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94(2), 1981, pp. 391-403WESTERN ATLANTIC SEA CUCUMBERS OF THE
GENUS *THYONE*, WITH DESCRIPTION OF TWO
NEW SPECIES (ECHINODERMATA: HOLOTHUROIDEA)

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Abstract.—Current status of each of the several Western Atlantic holothurians referred to the genus *Thyone* s.l. is discussed. Two new species, *Thyone adinopoda* and *T. crassidisca*, from the southeastern United States are described.

Dendrochirotid holothurians of the genus *Thyone* s.l. are burrowing, U-shaped forms with tube feet scattered over the body wall and not restricted to the ambulacral radii. They usually occur in muddy to sandy habitats, and range from the subtidal zone to depths in excess of 200 meters. Systematic study of "Thyone" species is rendered difficult because in many species the diagnostic characters may change with growth, and in many the calcareous ossicles of the body wall tend to disappear with growth.

Thyone currently comprises a miscellany of approximately 40 species. Of the 14 Western Atlantic species referred to *Thyone* by Deichmann (1930), only 2 remain in that genus today. The other species are now scattered among several genera in 2 dendrochirotid subfamilies. Panning (1949, and later papers) has been largely responsible for the reassignment of these species. In her later papers, Deichmann (1954, 1957, 1963) ignored Panning's revision of the Cucumariidae, and attempted some revisions independently, thus further confusing an already complex situation.

In this paper we attempt to bring up-to-date the nomenclature of the Western Atlantic "Thyones" by listing the currently accepted names for all species. In addition, in the course of a monographic study of Western Atlantic holothurians, we have found two new species of *Thyone* s.s., and the opportunity is taken to describe these here.

Type-material is deposited at the National Museum of Natural History, Smithsonian Institution (USNM), the Indian River Coastal Zone Museum, Harbor Branch Foundation-Smithsonian Institution, Fort Pierce, Florida (IRCZM), and the Florida Department of Natural Resources, St. Petersburg, Florida (FSBC). This paper is Harbor Branch Foundation, Inc. Contribution to Science No. 199. Financial support for this study was received from the Harbor Branch Foundation, Inc. and from the Smithsonian Institution Fort Pierce Bureau.

We thank Dr. Thomas S. Hopkins for allowing one of us (DLP) to study

holothurians collected under the auspices of the U.S. Bureau of Land Management, and the Florida Department of Natural Resources for giving us access to holothurians collected by the "Hourglass" Cruises and other investigations in the Gulf of Mexico.

Current Concept of the Genus *Thyone*

When Panning (1949:468) transferred species from *Havelockia* sensu Panning, 1949 to *Thyone* sensu Panning, 1949, he suggested that *Thyone* includes 2 groups of species; Group I comprising those species with tables but no rosettes in the introvert, and Group II comprising species with rosettes but no tables in the introvert. At least 3 Western Atlantic species, *pseudofusus* Deichmann, *inermis* Heller, and *crassidisca* n. sp. fall into yet another category, a Group III, where the introvert contains rosettes and tables.

A thorough revision of the "supergenous" *Thyone* is urgently needed, but is beyond the scope of this paper. While some species are well-defined, others appear to change greatly with growth, so that adults and young specimens may be referred to different species. Deichmann (1947) tended to dismiss Madsen's (1941) careful analysis of *T. fusus*, and his descriptions of new taxa. While Madsen's new species might not be valid, his detailed descriptions are excellent, and should form a model upon which a thorough revision of *Thyone* can be based.

Western Atlantic "Thyone" Species Listed or Described by Deichmann (1930, 1946)

Thyone briareus (Lesueur, 1824). Panning (1949) transferred this species to *Sclerodactyla*.

Thyone scabra Verrill, 1873. Panning (1949) transferred this species to *Havelockia*.

Thyone fusus (Müller, 1776). Deichmann (1930) described specimens of *Thyone* which she found to be very closely similar to *T. fusus* (Müller) from Northern Europe. In later papers, Deichmann (1946, 1947, 1954) concluded that the West Indian "fusos" and the Mediterranean "fusos" were identical, and that they differed in some respects from the typical northern European *T. fusus* (Müller). Deichmann applied the name *T. inermis* Heller to the Mediterranean-W. Atlantic species, and this name is accepted here.

Thyone pseudofusus Deichmann, 1930. Unchanged.

Thyone belli Ludwig, 1887. Panning (1949) transferred this species to *Pseudothyone*. Deichmann (1954) referred it to her (1941) genus *Neothyone*. Panning's action appears to be the more logical.

Thyone micropunctata Sluiter, 1910. Deichmann (1954) showed that this species is a junior subjective synonym of *Thyone belli* Ludwig, 1887.

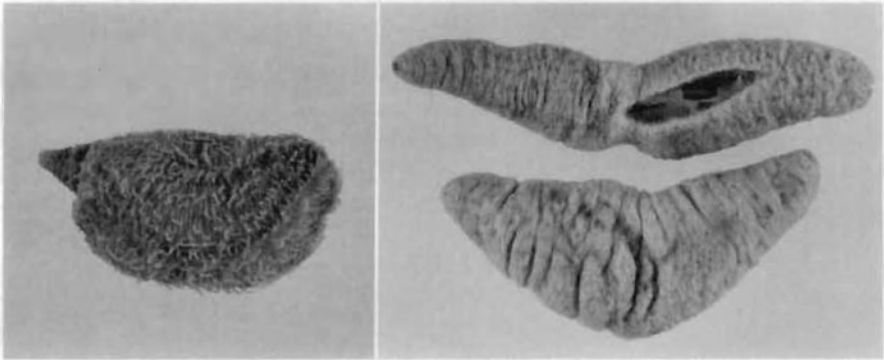


Fig. 1. Left, *Thyone adinopoda*, holotype, total length 26 mm; Right, *Thyone crassidisca*: upper, holotype, total length 51 mm; lower, paratype, total length 40 mm.

Thyone cognata (Lampert, 1885). Deichmann (1930) misspelled the species name as *cognita*. Referred to *Stolus* by Panning (1949). Referred unnecessarily to a new genus *Thyoneria* by Deichmann (1954). We prefer to accept the combination *Stolus cognatus*.

Thyone solida Deichmann, 1930. Referred to *Ludwigia* by Panning (1949). Mortensen (1925) and Pawson (1963) pointed out that *Ludwigia* is preoccupied, and is thus not available as a genus-name. Deichmann (1954) proposed *Euthyonacta* for this species, and we accept the combination *Euthyonacta solida*.

Thyone unisemita (Stimpson, 1851). Referred to *Stereoderma* by Panning (1949).

Thyone suspecta Ludwig, 1874. Referred to *Ocnus* herein. Panning (1949) had placed this species in his genus *Ludwigia* (see above).

Thyone surinamensis Semper, 1868. Referred to *Ocnus* by Panning (1949). Named as the type of a new genus *Parathyone* by Deichmann (1957). We accept the combination *Ocnus surinamensis*.

Thyone pervicax Theel, 1886. Referred to the preoccupied genus *Ludwigia* by Panning (1949). Referred to *Thyonella* by Deichmann (1954).

Thyone sabanillaensis Deichmann, 1930. In subsequent publications, Deichmann (1941, 1954) and Panning (1949) misspelled the species-name as *sabanillensis*. Referred to *Thyonacta* by Deichmann (1941) and by Panning (1949), then transferred to *Thyonella* by Deichmann (1954). We accept the combination *Thyonella sabanillaensis*.

Thyone gemmata (Pourtales, 1851). Referred to the preoccupied genus *Ludwigia* by Panning (1949), and to *Thyonella* by Deichmann (1954).

Thyone mexicana Deichmann, 1946. Referred herein to *Allothyone* Panning, 1949.

Genus *Thyone* Jaeger, 1833

Thyone Oken, 1815. (Oken's Lehrbuch der Naturgeschichte 1815–1816 was placed on the Official Index of Rejected Works by the International Commission on Zoological Nomenclature [Opinion 417, 1956]. As far as we can determine, Jaeger [1833:8] was the first to validate the genus-name *Thyone* in accordance with the requirements of the International Code of Zoological Nomenclature.)

Type-species.—*Holothuria fusus* Müller, 1776, by original designation of Jaeger, 1833.

Diagnosis.—Tentacles 10. Tube feet scattered on body wall, never restricted to ambulacral radii. Calcareous ring with long posterior projections, each made up of several pieces of calcite. Body wall ossicles tables with a spire of 2 pillars. Introvert may contain rosettes only, tables only, or tables and rosettes.

Remarks.—At the time of writing this paper, 3 species of *Thyone* were known from the Western Atlantic. They are *T. inermis* Heller, *T. pseudofusus* Deichmann, and *T. pawsoni* Tommasi. As *T. pawsoni* was described only briefly, illustrations of the calcareous ring and of ossicles from the introvert are given here (Fig. 2D, 2E). In this paper 2 further *Thyone* species are described.

Key to Western Atlantic Species of *Thyone* s.s.

1. Body wall tables with oval disc, 4 perforations and thick margins 2
 - Body wall tables mostly irregular in outline, perforations few to numerous, margin thin 4
2. Spires of body wall tables terminate in several short teeth 3
 - Spires of body wall tables terminate in a single blunt spine *Thyone crassidisca*, new species
3. Body wall tables with low, truncate spire. Ossicles in introvert tables and rosettes *Thyone pseudofusus* Deichmann, 1930
 - Body wall tables with high tapering spire. Ossicles in introvert rosettes only *Thyone adinopoda*, new species
4. Disc of body wall tables with 4–9 perforations. Spire of supporting tables in tube feet abruptly tapering ... *Thyone pawsoni* Tommasi, 1972
 - Disc of some body wall tables with 8–18 perforations. Spire of supporting tables in tube feet gently tapering ... *Thyone inermis* Heller, 1868

Thyone inermis (Heller)

Thyone inermis Heller, 1868:78.—Deichmann, 1946:3; 1947:87, pl. 1 figs. 7–13, pl. 2; 1954:397.—Panning, 1949:468.

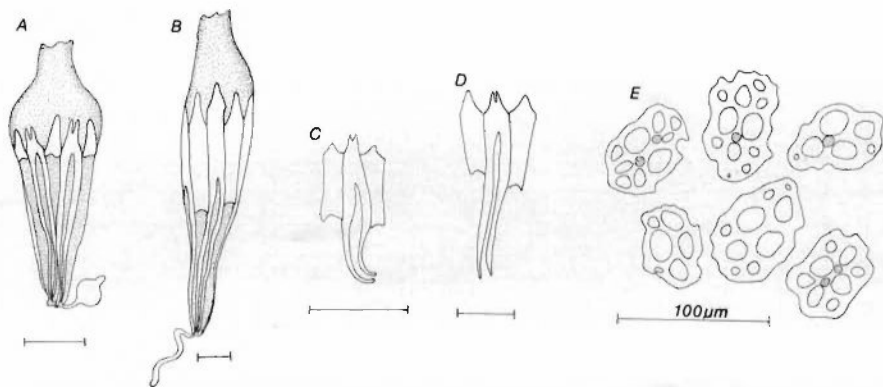


Fig. 2. A–D, calcareous rings of some species of *Thyone*. Scale line for all figures = 2 mm. A, *T. adinopoda*, radial and interradial pieces and single polian vesicle; B, *T. crassidisca*, radial and interradial pieces and single polian vesicle; C, *T. pseudofusus*, two interradial pieces and one radial; D, *T. pawsoni*, two interradial pieces and one radial; E, *T. pawsoni*, rudimentary tables from introvert.

Thyone fusus: Deichmann, 1930:167, pl. 14 figs. 1–5.—Domantay, 1958:196.
Thyone deichmannae Madsen, 1941:26.
Havelockia inermis: Panning, 1949:466.
 Not: *Thyone fusus* (Müller, 1776).

Diagnosis.—Two ventral tentacles smaller than others. Interradial pieces of calcareous ring moderately long, extending posteriorly beyond union of tails of radial pieces. Body wall tables with thin margins and 4 perforations, although some have 8 or more. Spires of supporting tables in tube feet gently tapering. Introvert with tables and rosettes.

Remarks.—Deichmann either overlooked or ignored Madsen's new species *Thyone deichmannae*, a name he applied to the W. Atlantic material described as *T. fusus* by Deichmann in 1930. If future research determines that the Western Atlantic *Thyone* should be referred to a different species, *T. deichmannae* Madsen is available. In the Western Atlantic, reported from Tobago, British West Indies, and Florida (Deichmann, 1954).

Thyone pseudofusus Deichmann

Fig. 2C

Thyone pseudofusus Deichmann, 1930:168, pl. 14 figs. 6–9.—Clark, 1933:114.—Deichmann, 1941:107; 1946:4.—Panning, 1949:467.—Deichmann, 1954:395.—Domantay, 1958:197.—Tommasi, 1969:12, fig. 14.

Diagnosis.—Two ventral tentacles smaller than others. Interradial pieces

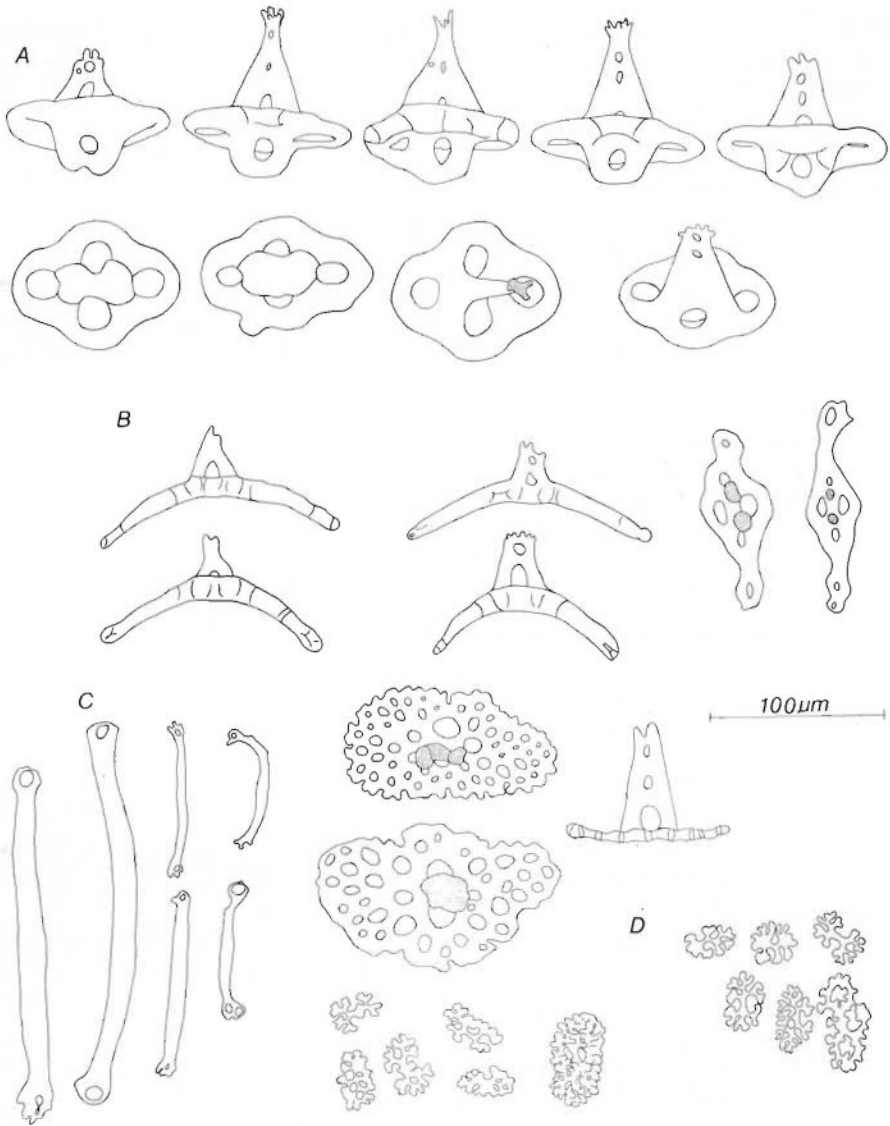


Fig. 3. *Thyone adinopoda*, ossicles. A, Tables from body wall; B, Tables from tube feet; C, Rods, rosettes and tables from tentacles; D, Rosettes from introvert.

of calcareous ring long, extending posteriorly well beyond union of tails of radial pieces. Body wall tables with 4 perforations, thick margins, and low truncate spire. Introvert with tables and rosettes.

Remarks.—The type-material was from Yucatan, in 45 meters depth.

Deichmann (1930) also noted that the species occurred in Tobago, British West Indies and in Florida. Tommasi reported *T. pseudofusus* from São Paulo, Brazil.

Table 1.—Average dimensions of tables from body wall and tube feet of *Thyone adinopoda*. n = 15. \bar{x} , mean; SD, standard deviation; SE, standard error.

Total length of specimen	Tables from body wall					
	Height of table			Length of table		
	\bar{x} (μm)	SD	SE	\bar{x} (μm)	SD	SE
16 mm	82.45	11.08	2.86	98.36	8.43	2.18
22 mm	77.65	6.63	1.71	90.45	5.83	1.51
25 mm	78.05	5.46	1.41	85.51	8.25	2.13
26 mm	80.25	9.69	2.50	88.59	9.59	2.48
39 mm	78.05	8.19	2.11	93.86	10.69	2.76
				Supporting tables from tube feet		
16 mm	62.70	8.58	2.22	119.73	9.04	2.33
22 mm	64.48	7.57	1.95	129.83	9.80	2.53
25 mm	64.02	10.69	2.76	107.45	10.44	2.70
26 mm	65.35	10.41	2.69	130.27	12.26	3.16
39 mm	60.08	6.58	1.68	117.53	8.93	2.31

Thyone pawsoni Tommasi

Fig. 2D, 2E

Thyone pawsoni Tommasi, 1972:19, figs. 12–15.

Diagnosis.—Two ventral tentacles smaller than others. Interradial pieces of calcareous ring large, extending posteriorly well beyond union of tails of radial pieces. Body wall tables with 4–9 perforations and thin margins. Spire of supporting tables in tube feet abruptly tapering. Introvert with tables; no rosettes.

Remarks.—The species was originally described from off the Gulf of Venezuela. Miller and Pawson (in preparation) describe material from off Georgia and off eastern and western Florida in 24–50 meters.

Thyone adinopoda, new species

Figs. 1, 2A, 3

Diagnosis.—Two ventral tentacles smaller than others. Interradial pieces of calcareous ring short, scarcely extending posteriorly beyond union of tails of radial pieces. Tables in body wall with oval disc, 4 perforations, thick margins and high tapering spires terminating in several short teeth. Ossicles in introvert rosettes only.

Etymology.—Species name derived from Greek, adinos = crowded, pous = foot, in reference to the numerous crowded tube feet on body wall.

Material examined.—Holotype USNM E21111, total length 26 mm, U.S. Bureau of Land Management, Sta. 13-45-VI-C(C-13), 19 July 1975, 29°30'45"N, 87°24'15"W, 63 meters. Paratypes: USNM E21112, 6 specimens, total lengths 12, 16, 18, 22, 25, 39 mm, same locality data as holotype; IRCZM 71:116, 2 specimens, total lengths 18, 22 mm, same locality data as holotype.

Description.—Body stout, more or less U-shaped, narrowing abruptly posteriorly to form a tail. Body wall thin but moderately stiff due to numerous ossicles. Tube feet numerous, apparently not completely retractile, in double rows anteriorly and posteriorly and scattered in radii and interradii elsewhere. Feet much more numerous in ventral interradii than in dorsal interradii.

Body wall and tentacles dirty white to light brown in alcohol. Tentacles 10, 2 ventral smaller than others. Calcareous ring tubular (Fig. 2); radials with very long posterior projections, each made up of numerous individual pieces of calcite. Interradials triangular, short, scarcely extending posteriorly beyond union of radial tails. Interradials rounded anteriorly, radials with anterior notch for insertion of retractor muscles. One Polian vesicle.

Body wall ossicles include tables, 60–90 μm high (from bottom of half-ring to top of spire), average 78 μm , and 72–118 μm long, average 91 μm . Disc oblong, swollen medially, with smooth thick margin and 4 equal-sized perforations. Occasionally 1–4 accessory perforations present. Spire composed of 2 strong pillars joined approximately $\frac{1}{3}$ the way up their length and tapering to a blunt tip, armed with 2–7 short teeth. Opposite spire (on the inner part of disc), projects a distinct handle or half-ring with a large central perforation. Introvert with numerous rosettes 30–100 μm long, average 60 μm .

Tube feet with numerous supporting tables 50–85 μm high, average 63 μm and 92–158 μm long, average 120 μm . Disc elongate, strongly curved, with 4 central perforations and usually a single perforation at each end. Spire composed of 2 strong pillars, tapering to end in 0–6 small teeth. End plate well developed with several concentric rings of perforations, which increase in size from center of plate outwards.

Tentacles with numerous slender rods, rosettes and large tables. Rods 138–270 μm long, straight to slightly curved, with single perforation at each end. Tables (average 150 μm long by 80 μm wide) with flat disc, serrate margin and numerous perforations.

Remarks.—*Thyone adinopoda* shares with *T. crassidisca*, *T. pawsoni*, and *T. pseudofusus* the presence of handles or half-rings on tables from the body wall. Unlike *T. pseudofusus* and *T. crassidisca*, *T. adinopoda* has tables with a relatively thin disc, the spire is taller and gently tapering, and

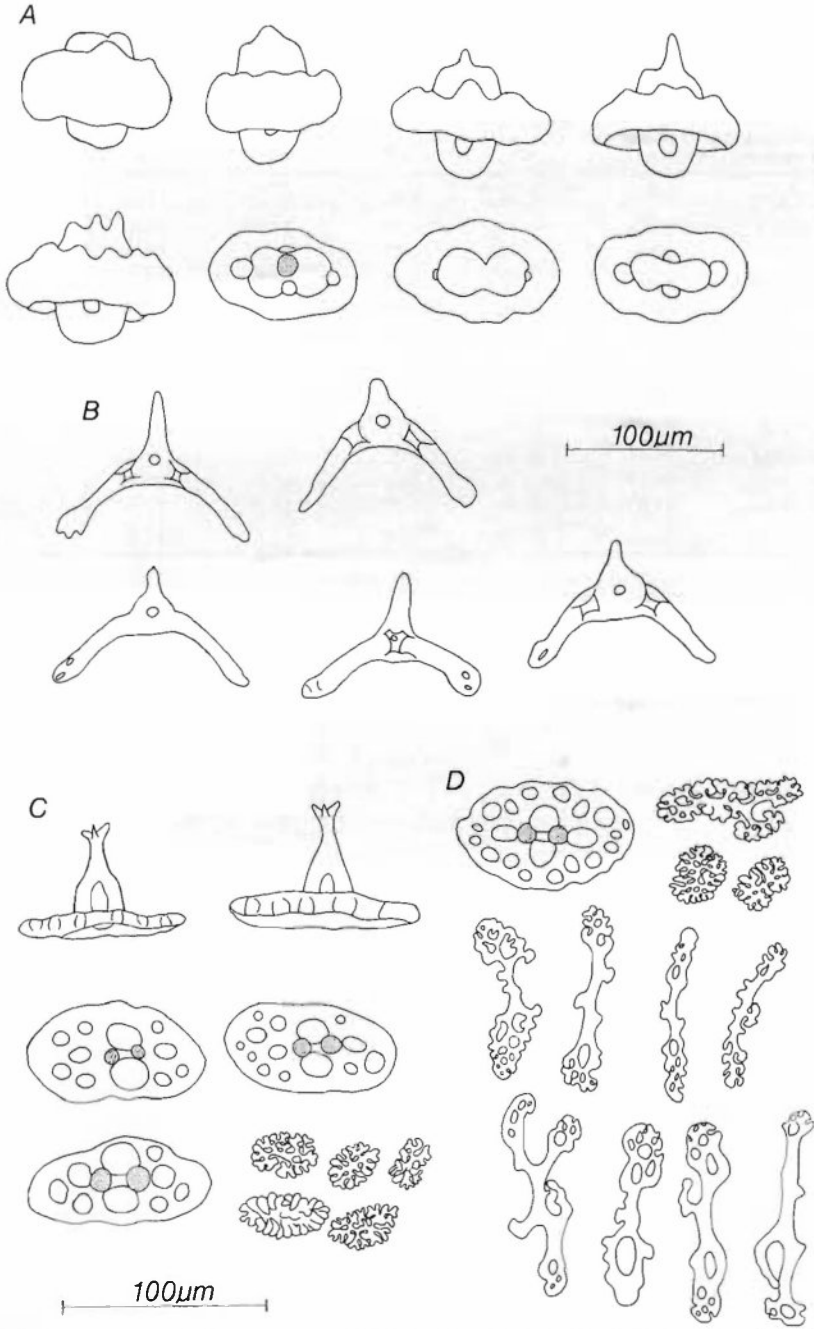


Fig. 4. *Thyone crassidisca*, ossicles. A, Tables from body wall; B, Tables from tube feet; C, Tables and rosettes from introvert; D, Table, rosettes and rods from tentacles.

Table 2.—Average dimensions of tables from body wall and tube feet of *Thyone crassidisca*. $n = 15$. \bar{x} , mean; SD, standard deviation; SE, standard error.

Total length of specimen	Tables from body wall					
	Height of table			Length of table		
	\bar{x} (μm)	SD	SE	\bar{x} (μm)	SD	SE
28 mm	67.11	7.13	1.84	81.55	4.16	1.07
30 mm	70.62	7.22	1.86	89.90	6.91	1.78
40 mm	68.42	7.77	2.01	96.48	10.75	2.77
41 mm	67.11	8.33	2.15	90.79	9.71	2.51
51 mm	78.07	11.62	3.00	94.31	8.50	2.20
60 mm	82.01	9.91	2.56	100.45	7.65	1.98
	Supporting tables from tube feet					
28 mm	78.95	13.39	3.46	145.61	13.11	3.39
30 mm	83.33	18.05	4.66	144.30	16.39	4.23
40 mm	74.11	11.52	2.97	130.71	10.52	2.72
41 mm	74.12	11.24	2.90	122.81	8.86	2.29
51 mm	91.67	9.80	2.53	134.21	12.87	3.32
60 mm	91.23	11.38	2.94	121.93	19.07	4.92

the perforations of the disc are conspicuous when viewed from above. In *T. pawsoni* the handles are much less common than in *T. adinopoda* and the spires of the tables are conspicuously different in both species. The supporting tables of the tube feet in *T. adinopoda* are similar to those of *T. pseudofusus*. Unlike *T. pseudofusus* and *T. crassidisca*, the introvert of *T. adinopoda* contains only rosettes and no tables. Like *T. crassidisca*, *T. adinopoda* appears to have no other close relatives in the genus *Thyone*.

The handles or half-rings on the body wall tables of the *Thyone* species discussed above are not unique to Western Atlantic species. For example, the Australian species *T. axiologa* H. L. Clark, 1938, also possesses this structure.

Thyone crassidisca, new species

Figs. 1, 2B, 4

Diagnosis.—Two ventral tentacles smaller than others. Interradial pieces of calcareous ring moderately long, extending posteriorly well beyond union of tail of radial pieces. Tables in body wall with oval disc, 4 perforations, thick margins, with short spires terminating in a single blunt spine. Introvert with tables and rosettes.

Etymology.—Species name derived from Latin, crassus = thick, discus = plate, in reference to the thick discs of the body wall tables.

Material examined.—Holotype, USNM E21113, total length 51 mm, R/V Gosnold Cruise 243, Station 621, 16 August 1974, 28°58.8'N, 79°58.8'W, 27

rations and undulate margins. Also rosettes and few tables like those found in the introvert.

Remarks.—*Thyone crassidisca* appears to be most closely related to *T. pseudofusus* Deichmann. They both possess robust 4-holed tables in the body wall, the tables with a handle or half-ring on the inner side of the disc. The species are sharply distinguished, however, on the basis of the ossicles in the body wall and elsewhere. In the body wall tables, the spire of *T. crassidisca* tends to terminate in a single point, the disc is very thick and, when viewed from above, the disc perforations are almost completely obscured by the robust spire. In *T. pseudofusus* the spires are low, with a series of (usually) 3 subequal teeth, the disc is not nearly so thick as in *T. crassidisca*, and the spire is not as robust when viewed from above, so that the disc perforations are clearly visible. The supporting tables in the tube feet of *T. crassidisca* have a spire which comes to a single blunt point, while in *T. pseudofusus* the spire ends in 3–5 blunt points.

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meters, pipe dredge, collected by D. K. Young. Paratypes: USNM E21114, 4 specimens, total lengths 28, 30, 40, 41 mm, R/V *Hernan Cortez*, Hourglass Project, Station I, Field No. EJ-66-364, 4 September 1966, 26°24'N, 82°06'W, 6 meters, box dredge, sand and shell, collected by B. Presley; USNM E21115, 1 specimen, total length 60 mm, U.S. Bureau of Land Management, Sta. HE-33-44, 18 June 1974, 28°26'30"N, 84°23'30"W, 45 meters; IRCZM 71:117, 1 specimen, total length 59 mm, R/V *Hernan Cortez*, Federal Clam Project, Station 805, Field No. EJ-71-364, 23 August 1971, 25°43.9'N, 81°42.2'W, 6.1 meters, Nantucket clam dredge, sand, 29.5°C, collected by C. Myhree; FSBC I 2400, 1 specimen, total length 16 mm, R/V *Hernan Cortez*, Hourglass Project, Station I, Field No. EJ-66-81, 9 March 1966, 26°24'N, 82°06'W, 6 meters, box dredge, mud and shell, 17.9°C, collected by B. Presley.

Description.—Body fusiform, with rounded anterior and posterior ends. Tube feet numerous, completely retractile, virtually invisible in contracted specimens. Feet scattered over body wall, with no obvious regular arrangement, although a tendency towards arrangement in double rows in radii is apparent anteriorly and posteriorly. Body wall slightly gritty to touch. Color whitish to light brown, with scattered light to dark brown patches of variable size and shape, up to 1 mm in diameter. Incidence of brown patches varies; some specimens have numerous patches, others have virtually none.

In some specimens calcareous ring, tentacles and associated structures have been autotomized. Calcareous ring tubular, radials with long anterior pieces and long posterior prolongations or tails. Interradial pieces also elongate, extending posteriorly slightly beyond point of junction of tails. Radials and interradians made up of a mosaic of small pieces of calcite.

Body wall ossicles include numerous tables 60–99 μm high (measured from bottom of half-ring to top of spire), average 72 μm , and 72–112 μm long, average 92 μm . Disc oval with 4 perforations, thick and strongly knobbed on margin. Spire robust, composed of 2 pillars, truncate or greatly tapered to a blunt tip. Inner surface of disc with distinct "handle" or half-ring. Introvert with large tables and rosettes. Tables 92–112 μm long, average 105 μm , 53–60 μm wide, average 56 μm and 66–92 μm high, average 79 μm . Disc oval with smooth margin, 4 central perforations and several accessory perforations at each end. Spire, composed of 2 pillars, tapers to a single acute spine with 1–4 minute teeth at the terminus. Rosettes scattered, 26–46 μm long.

Tube feet contain numerous supporting tables 53–105 μm high, average 82 μm and 99–165 μm long, average 133 μm . Disc elongate, strongly curved, with 4 central and 1–2 terminal perforations. Spire high, composed of 2 pillars greatly tapering to blunt or acute terminus. Endplates in tube feet composed of several pieces.

Tentacles with rods 79–118 μm long, average 90 μm with several perfo-

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