Thaumastoderma species have also been recorded from Somalia (VALBONESI & LUPORINI 1984), and from Tuamotu

in the Tropic of Pacific (GOURBAULT & RENAUD-MORNANT 1989). The genus was, however, previously not known from the Pacific of East Asia. During a taxonomic survey of marine gastrotrichs collected along the coasts of South Korea, we found two new species of *Thaumastoderma*, which are described below.

MATERIAL AND METHODS

Material was collected from intertidal or shallow sublittoral sediments at Manripo, Taean-gun Chungchongnam-do (Stn 1) and at Sopori, Tokchok Island (Stn 2), northern Yellow Sea, and from the shallow sublittoral zones between rocks at Pongpo, Sokcho (Stn 3) and at Gampo (Stn 4) in the East Sea of Korea.

Samples were collected in polyethylene bags by scuba diving, and were later extracted in the laboratory using the anaesthetization-decantation technique (see PFANNKUCHE & THIEL 1988). Specimens were fixed either in Bouin's fixative or 4 % formaldehyde, mounted in lactophenol on Cobb's aluminium slide frame, and measured and photographed under a differential interference contrast (DIC) microscope. Drawings were made with the aid of a camera lucida.

Several specimens were prepared for SEM analyses. The SEM material was fixed with hot (about 80 °C) ethanol immediately after extraction, fixed again at 4 °C in 2.5 % glutaraldehyde overnight, and postfixed with 1 % cold osmium tetroxide. After dehydration through a graded series of ethanol (50 %, 60 %, 70 %, 80 %, 90 %, 100 %, 100 % for 30

minutes each), the material was critical point dried, and coated with gold-palladium in a high vacuum evaporator, and examined in a Hitachi S-520 scanning electron microscope operated at 20 kV.

Part of the material was also studied alive, and measurements of five live specimens showed a mean linear size reduction of 12 % after fixation and mounting in lactophenol. Due to the firmness of the armed cuticle, however, the body shape and relative positions of organs are retained well after fixation. All measurements presented here are from mounted material.

The set of morphological symbols and conventions used in the text is given in Table 1.

Abbreviations used in the figures

ac	Accessory cirrus
at	Anterior tentacle
dc	Dorsal cirrus
eg	Epithelial gland
lt	Lateral tentacle
st	Spatulate tentacle
t	Testis
tr	Tetrancres
vlt	Ventrolateral cirrate tube

THE SPECIES

Order Macrodasysida REMANE, 1925

[RAO & CLAUSEN, 1970]

Family Thaumastodermatidae REMANE, 1926

Subfamily Thaumastodermatinae RUPPERT, 1978

Genus *Thaumastoderma* REMANE, 1926

Thaumastoderma coronarium sp. nov.

(Figs 1, 2)

Diagnosis

A *Thaumastoderma* with an adult length to 216 μ m; PhJIn at about U 32; one pair of simple, spatulate tentacles; six pairs of dorsal cirri, sixth pair longest, third pair shortest; without eye spots; dorsal side of head with four conspicuous conical papillae near the anterior margin.

Table 1. Key to morphological symbols and conventions

Cirrate tubes	Tubes with a finely granulated content, apparently non-adhesive
Lt	Length, total from anterior end of head to posterior end of caudal lobes excluding adhesive tubes
U	Percentage units of Lt from anterior to posterior
PhJIn	Junction between pharynx and intestine
TbA	Anterior adhesive tubes
TbP	Posterior adhesive tubes
TbVL	Ventrolateral adhesive tubes
Columns	Longitudinal in orientation
Rows	Transverse in orientation

Localities. Stn 1. 12 May 1995, 16 May 1997. Stn 2. 27 Oct. 1995.

Holotype. Adult specimen 199 μ m long, lactophenol preparation, collected on 12 May 1995.

Type locality. Korea, Manripo 36°47'53"N, 126°08'59"E, bottom fine sand. Zoological Museum, University of Bergen (ZMBN), Cat. No. 66771.

Paratypes. 15 specimens, from the type locality. ZMBN, Cat. Nos 66772-6 and Taegu University.

Additional material. Nine specimens, two from Sopori, 27 Nov. 1995, and seven from the type locality, 16 May 1997.

Etymology. Corona (L)-crown, pertaining to the crown-like shape of the anterior part of head caused by the four papillae.

Description

Body length up to 216 μ m; pharyngo-intestinal junction at about U 32. Body with inflated trunk, narrowing gradually to a bilobed caudum. Head bearing four dorsal, conical, papilla-like projections near its anterior margin; tip of each papilla with a short hair. Head appendages consist of a pair of rod-shaped anterior tentacles, a pair of rod-shaped lateral tentacles, and a pair of simple, spatulate tentacles; bases of lateral and spatulate tentacles distinctly separated. Eye spots lacking. Six pairs of dorsal cirri at about U 8, U 32, U 48, U 64, U 83, and U 95 respectively; mean lengths of cirri (1-6) in μ m with standard deviations (\pm sd): 1 (26.7 \pm 3.4), 2 (19.4 \pm 3.2), 3 (18.9 \pm 3.4), 4 (23.2 \pm 4.5), 5 (21.6 \pm 3.4), 6 (34.0 \pm 3.3). Epithelial glands few, round to elliptical (5-10 μ m in diameter).

Cuticular armature: dorsal surface with about 14 columns of tetrancres; length of tines about 7 μ m in the middle body region, markedly shorter tines in the anterior head region and on the posterior lobes.

Adhesive tubes: TbA, four per side (5-7 μ m) arranged transversely posterior to the mouth, the medial ones inserted singly and widely spaced; TbVL, 15-16 per side, two small ones protruding laterally in pharyngeal region at about U 14 and U 20, the remainder, of variable lengths (9-20 μ m) more ventrally inserted, from posterior pharyngeal region (U27-30) to U 78-80); TbP, six per side, two (ca 10 μ m) forming the 'foot' at tip of the lobes, the others flanking the lobes, two (ca 8 μ m) medially, on the posterior trunk margin, and two (ca 7 and 11 μ m) laterally.

Reproductive tract: a single gonad on the right side with an anterior elongate testis and posterior ovary.

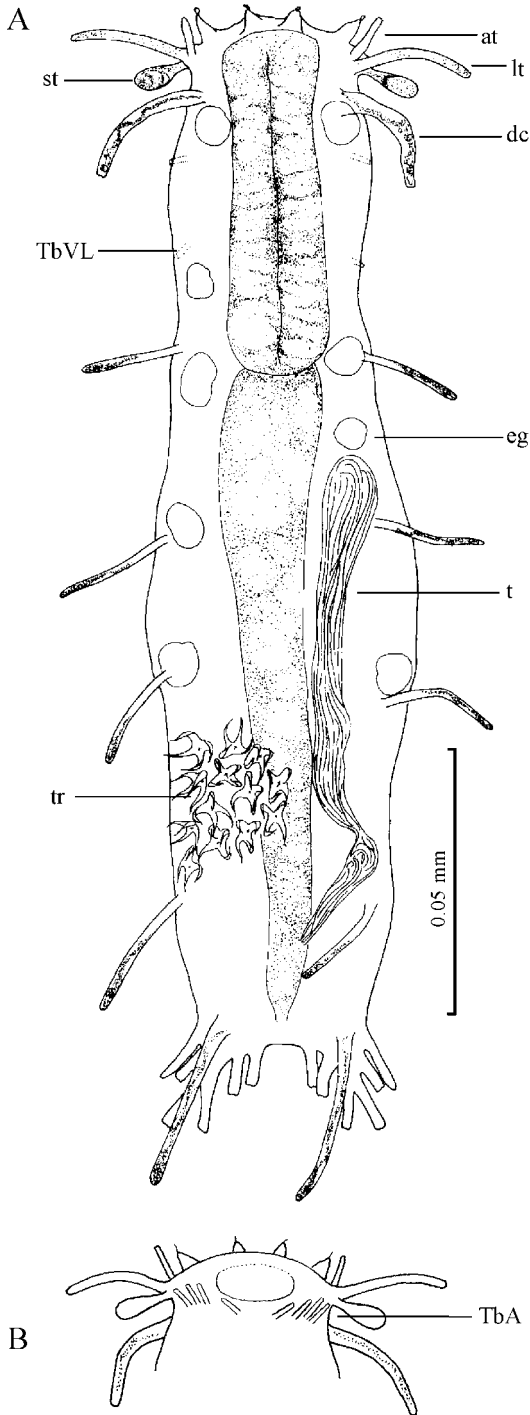


Fig. 1. *Thaumastoderma coronarium* sp. nov. A. Dorsal view showing details of the body configuration. Cuticular cover of tetrancres shown only partly for clarity. B. Ventral view of head region showing the anterior adhesive tubes. Scale line 50 μ m.

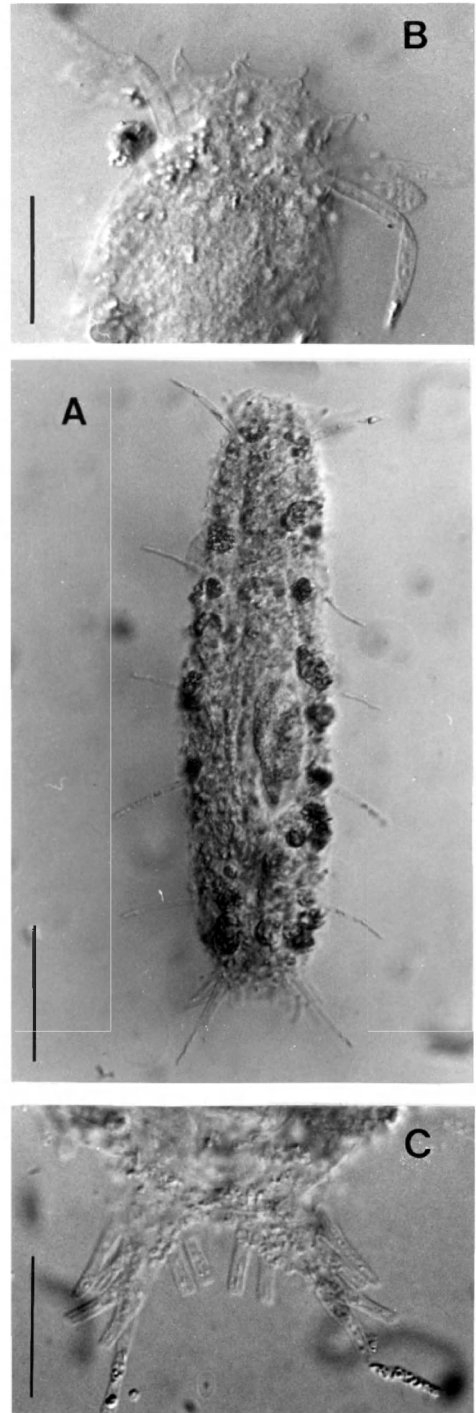


Fig. 2. *Thaumastoderma coronarium* sp. nov. LM graphs (DIC), dorsal views. A. Habitus. B. Head portion. C. Posterior portion, showing posterior adhesive tubes and sixth pair of dorsal cirri. Scale line in A, 50, in B and C, 20 μ m.

Remarks

Measurements were made on 11 specimens; body lengths varied from 164 to 216 μm (mean 201, $\text{sd} = 20.4$), number of tetrancre columns from 13 to 15. The four anterior papilla-like projections most probably represent especially large conical bases of sensory hairs.

Taxonomic affinities

The new species resembles *T. truncatum* or *T. bifurcatum*, in having the following characters: one pair of simple, spatulate tentacles, six pairs of dorsal cirri, and the absence of eye spots. However, the occurrence of conspicuous head papillae makes the new species easily discernible from the other two species, as do the different size and arrangement of the dorsal cirri. Furthermore, its body size is much smaller than that of *T. bifurcatum* (to 340 μm), and the vas deferens is without a posterior loop, in contrast to that of *T. truncatum* (cf. CLAUSEN 1991).

Thaumastoderma appendiculatum sp. nov.

(Figs 3-5)

Diagnosis

A *Thaumastoderma* with an adult length to 200 μm ; PhJIn at about U 35; one pair of simple, spatulate tentacles; eye spots absent; five pairs of dorsal cirri, second, third and fourth pairs often accompanied by an accessory cirrus; posterior margin of body with a pair of short and stout adhesive tubes medially; ventrolaterally on each side in posterior half of body three or four small cirrate tubes.

Localities. Stn 3 a, b.

Holotype. Adult specimen 193 μm long, lactophenol preparation, collected on 11 Apr. 1996.

Type locality. Korea, Sokcho, Pongpo beach, 38°14'57"N, 128°34'08"E, bottom course sand. ZMBN, Cat. No. 66777.

Table 2. Occurrence of accessory cirri in *Thaumastoderma appendiculatum* sp. nov.

Accessory cirri at dorsal cirri 2-4	Number of specimens	Ratio (%)
Absent	34	47.22
At 2 only	7	9.72
At 3 only	9	12.50
At 4 only	1	1.39
At 2 + 3	13	18.06
At 3 + 4	1	1.39
At 2 + 3 + 4	7	9.72
Total	72	100.00

Paratypes. Ten specimens from the type locality. ZMBN, Cat. Nos 66777-8 and Taegu University.

Additional material. 72 specimens: 70 from the type locality, four on 2 Aug. 1996, 57 on 25 Aug. 1996, and nine on 24 Dec. 1966; and two from Gampo on 29 Mar. 1997.

Etymology. The species name 'appendiculatum' pertains to the presence of accessory dorsal cirri.

Description

Body length up to 200 μm ; pharyngo-intestinal junction at about U 35. Body with slightly inflated trunk narrowing to a broad, bilobed caudum. Anterior margin of head gently grooved with three to four indentations. Head appendages consist of a pair of rod-shaped dorsal (anterior) tentacles of cirrate nature, a pair of rod-shaped lateral tentacles, and a pair of simple, spatulate tentacles; bases of lateral and spatulate tentacles distinctly separated. Eye spots lacking. Five pairs of dorsal cirri at about U 11, U 38, U 60, U 82, and U 95 respectively, second to fourth pairs often more or less swollen for most of their lengths; mean lengths of cirri (1-5) in μm with standard deviations ($\pm \text{sd}$): 1 (27.4 ± 2.6), 2 (16.5 ± 2.8), 3 (23.3 ± 3.3), 4 (18.4 ± 2.5), 5 (32.5 ± 3.6). Second, third and fourth pair of cirri often accompanied (on either left or right side or both) by a, frequently cigar-shaped, accessory cirrus, standing just dorsal, or antero-dorsal, to the main cirrus and approximately half its size or less (see Table 2). Epithelial glands few (5-11 μm in diameter).

Cuticular armature: dorsal surface covered with alternating columns of tetrancre (nine or ten visible in dorsal view), with the tines reaching 7 μm in middle body region.

Adhesive tubes: TbA, three to four per side in a ventral row posterior to the mouth, with the medial ones shortest (6 vs 7-8 μm) and widely spaced; TbVL, a paired column of 12-13 tubes (10-18 μm), all confined within the intestinal region from ca U 37 to U 82; TbP, five per side, one unusually broad and short tube (ca 5 μm) inserting medially close to the corresponding tube of the other side, three tubes connected with each lobe, and one small tube (7 μm) inserting laterally at the sloping edge of the trunk; of the three lobe tubes, two (ca 10 μm) insert distally, forming the lobe foot, and a longer one (14 μm) inserts laterally at base of lobe.

In addition to the dorsal and accessory dorsal cirri, in the posterior half of the body a third set of three to four paired cirrate tubes occur, inserting ventrolaterally just above the column of TbVL: two thin tubes (ca 9 μm) protruding in the interval between second and third dorsal cirrus, at about U 46 and U 58, and usually also one of

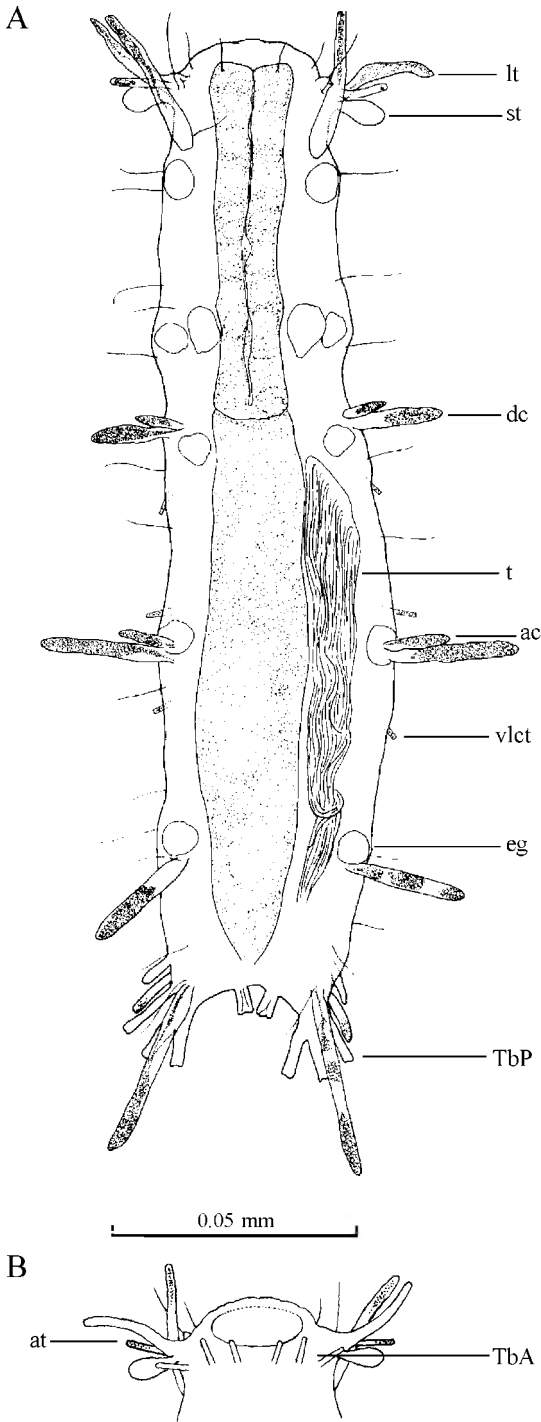


Fig. 3. *Thaumastoderma appendiculatum* sp. nov. A. Dorsal view showing details of the body configuration. Tetrancres omitted. B. Ventral view of head region showing the anterior adhesive tubes. Scale line 50 μ m.

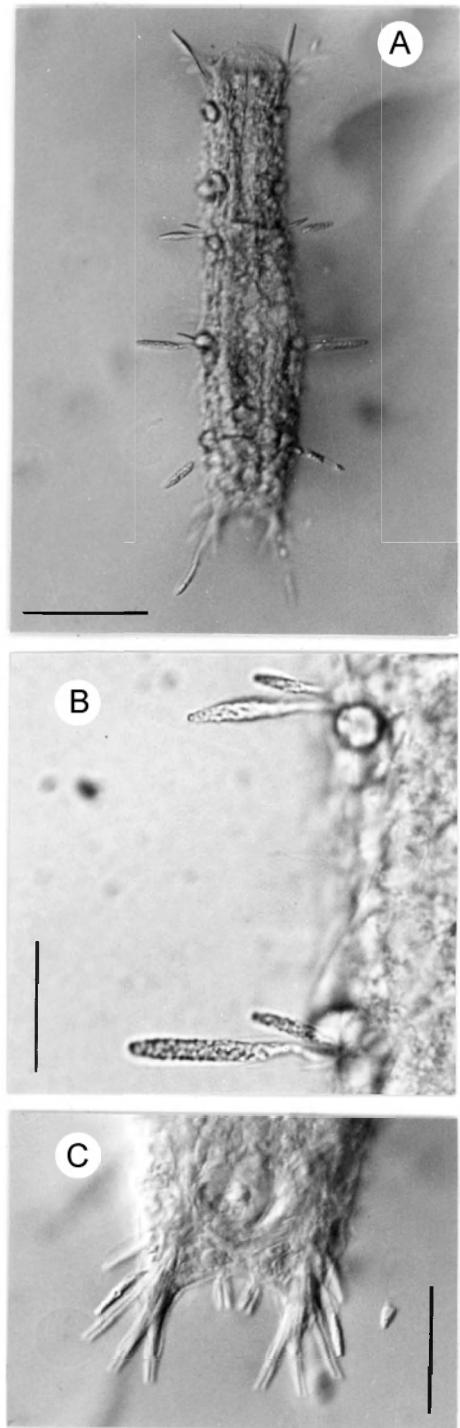


Fig. 4. *Thaumastoderma appendiculatum* sp. nov. LM graphs (DIC), dorsal views. A. Habitus. B. Second and third dorsal cirri with accessory cirri, left side. C. Posterior portion, showing posterior adhesive tubes. Scale line in B, 50, in A and C, 20 μ m.

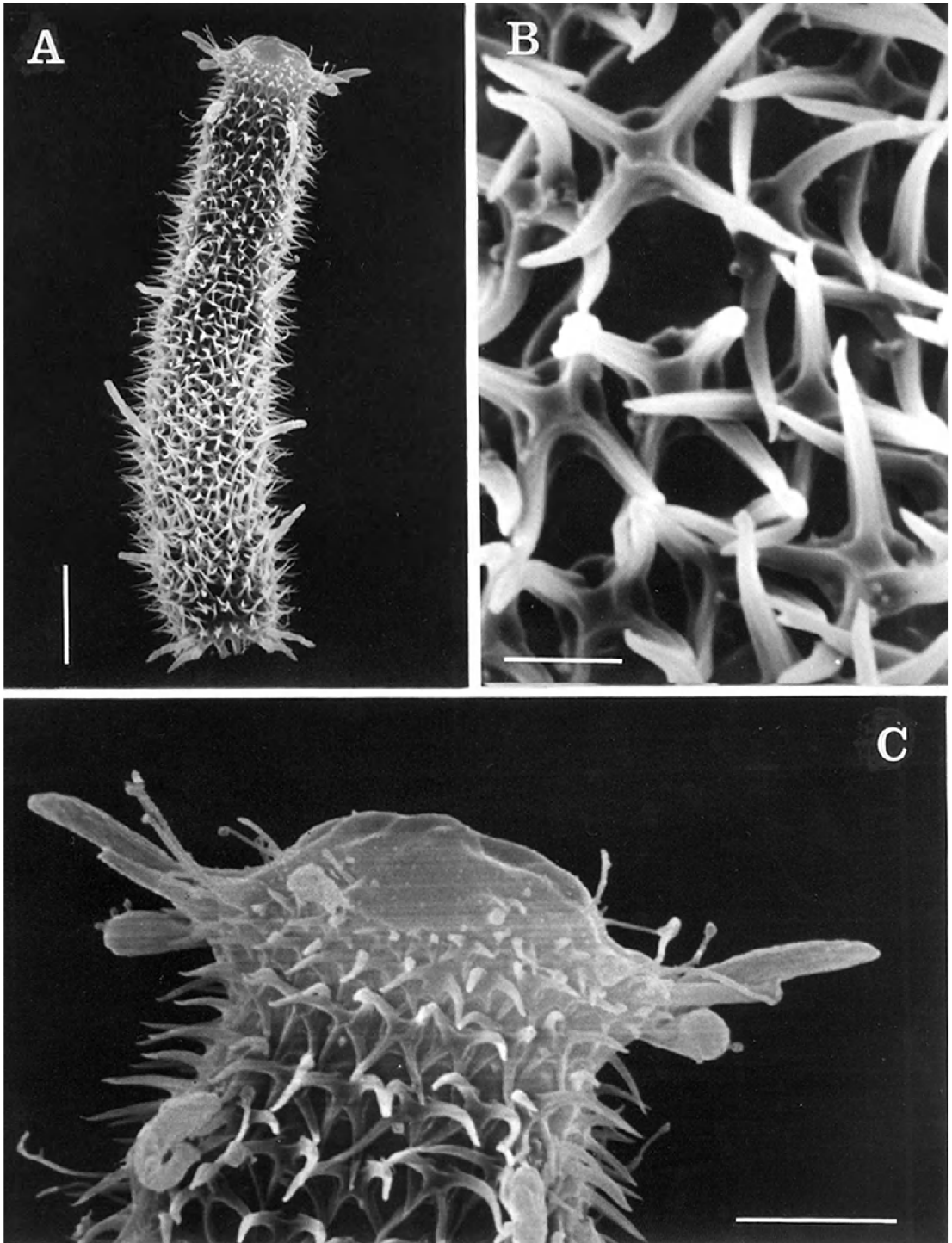


Fig. 5. *Thaumastoderma appendiculatum* sp. nov., SEM graphs. A. Habitus, dorsal view. B. Head portion, dorsal view. C. Tetrancres. Scale line in A, 30, in B, 12, and in C, 2 μ m.

same size between second and third cirrus, at about U 72; lastly, between the two outer TbP, a ca 11 µm long, thicker cirrate tube inserts ventral to the base of the posterior dorsal cirrus.

Reproductive tract: a single gonad on the right side, with posterior ovary and anterior, elongate testis.

Remarks

Neither accessory dorsal cirri, ventrolateral cirrate tubes, nor a single pair of blunt adhesive tubes on the posterior body margin were previously reported in *Thaumastoderma*. However, larger, dorsolateral tubes have been reported from several species of the closely related genus *Tetranchyroderma*. Tubes resembling the dorsal cirri of *Thaumastoderma* are described in *T. cirrophorum* LÉVI, *T. verum* WILKE, *T. massiliense* SWEDMARK, and *T. indicum* RAO & GANAPATI. In *T. norvegicum* CLAUSEN, three pairs of smaller, lateral

tubes of cirrate nature recall the ventrolateral cirrate tubes of the new species.

Taxonomic affinities

The three characters emphasized above clearly identify the new species as separate from all other species of *Thaumastoderma*. *T. appendiculatum* approaches *T. heideri* and *T. mediterraneum* in that it has one pair of simple spatulate tentacles and five pairs of dorsal cirri, and with respect to body size.

ACKNOWLEDGEMENTS

The work was partly supported by a grant from the Korea Science and Engineering Foundation (project No. KOSEF 961-0508-067-2) to C.Y. Chang, and by the Research Council of Norway to C. Clausen. We are much grateful to Dr Jessica Marks for correcting the English.

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Accepted 20 February 1998

Editorial responsibility: Ulf Båmstedt