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Three new species of Dendrochirotida (Holothuroidea, Echinodermata) from the Weddell Sea (Antarctica)

by Cl. MASSIN

Abstract

Three new species of dendrochirote holothurians are described: *Echinopsolus parvipes, Cucumaria acuta,* and *Trachythyone maxima.* The specimens were collected between 400 and 800 m in the south-eastern Weddell Sea, Antarctica.
Key-words: Holothuroidea, Dendrochirotida, new species, Antarctica

Résumé

Trois nouvelles espèces d'holothuries dendrochirotes sont décrites: *Echinopsolus parvipes, Cucumaria acuta,* et *Trachythyone maxima.* Les animaux ont été récoltés entre 400 et 800 m de fond dans la partie sud-est de la mer de Weddell (Antarctique).
Mots-clés: Holothuroidea, Dendrochirotida, nouvelles espèces, Antarctique.

Introduction

The Weddell Sea was intensively investigated during the Expedition ANT I/2, ANT II/4 and ANT III/3 of the RV "Polarstern" in 1983, 1984 and 1985 respectively. The holothurians collected during these expeditions were studied by GUTT (1988, 1990 a, b, 1991) and GUTT & PIEPENBURG (1991).

During the Expedition ANT VII/4 (EPOS 3) of the RV "Polarstern" in 1989 (see ARNTZ *et al.* 1990) a large number of holothurians were collected. This material was sorted by the Centre National de Tri d'Océanographie Biologique (CENTOB, Brest, France); all holothurians collected between 0 m and 800 m were sent for study to the Royal Belgian Institute of Natural Sciences (IRSNB).

The present contribution describes three new species of dendrochirote holothurians found amongst this material. The type material is deposited at the IRSNB.

Taxonomic account

Psolidae PERRIER, 1902
Echinopsolus GUTT, 1990
Echinopsolus parvipes n. sp.
(Figs 1-5)

DIAGNOSIS

Small holothurian (10-30 mm long), twice as long as wide, with a distinct ventral sole. Tube feet on ventrolateral radii, midventral radius naked except anteriorly and sometimes posteriorly. Dorsal side smooth with few papillae. Dorsal ossicles numerous multilayered perforated plates. Ventral ossicles reduced to small perforated plates and baskets. Ten tentacles, the two ventral reduced. Tentacular ossicles very small rods and perforated plates.

MATERIAL EXAMINED

Holotype: specimen labelled IG27718/EPOS3/261BPN6subs/5-1 caught by semipelagic trawl at 799 m the 10/02/89.
Type locality: Weddell Sea, 74°36,5'S-29°41,2'W.
Paratypes: IG27718/EPOS3/248GSN10subs/2 (12 specimens), subs/38 (1 specimen), sub/51 (6 specimens) (74°39,9'S-29°31,3'W; 602 m; 03/02/89).
IG27718/EPOS3/261BPN6subs/1 (2 specimens), subs/4 (4 specimens), subs/5 (2 specimens), subs/15 (1 specimen) (74°36,5'S-29°41,2'W; 799m; 10/02/89).
Additional material: IG27718/EPOS3/269BPN7RS/5 (1 specimen) (72°54,7'S-19°49,4'W; 602 m; 12/02/89).
IG27718/EPOS3/289AGT23subs/8 (5 specimens), subs/15 (1 specimen), subs/16 (1 specimen), subs/17 (1 specimen), subs/24 (1 specimen) (71°12,0'S-13°27,9'W; 672 m; 19/02/89).
IG27718/EPOS3/290AGT24subs/21 (1 specimen) (71°05,9'S-12°34,0'W; 522 m; 19/02/89).

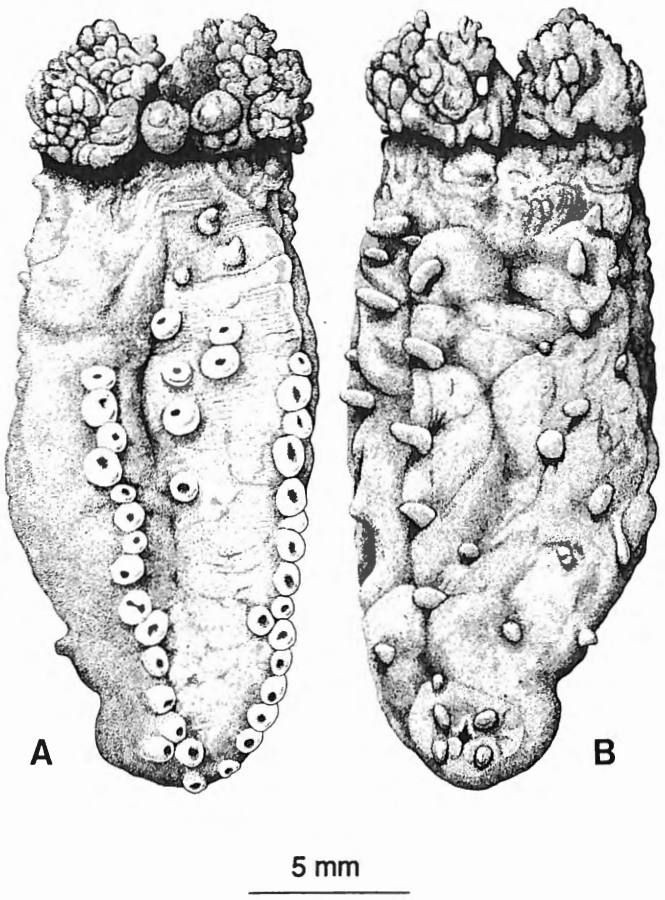


Fig. 1 – Echinopsolus parvipes *n. sp. A: ventral view; B: dorsal view.*

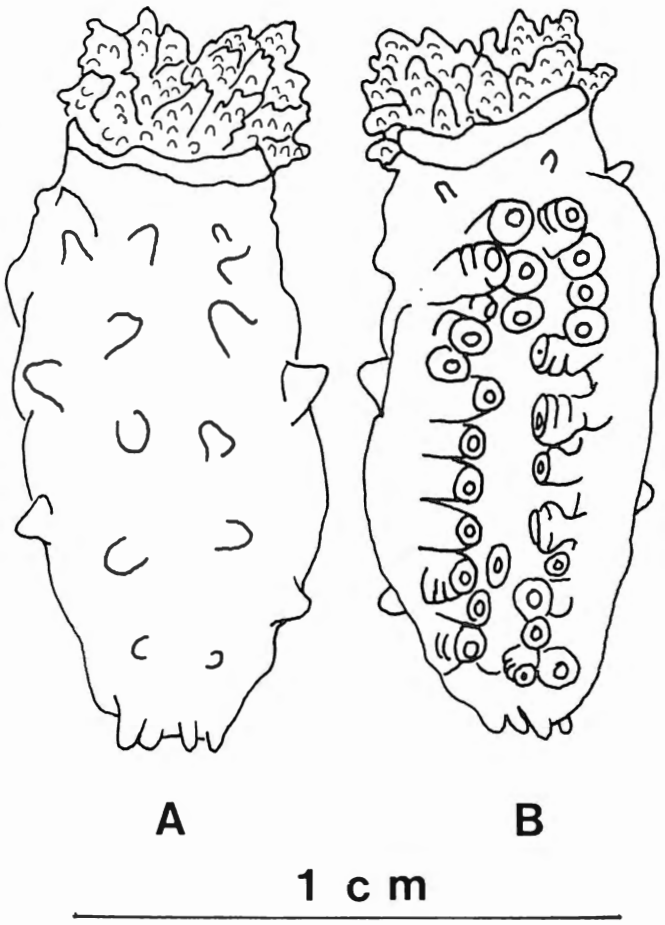


Fig. 2 – Echinopsolus parvipes *n. sp. Small specimen. A: dorsal view; B: ventral view.*

DESCRIPTION

Body cylindrical, slightly tapering posteriorly (fig.1A, B). Mouth and anus dorsal. Ten tentacles; two ventral tentacles reduced and poorly branched. Except for two paratypes, the tentacles are always fully extended. One genital papilla is present dorsally in the tentacular crown. The genital papilla is only present in specimens longer than 10 mm. The anus is surrounded by 4 large papillae (fig. 1B). Body smooth dorsally and laterally, bearing only retractile papillae. These papillae are scattered without any arrangement and their average density varies between 6 and 8 per cm^2 (figs 1B, 2A). Papillae are present only in specimens longer than 7-8 mm.

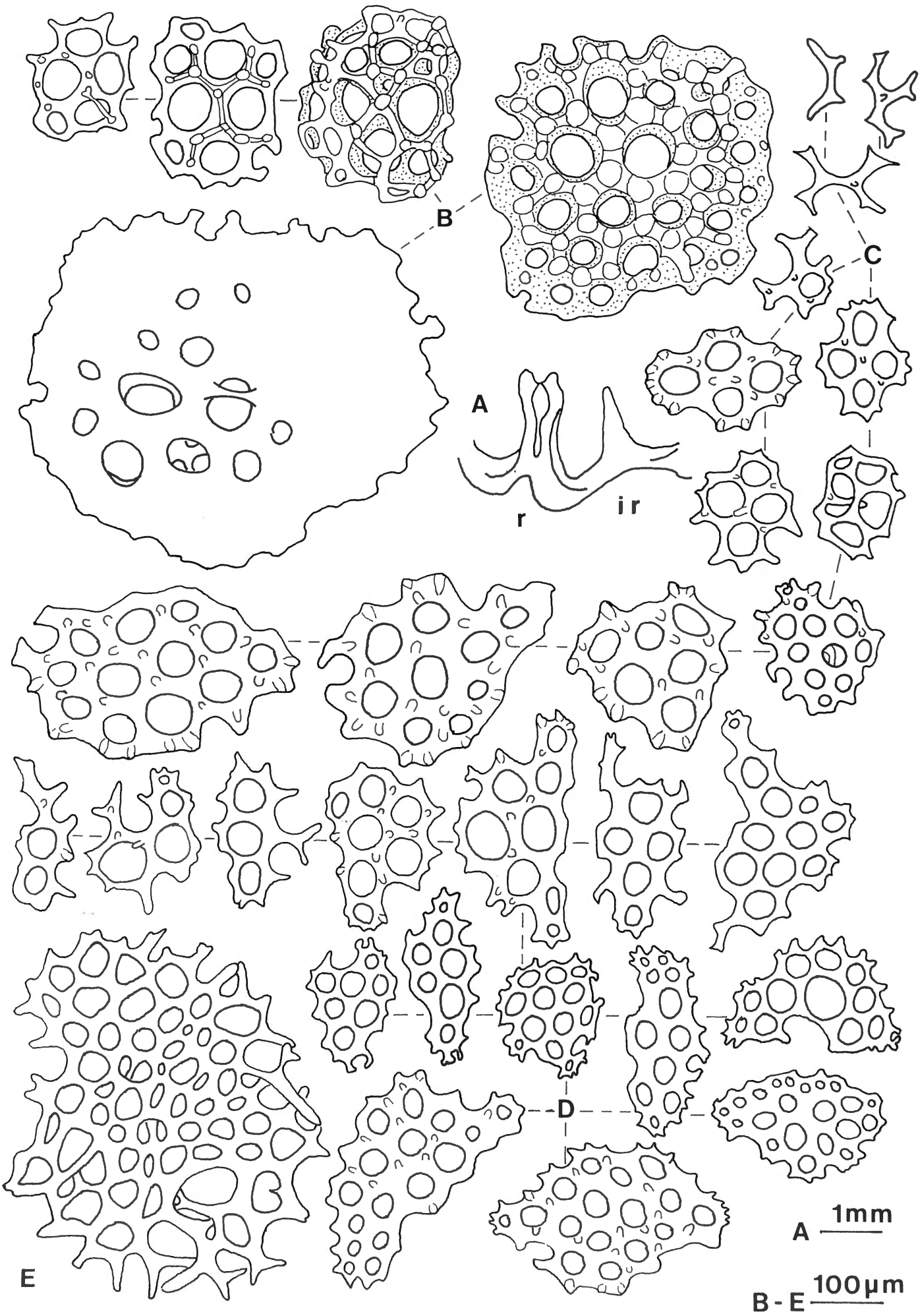
Ventral sole well defined, starting 2-4 mm behind the tentacular crown (figs 1A, 2B). Tube feet limited to the ventral sole, in a single row on the lateral radii and in a double anteriorly located row on the midventral radius. In large specimens one to four tube feet may appear posteriorly along the midventral radius.

The number of ventral feet (Y1) and the number of dorsal papillae (Y2) are correlated with the body length (X): $Y1 = 1.5X + 8.2$ ($P<0.01$, $r=0.88$, $n=40$) and $Y2 = 2.7X - 13.3$ ($P<0.01$, $r=0.90$, $n=35$) (cf. tab. 1).

The calcareous ring is without posterior projections (fig. 3A). Radial pieces are one third larger than interradial pieces. The anterior projection of the radial pieces has a notch at the apex; that of the interradial pieces ends in a smooth point (fig. 3A). The number and shape of the ossicles is similar in small and large specimens. However, ossicle size decreases with increasing body size. The dorsal ossicles are different from the ventral ossicles. Dorsally, there are large knobbed, multilayered perforated plates, with an average diameter of 400 µm (maximum 600 µm) (fig. 3B). In the largest plates, about ten holes are not covered by the secondary structures and perforate the whole plate (fig. 3B). Ventrally, there are spiny or knobbed, small perforated plates derived from X shape bodies (fig. 3C). Their average diameter is only 200 µm with a maximum of 375 µm.

Table 1
Echinopsolus parvipes n. sp. Body size (in mm), number of feet and dorsal papillae. L: length; W: width; R: right; C: central; L: left; T: total; "/": not countable.

Specimens	L	W	Feet				Dorsal papillae
			R	C	L	T	
248GSN1Osubs/51-1	3.9	1.5	4	2	4	10	0
248GSN10subs/51-5	4.3	2.4	5	2	6	13	0
248GSN10subs/51-4	5.7	2.4	4	2	6	12	0
248GSN10subs/51-3	6.1	2.7	7	2	7	16	0
289GSN10subs/17	6.4	3.6	8	2	8	20	5
261BPN6subs/15	6.9	2.6	7	2	6	15	5
248GSN10subs/2-1	7.0	3.7	7	2	8	17	5
289AGT23subs/15	7.1	4.0	7	2	7	16	3
289AGT23subs/16	7.2	2.8	8	4	9	21	/
289AGT23subs/24	7.8	2.1	7	2	7	16	5
248GSN10subs/2-2	8.1	2.4	8	2	9	19	5
248GSN10subs/51-2	9.2	3.2	8	2	8	18	6
248GSN10subs/51-1	9.6	3.1	8	3	10	21	5
248GSN19subs/38	10.9	6.9	14	5	11	30	20
248GSN10subs/2-4	11.2	5.5	12	3	13	28	20
261BPN6subs/4-3	11.2	5.3	10	4	9	23	15
248GSN10susb/2-5	11.5	5.0	11	5	11	27	20
290AGT24subs/21	11.7	5.2	13	/	14	27	25
248GSN10subs/2-3	11.9	5.1	9	3	12	24	10
289AGT23subs/8-2	11.9	5.2	14	11	14	39	/
248GSN10subs/2-6	12.2	5.6	13	7	11	31	20
289AGT23subs/8-1	12.5	5.2	14	10	14	38	20
289AGT23subs/8-3	14.6	7.4	16	12	16	44	50
261BPN6subs/4-1	14.7	8.3	13	5	14	32	40
248GSN10subs/2-7	15.2	8.7	13	4	13	30	25
261BPN6subs/4-2	15.5	8.4	14	7	13	34	50
248GSN10subs/2-8	16.2	8.5	11	5	13	29	20
269BPN7RS/5	17.3	8.6	14	9	15	38	50
261BPN6subs/1-1	17.6	9.3	14	4	13	31	30
248GSN10subs/2-9	18.5	9.6	14	5	15	34	30
261BPN6subs/5-1	19.3	8.5	18	7	17	42	40
261BPN6subs/5-2	19.8	9.3	14	12	15	41	40
248GSN10subs/2-10	20.2	9.8	17	10	18	45	50
261BPN6subs/5-3	20.6	9.4	14	14	16	44	50
261BPN6subs/4-4	21.1	10.0	15	8	14	37	25
289AGT23subs/8-4	21.8	7.1	16	6	16	38	50
248GSN10subs/2-11	22.9	11.0	13	7	16	36	50
248GSN10subs/2-12	23.0	10.4	18	8	17	43	50
289AGT23subs/8-5	23.6	8.8	19	14	19	52	50
261BPN6subs/1-2	29.7	12.0	16	7	17	40	65


B
C
A
r
ir
D
E
A 1mm
B - E 100µm

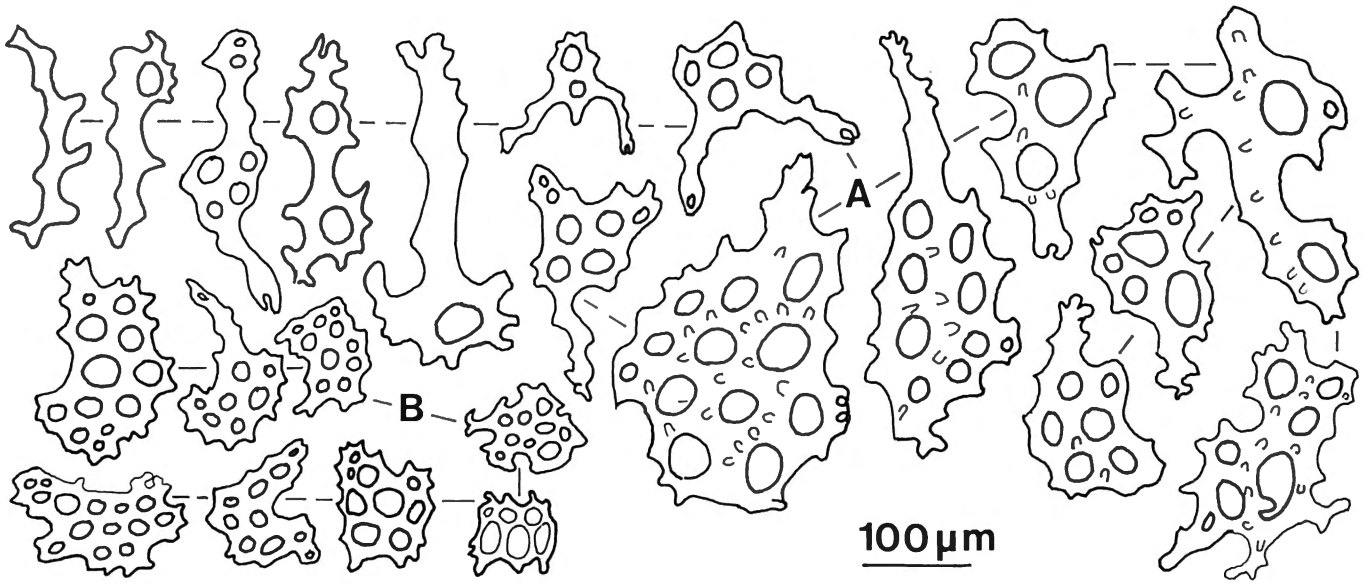


Fig. 4 – Echinopsolus parvipes *n. sp. Tentacular ossicles A: plates with large holes; B: plates with small holes.*

The tube feet have small perforated plates, the largest (300 µm) being knobbed (fig. 3D). The edges of the plates are very often spiny. The end plates (fig. 3E) have an average diameter of 600 µm. There are two kinds of tentacular ossicles: rods and irregular perforated plates (200-300 µm long) with large holes (20-50 µm in diameter) (fig. 4A), and small irregular perforated plates (100 µm in diameter) with numerous small holes (10-20 µm in diameter) (fig. 4B).

DISCUSSION

Echinopsolus parvipes n. sp. is similar to *Echinopsolus acanthocola* GUTT, 1990 in its general aspect, average size and number of tube feet. However, the species differ in the number of dorsal papillae and in the shape of their ossicles. *E. parvipes* n. sp. has only 6-8 dorsal papillae per cm^2, whereas *E. acanthocola* has 40 per cm^2 (erroneously cited as 4 per cm^2 by GUTT (1990a)). *E. parvipes* n. sp. lacks the very large plates with a multilayered network and the tower-like structure in the dorsal body wall. Furthermore, multilayered plates are absent from the ventral body wall, feet, and tentacles of *E. parvipes* n. sp., but present in *E. acanthocola.*

Both species have the same geographical distribution in the East Weddell Sea. However, *E. parvipes* n. sp. lives slightly deeper (520-800 m) than *E. acanthocola* (200-650 m). Both species were found commensally on sea urchin spines: *E. parvipes* n. sp. on *Notocidaris mortenseni* (KOEHLER, 1900) (fig. 5) and *E. acanthocola* on *Ctenocidaris perrieri* KOEHLER, 1912.

Fig. 5 – Echinopsolus parvipes *n. sp. on the spine of a* Notocidaris mortenseni *(KOEHLER, 1900).*

◁ Fig. 3 – Echinopsolus parvipes *n. sp. A: calcareous ring (r: radial piece; ir: interradial piece); B: body wall dorsal plates; C: body wall ventral plates; D: plates from tube feet; E: end plate from tube feet.*

Cucumariidae LUDWIG, 1894
Cucumaria BLAINVILLE, 1834
Cucumaria acuta n. sp.
(Figs 6-8)

DIAGNOSIS

Small cylindrical holothurian (10-20 mm long) with mouth and anus terminal. Tube feet in single row on radii. Ten tentacles, the two ventral ones smaller. Ossicles reduced or absent from adult body wall, except around anus. Ossicles from body wall and tentacles thick spiny perforated plates.

MATERIAL EXAMINED

Holotype: specimen labelled IG27718/EPOS3/291GSN14subs/13 caught by bottom trawl at 494 m the 19/02/89.

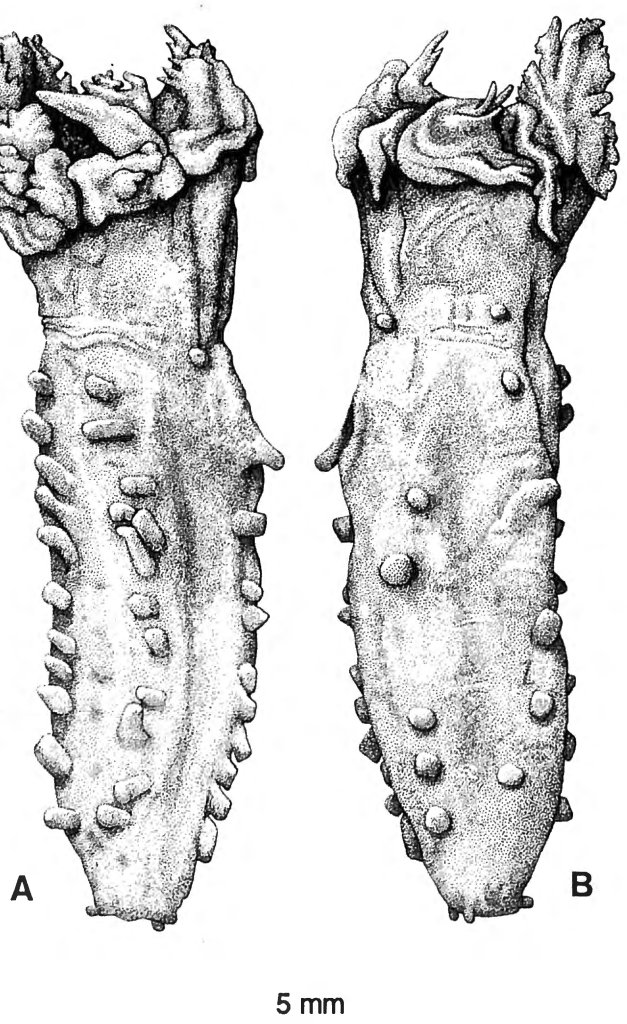


Fig. 6 – Cucumaria acuta *n. sp. A: ventral view; B: dorsal view.*

Type locality: Weddell Sea, 71°03,8'S-12°42,1'W.
Paratypes:
IG27718/EPOS3/290AGT24subs/7 (1 specimen), subs/11 (1 specimen) (71°05,9'S-12°34,0'W; 522 m; 19/02/89).
IG27718/EPOS3/291GSN14subs/25 (1 specimen, subs/39 (1 specimen), subs/44 (1 specimen), Subs/54 (2 specimens) (71°06,1'S-12°33,5'W; 494 m; 19/02/89).
IG27718/EPOS3/292MG21(4)/5 (1 specimen) (71°03,8'S-12°42,1'W; 561 m; 19/02/89).
Additional material: IG27718/EPOS3/249AGT10tot/6 (1 specimen) (74°36,2'S-29°42,5'W; 699 m; 04/02/89).

DESCRIPTION

Body cylindrical, slightly tapering posteriorly, mouth and anus terminal (fig. 6). Body length and width are listed in table 2. The skin is smooth in relaxed specimens. The tube feet are large and form a single row along each radius (fig. 6A). The introvert does not possess tube feet. For the largest specimens there are 11-13 feet in each row ventrally and 6-10 dorsally (fig. 6B). Smaller specimens (<10 mm) have fewer feet: 5-6 in each row ventrally (not countable dorsally). Ten tentacles, the two ventral tentacles smaller. In specimens longer than 10 mm, a well developed genital papilla is located dorsally in the tentacular crown. The anus is surrounded by five prominent papillae.

The calcareous ring lacks posterior processes. All the pieces of the calcareous ring are approximately the same height but the anterior processes of the radial pieces are three times larger than the anterior processes of the interradial pieces (fig. 7A).

Table 2
Cucumaria acuta n. sp. Body size (in mm), presence of the genital papilla (gen. pap.). L: length; W: width.

Specimens	L	W	Gen. pap.
291GSN14subs/44	4.6	2.0	–
291GSN14subs/54-1	5.0	2.1	–
292MG21(4)/5	7.6	5.6	–
291GSN14subs/39	7.7	4.2	–
291GSN14subs/54-2	8.7	3.6	–
249AGT10tot/6	10.7	5.6	+
290AGT24subs/11	11.2	4.6	+
291GSN14subs/25	15.0	6.0	+
291GSN14subs/13	15.9	4.6	+
290AGT24subs/7	18.4	6.2	+

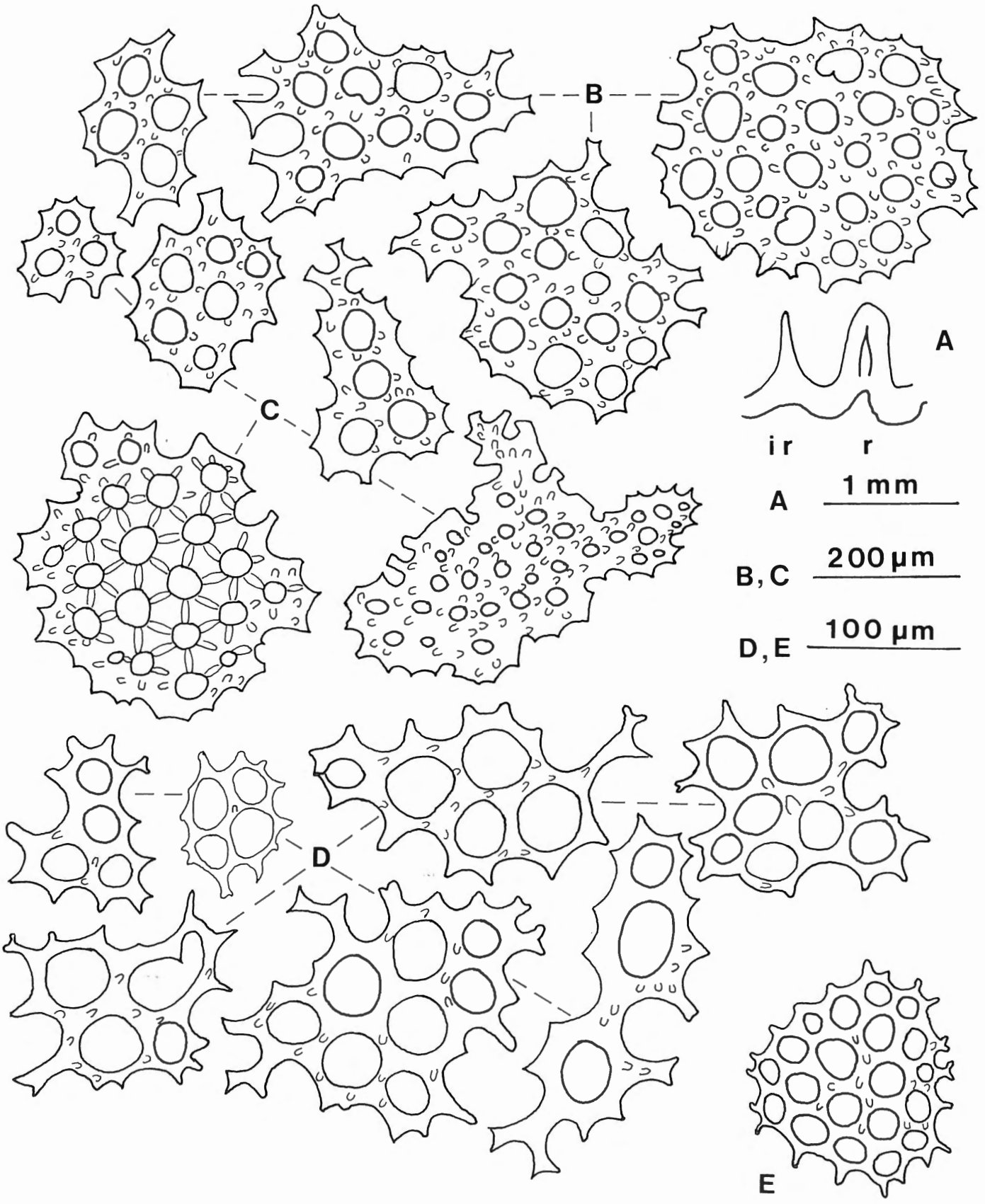


Fig. 7 – Cucumaria acuta *n. sp. A: calcareous ring (r: radial piece; ir: interradial piece); B: body wall perforated plates; C: anal perforated plates; D: ossicles from tube feet; E: end plate from tube feet.*

The body wall ossicles are large spiny perforated plates (100-400 µm in diameter) (fig. 7B). They are present only in the body wall of very young specimens (4-7 mm long). In larger specimens, they are absent, except around the anus, where the perforated plates are always very large and thick (fig. 7C).
On these plates, some spines fuse to form ridges between the holes (fig. 7C). In some small specimens, the peripheral holes of the perforated plates in the body wall are smaller (10-30 µm in diameter) than the central holes (50-80 µm in diameter).

The tube feet carry small, nearly smooth perforated plates (50-200 µm long) (fig. 7D). The end plates (fig. 7E) are 120-150 µm in diameter and slightly curved.
Two kinds of ossicles, which overlap slightly in shape, are present in the tentacles: large spiny perforated plates (200-400 µm long) which are elongate, triangular or oval (fig. 8A), and irregular small smooth perforated plates (70-180 µm) (fig. 8B). Both kinds are very often curved.

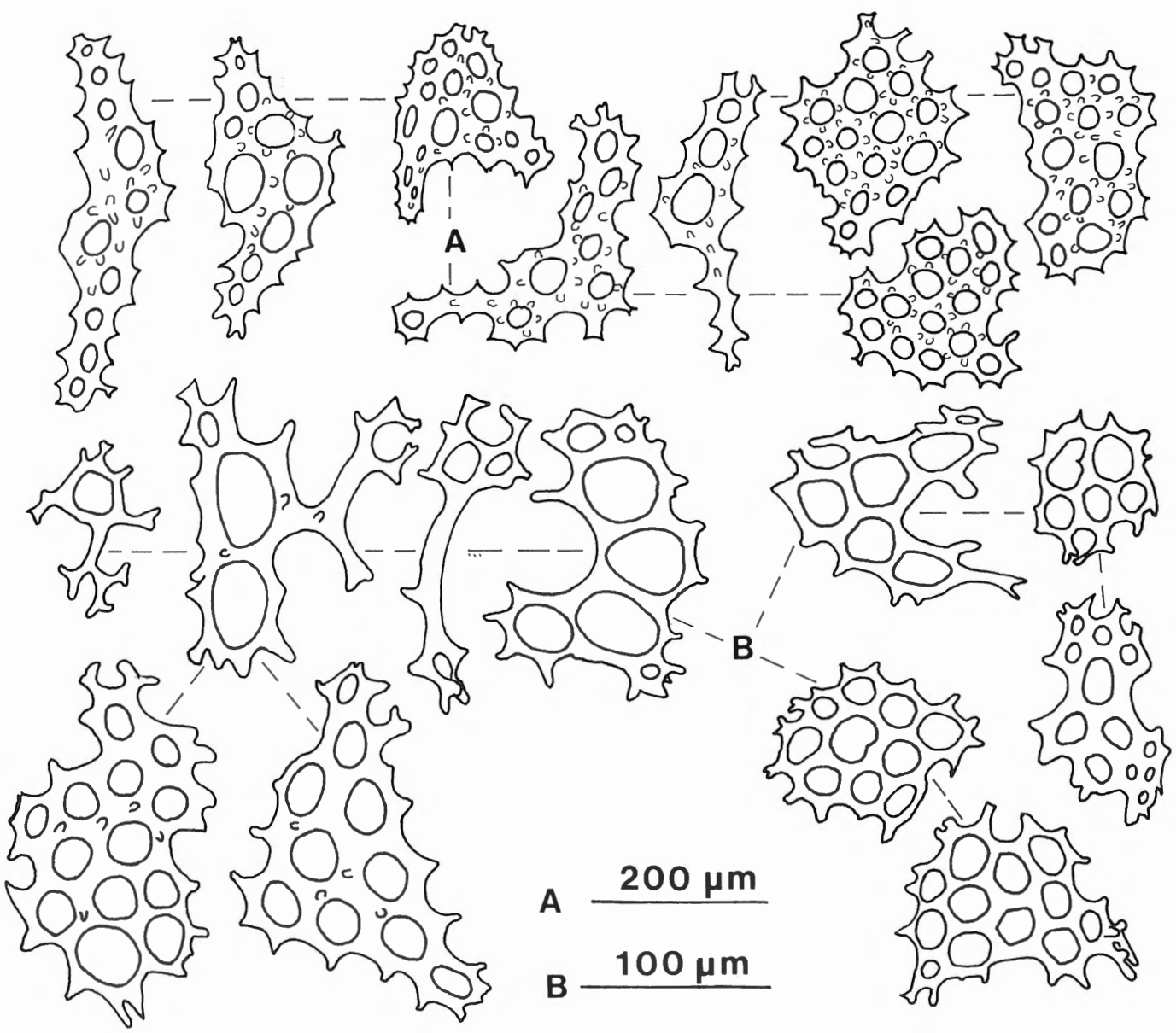


Fig. 8 – Cucumaria acuta *n. sp. Tentacular ossicles. A: large spiny perforated plates; B: small smooth perforated plates.*

DISCUSSION

The general anatomy and ossicle shape place *Cucumaria acuta* n. sp. in the *Cucumaria georgiana* group. This group was erected by GUTT (1988) to include small antarctic dendrochirote holothurians, with the tube feet on 1-3 rows in each ventral radius and more randomly scattered dorsally. Their ossicles, abundant in young specimens and often rare or absent in adults, are knobbed or spiny perforated plates, which show great variability. The taxonomical confusion of the *C. georgiana* group results from: 1. The presence of, at least, two different species in the type series in the Zoologischer Museum Hamburg (GUTT 1988, MASSIN personal observation); 2. The long list of synonyms published for *C. georgiana* by EKMAN (1927) but contested by other workers, e.g. CHERBONNIER (1948, 1974); 3. The great dissimilarity of the spicules between young and adult specimens. I include the following species in the *C. georgiana* group: *C. georgiana* LAMPERT, 1886, *C. acuta* n. sp., *C. analis* VANEY, 1908, *C. armata* VANEY, 1908, *C. attenuata* VANEY 1906, *C. joubini* VANEY, 1914, *C. lateralis* VANEY, 1906, *C. perfida* VANEY, 1908, *C. periprocta* VANEY, 1908, *C. secunda* VANEY, 1908, and *C. vaneyi* CHERBONNIER, 1948.
C. acuta n. sp. differs from all other species of the *C. georgiana* group in its perforated plates. *C. acuta* n. sp. has spiny perforated plates with strong spines at the edge and on the surface of the plates, whereas the other species have smooth or knobbed perforated plates.
The spicules of *C. acuta* n. sp. resemble those of *Cucumaria godeffroyi* SEMPER, 1868 from Chile. The species differ in the arrangement of their tube feet and in ossicle shape. *C. acuta* n. sp. possesses only one row of feet in each radius, whereas *C. godeffroyi* has two rows. The holotype of *C. godeffroyi* (35 mm long) has well developed ossicles in the body wall (PANNING 1955; personal observation). Specimens of *C. acuta* longer than 15 mm have no ossicles in the body wall. Moreover, *C. acuta* n. sp. has spiny perforated plates in the tentacles and no rods, while *C. godeffroyi* has smooth rods and no plates.
The appearance of the genital papilla (evidence of sexual maturity ?) coincides with the reduction of the ossicles in the body wall. There may be a correlation between these two phenomena.

Colochirinae PANNING, 1949
Trachythyone STUDER, 1876
Trachythyone maxima n. sp.
(Figs 9-12)

DIAGNOSIS

Large holothurian (174 mm) with a curved, cylindrical body, posteriorly tapering to a sharp point. Skin thin and rigid. Dorsal feet scattered randomly, ventral feet on double row in each radius. Feet in internal row of ventrolateral radii much more numerous than external row. Calcareous ring without posterior projections. Body wall ossicles large knobbed perforated plates, and small spiny baskets. Ossicles from tube feet and tentacles perforated plates.

MATERIAL EXAMINED

Holotype: specimen labelled IG27718/EPOS3/284GSN13RS/1 caught by bottom trawl at 402 m the 18/02/89.
Type locality: Weddell Sea, 71°12,0'S-13°14,0'W.

DESCRIPTION

The body is cylindrical (174 mm long), curved and posteriorly tapering to a sharp point (fig. 9A). The anterior, middle, and posterior diameter is 16, 10 and 3 mm respectively. The specimen is contracted, the introvert completely retracted. The body wall is particularly tough, the tube feet stiff and non-retractile.

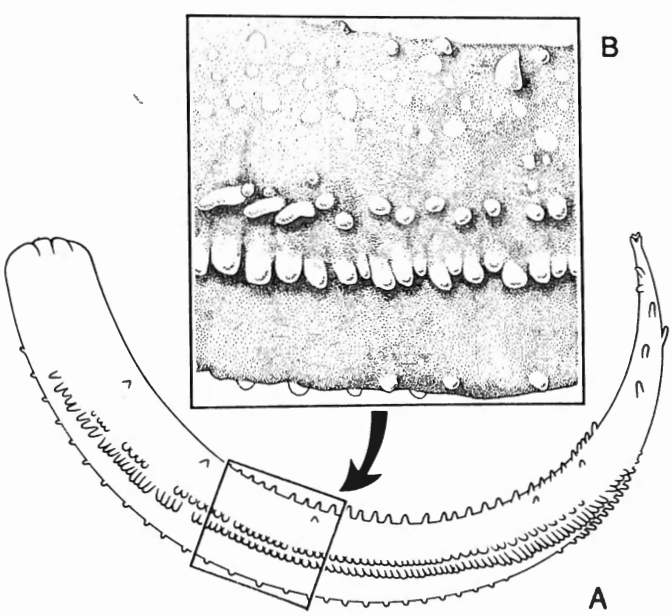


Fig. 9 – Trachythyone maxima *n. sp. A: general lateral view; B: ventrolateral radii with asymmetrical number of feet in internal and external rows.*

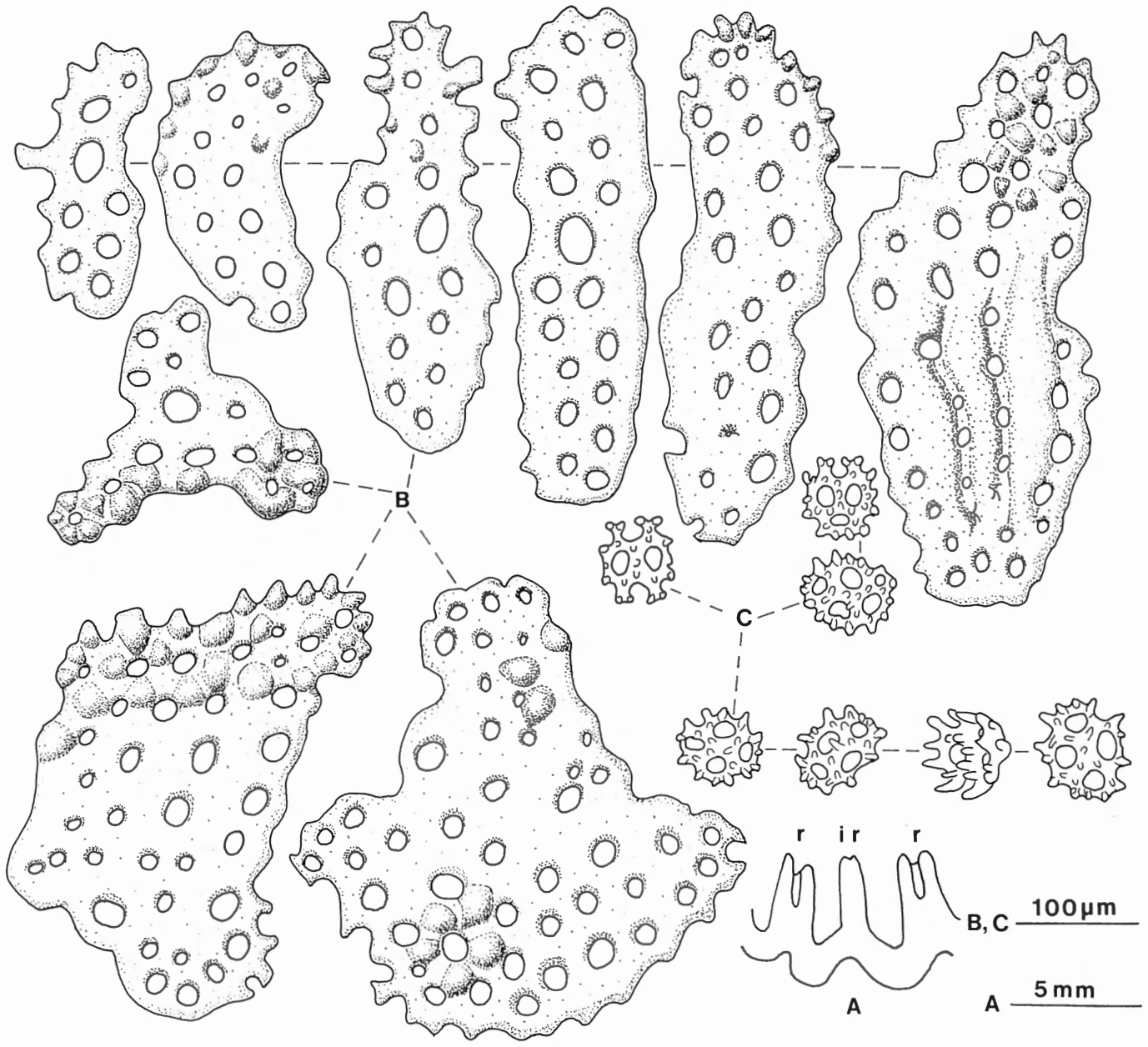


Fig. 10 – Trachythyone maxima *n. sp. A: calcareous ring (r: radial piece; ir: interradial piece); B: body wall perforated plates; C: body wall baskets.*

A double row of feet occupies each ventral radius. The midventral radius has 3-4 feet per cm in each row. The lateral radii have 5-6 feet per cm in the external row, and 7-10 feet per cm in the internal row (fig. 9B). In the two dorsal radii, the feet are more or less scattered, and no rows can be distinguished (fig. 9B).

The calcareous ring lacks posterior projections. The anterior projections of the radial and interradial pieces are of approximately the same length, but the projections of the radial pieces are twice as wide as those of the interradial pieces (fig. 10A).

Two significantly different kinds of ossicles are present in the body wall: large, knobbed perforated plates and spiny baskets. The perforated plates are densely packed in 1-3 layers and stiffen the body wall. They are elongate, triangular, sometimes square or rounded (fig. 10B). Approximately 30% of the elongate plates have a small hand-like structure at one extremity (fig. 10B). The length of the knobbed plates varies from 240 to 460 µm. The baskets form the outermost layer of ossicles. They are very abundant, 60-70 µm in diameter with four holes and numerous strong spines all over their surface (fig. 10C).

Three significantly different kinds of ossicles are present in the tube feet. a) Large (160-300 µm long), knobbed perforated plates (fig. 11A). In most of the plates, the knobs are present on only one side, or at one extremity of the plates. b) Spiny baskets (fig. 11B) similar to the baskets of the body wall. c) Perforated plates with large central holes and small peripheral holes. The latter plates are slightly curved and sometimes spiny (fig. 11C)

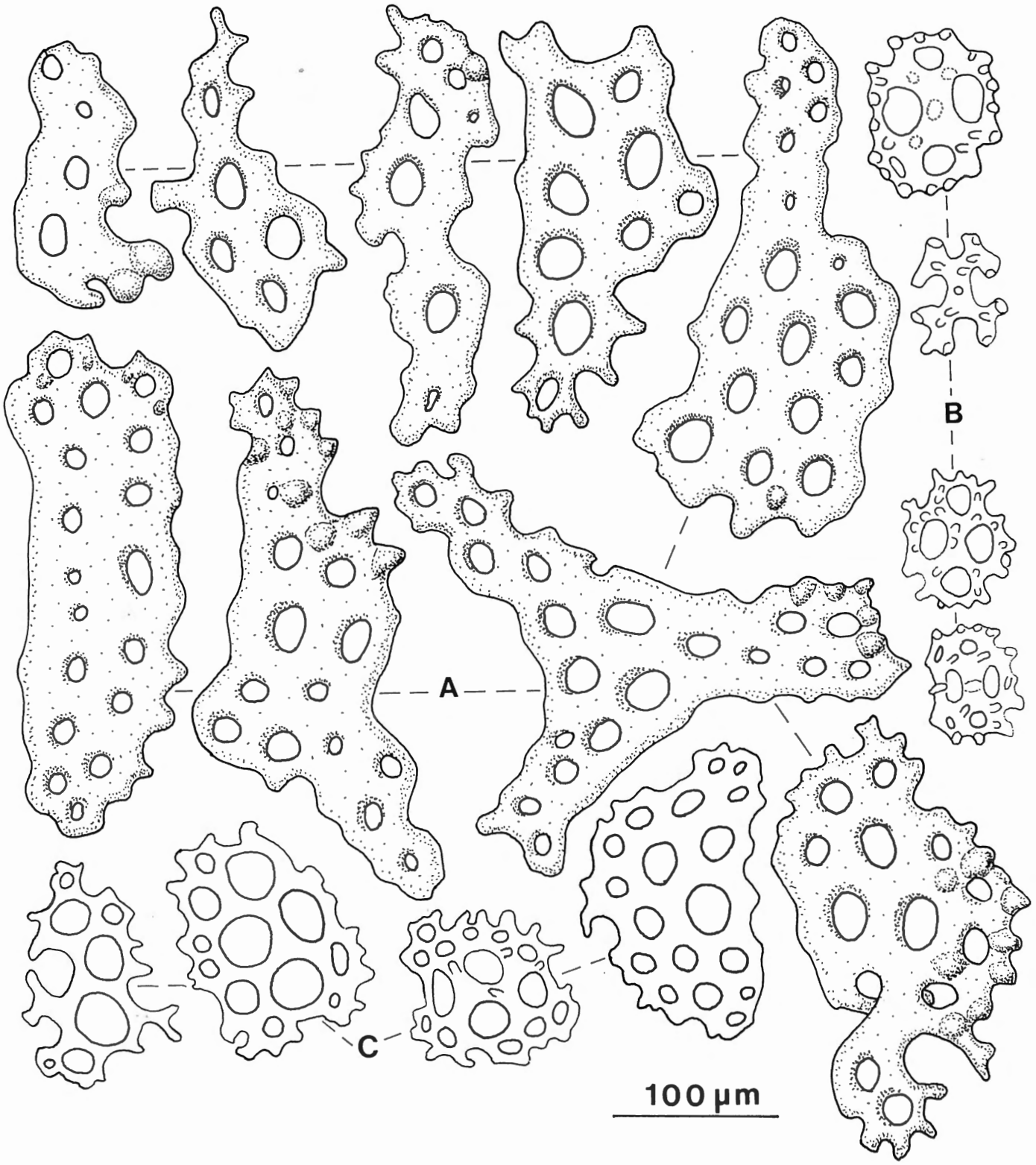


Fig. 11 – Trachythyone maxima *n. sp. Ossicles from tube feet A: large knobbed plates; B: baskets; C: small perforated plates.*

Three kinds of ossicles are present in the tentacles. a) At the base of the tentacles, spiny elongated plates (360-530 µm long) with large holes (30-100 µm in diameter) (fig. 12A). Similar ossicles are in the introvert. Occasionally, these spiny elongated plates are rod-like (fig. 12A). b) Irregular spiny plates (150-300 µm long) (fig. 12B) with large holes (30-50 µm in diameter). This category of ossicles overlaps in shape with the category "a". c) Irregular spiny plates (100-170 µm long) with large central holes (20-40 µm in diameter) and small peripheral holes (5-15 µm in diameter) (fig. 12C). Most of these plates are slightly curved.

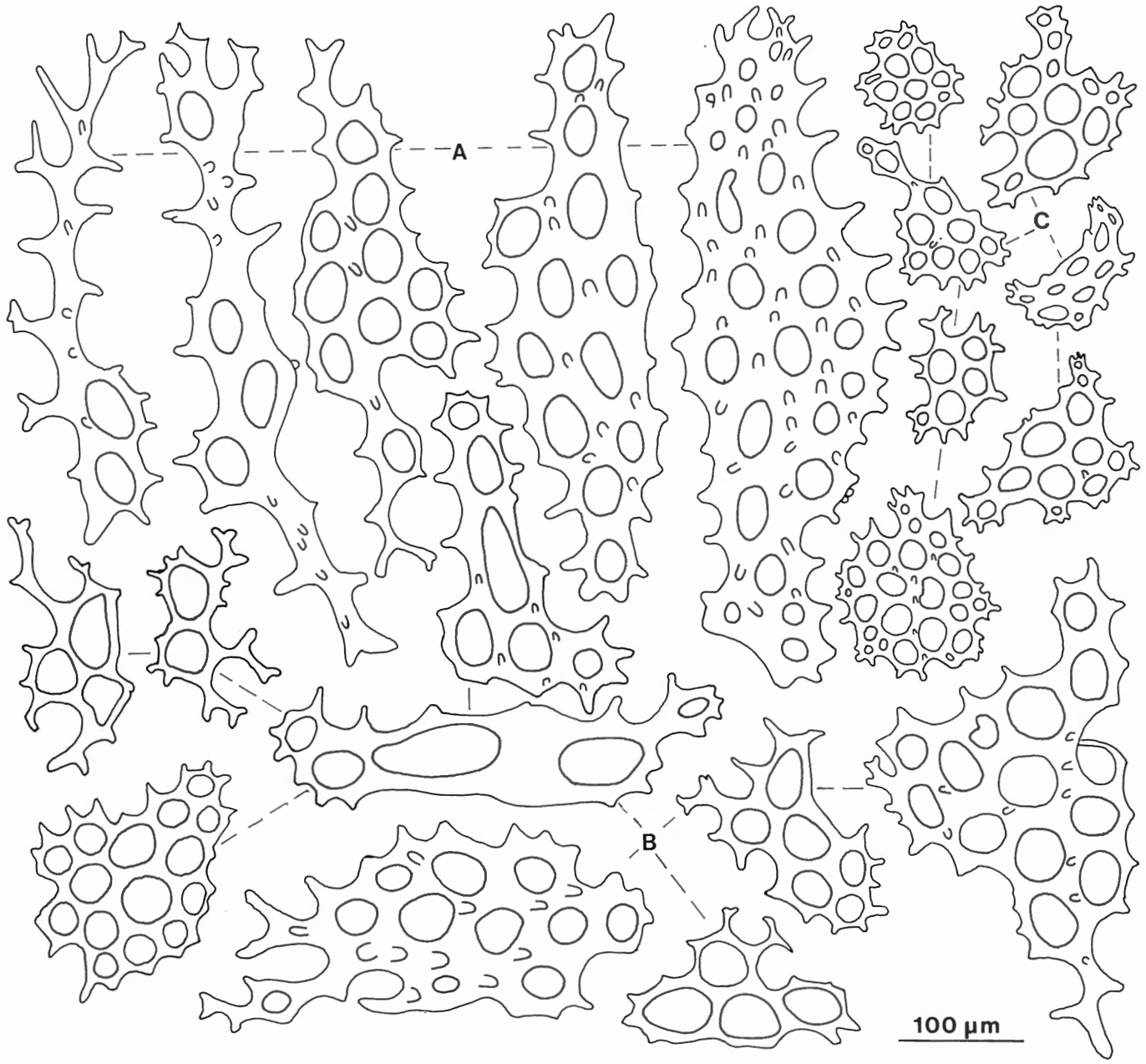


Fig. 12 – Trachythyone maxima *n. sp. Tentacular ossicles. A: spiny elongated plates; B: irregular spiny plates; C: small irregular spiny plates with small peripheral holes.*

DISCUSSION

The calcareous ring and the double layer of ossicles (outer layer of baskets and inner layer of large, perforated plates) are characteristic of the genus *Trachythyone* STUDER, 1876. Eleven species of *Trachythyone* are described from antarctic and subantarctic waters, namely: *Trachythyone amokurae* (MORTENSEN, 1925), *T. baja* HERNANDEZ, 1987, *T. bollonsi* (MORTENSEN, 1925), *T. bouvetensis* (LUDWIG & HEDING, 1935), *T. ekmani* (LUDWIG & HEDING, 1935), *T. lechleri* (LAMPERT, 1885), *T. macphersonae* PAWSON, 1962, *T. muricata* STUDER, 1876, *T. parva* (LUDWIG, 1875), *T. peruana* (SEMPER, 1868) and *T. squamata* (LUDWIG, 1898).

T. maxima n. sp. (174 mm long, strong spiny baskets) is easily distinguished from *T. amokurae, T. bollonsi, T. ekmani, T. parva,* and *T. peruana* as all of these reach a maximum length of only 35 mm and have reduced or smooth knobbed baskets (MORTENSEN 1925, LUDWIG & HEDING 1935, PANNING 1964, HERNANDEZ 1982).

T. maxima n. sp. (large perforated plates 240-460 µm long with numerous holes) is also different from *T. macphersonae* and *T. lechleri*, mainly because the two latter species have small perforated plates (150-200 µm long) with few or no holes (LAMPERT 1885, PAWSON 1962, HERNANDEZ 1982).

T. maxima n. sp. is closely related to *T. baja, T. bouvetensis, T. muricata* and *T. squamata*. Unlike *T. maxima* n. sp., *T. baja, T. muricata,* and *T. squamata* possess rods in the tentacles and/or in the tube feet

(LUDWIG 1898, LUDWIG & HEDING 1935, HERNANDEZ 1987). The baskets of *T. maxima* n. sp. are unique in having strong spines on the edge, and on the primary cross, whereas *T. bouvetensis* possesses strong spines on only the edges of the baskets (LUDWIG & HEDING 1935, MASSIN personal observation).
T. maxima n. sp. is immediately recognised by the very characteristic distribution of the feet. The strong asymmetry between the midventral radius and the ventrolateral radii, and the asymmetry between the internal and the external row of feet in the ventrolateral radii have never been reported in any other species of *Trachythyone* from antarctic or subantarctic waters.

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References

ARNTZ, W., ERNST, W. & HEMPEL, I. 1990. The expedition ANTARKTIS VII/4 (EPOS leg 3) and VII/5 of RV "Polarstern" in 1989. *Berichte zur Polarforschung,* 68: 1-214.

CHERBONNIER, G. 1948. Une nouvelle holothurie incubatrice de l'antarctique chilien: *Cucumaria vaneyi* n. sp. *Revista de Biologia Marina,* 1 (3): 229-232 + 2 pls.

CHERBONNIER, G. 1974. Invertébrés marins des XIIème et XVème expéditions antarctiques françaises en Terre Adélie. 15. Holothurides. *Tethys,* 5 (4): 601-610.

EKMAN, S. 1927. Holothurien. *Deutsche Südpolar-Expedition XIX. Zoologie,* XI: 359-419.

GUTT, J. 1988. Zur Verbreitung und Okologie der Seegurken (Holothuroidea, Echinodermata) im Weddellmeer (Antarktis). *Berichte zur Polarforschung,* 41: 1-87.

GUTT, J. 1990a. New Antarctic holothurians (Echinodermata)-I. Five new species with four new genera of the order Dendrochirotida. *Zoologica Scripta,* 19 (1): 101-117.

GUTT, J. 1990b. New Antarctic holothurians (Echinodermata)-II. Four new species of the orders Aspidochirotida, Elasipodida and Apodida. *Zoologica Scripta,* 19 (1): 119-127.

GUTT, J. 1991. On the distribution and ecology of holothurians in the Wedell Sea (Antarctica). *Polar Biology,* 11 (3): 145-155.

GUTT, J. & PIEPENBURG, D. 1991. Dense aggregations of three deep-sea holothurians in the southern Weddell Sea, Antarctica. *Marine Ecology Progress Series,* 68 (3): 277-285.

HERNANDEZ, D.A. 1982. Holothuroidea des Südwestatlantiks I. Die Trachythyone-Arten. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut,* 79: 251-261.

HERNANDEZ, D.A. 1987. *Trachythyone baja* sp. n., a new species from Antarctic waters (Echinodermata: Holothurioidea). *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut,* 84: 161-165.

LAMPERT, K. 1885. Die Seewalzen (Holothurioidea). *SEMPER Reisen im Archipel der Philippinen,* (2) 4 (3): 1-312 +
1 pl.

LUDWIG, H. 1875. Beiträge zur Kenntnis der Holothurien. *Arbeiten aus dem Zoologisch-zootomischen Institut in Würzburg,* 2 (2): 77-118 + 2 pls.

LUDWIG, H. 1898. Holothurien. Ergebnisse der Hamburger Magalhaenischen Sammelreise 1892/1893, I Band. L. FRIEDERICHSEN, Hamburg, 98 pp + 3 pls.

LUDWIG, H. & HEDING, S. 1935. Die Holothurien der Deutschen Tiefsee Expedition I. Fusslose und dendrochiroten Formen. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899,* XXIV (2): 123-214 + 2 pls.

MORTENSEN, Th. 1925. The echinoderms of New Zealand and Auckland-Campbell Islands. Part IV. Holothuroidea. *Videnskabelige Meddelelser fra Dansk naturhistorisk Forening i Kobenhavn,* 79: 322-386.

PANNING. A. 1955. Bemerkungen über die Holothurien. Familie Cucumariidae (Ordnung Dendrochirotida). 1. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut,* 52: 33-47.

PANNING, A. 1964. Bemerkungen über der Holothurien-Familie Cucumariidae (Ordnung Dendrochirotida). 4. Die Gattungen *Stereoderma, Staurothyone,* und *Trachythyone. Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut,* 61: 159-174.

PAWSON, D.L. 1962. A New Sea Cucumber from MacQuarie Island. *Transactions of the Royal Society of New Zealand,* 2 (7): 47-48.

SEMPER, C. 1868. Reisen im Archipel der Philippinen. II. Wissenschaftliche Resultate 1, Holothurien. Leipzig, X + 288 pp + 40 pls.

STUDER, T. 1876. Uber Echinodermen aus dem antarktischen Meere und zwei neue Seeigel von den Papua-Inseln, gesammelt auf der Reise S.M.S. "Gazelle" um die Erde. *Monatsberichte der Kgl. preussischen Akadademie der Wissenschaften zu Berlin,* 1876: 452-465.

VANEY, C. 1906. Expédition antarctique française (1902-1903). Sciences naturelles: Documents scientifiques. Holothuries. Masson & Cie, Paris, 3O pp + 2 pls

VANEY, C. 1908. Les holothuries recueillies par l'Expédition antarctique écossaises. *Zoologische Anzeiger,* 33 (10): 290-299.

VANEY, C. 1914. Deuxième Expédition antarctique française (1908-1910). Sciences naturelles: Documents scientifiques. Holothuries. Masson & Cie, Paris, 54 pp + 5 pls

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