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Nomenclatural changes in some sea cucumbers with the erection of a new genus and description of a *Thyone* ?juvenile (?n. sp.) from the Gulf of California (Echinodermata:Holothuroidea:Dendrochirotida)

AHMED S. THANDAR
School of Life Sciences, University of Kwazulu-Natal, Private Bag X54001, Durban 4000, South Africa.
thandara@ukzn.ac.za; https://orcid.org/0000-0002-7368-5560

Abstract

This paper includes several nomenclatural changes in dendrochirotid holothuroids, mostly based on materials from the USNM. These include the erection of a new genus *Pseudostolus* for two Indo-Pacific *Stolus* species [(*S. kilberti* Rajpal & Thandar, 1999 and *S. rapax* Koehler & Vaney (1908)], re-assignment of *Havelockia uniannulatus* (Sluiter, 1914), *Thyone pseudofusus* Deichmann 1930, *T. parafusus* Deichmann, 1941 and *T. axiologa* H.L. Clark, 1938, to the genus *Stolus*, and re-assignment of *Havelockia nozawai* (Mitsukuri, 1912) and *Thyone adinopoda* Pawson & Miller, 1981 to the genus *Sclerothyone* Thandar, 1989. In addition, a lectotype is designated for (*T. vilis* Sluiter, 1901), based on the study of type material at the ZMUA. The Caribbean *Stolus cognatus* is also described and commented on and a single, perhaps juvenile specimen from the Gulf of California is described as *Thyone* ? **n. sp.**

Key words: Sclerothyonidae, Thyonidae, Sclerothyoninae, *Havelockia, Sclerothyone, Stolus*, *Thyone*

Introduction

While critically looking at the subfamilies Thyoninae and Sclerodactylinae (sensu Panning 1949) of the order Dendrochirotida, the writer critically examined the descriptions of all species assigned by Panning (1949) and subsequent authors to these two family-group taxa and also had the opportunity to visit several international museums to look at types, voucher specimens and other reliably identified materials belonging to these two subfamilies. A large part of this research was compiled by Arumugam (2011), for her master's dissertation which regrettably still remains unpublished. Since time did not permit the examinations of all materials held at the various international institutions visited, some specimens from the NHMUK and the USNM had to be obtained on loan for study at home. That, which was obtained from the NHMUK, originally tentatively identified as ?*Havelockia*/?*Thyone* spp., were described in two papers by the writer (Thandar 2017 & 2019) while that from the USNM is now reported here for the first time in order to identify unnamed species, verify the identities of those already named, and publish new records for the world holothuroid fauna. Although poor in the number of specimens, it contains, besides those correctly identified, several species belonging to the genus *Thyone* which has for some time assumed the status of a 'supergenus' [sensu Pawson & Miller (1981)] currently containing over 60 nominal species (146116, WoRMS, accessed 16 June 2021). The genus therefore urgently requires a revision and a re-assignment of the many species it contains based on the type species of the genus. Most of these were reassessed by Arumugam (2011), under my supervision, but this research still awaits updating and publication. Hence the several undetermined *Thyone* species in the current USNM materials, will be reported in a later paper once the many problems encountered in their identifications are clarified in comparison with types and new materials and in consultation with other specialists. The current paper hence only deals with brief descriptions of those species correctly determined and some nomenclatural changes of these and some others which, in the opinion of the writer, are not currently correctly assigned. In addition, a new genus is diagnosed for two *Stolus* species and the lectotype designated for *Thyone vilis* (Sluiter, 1901). Finally, a single, presumably juvenile specimen from the Gulf of California is briefly described as *Thyone* ?**n. sp.** since it is not identical to any currently known forms.

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Panning's (1949) system on the Dendrochirotida has been widely used, albeit many changes, but the broader acceptance of his revision still awaits detailed phylogenetic analyses of the various taxa based on both molecular and morphological data. Although the order was recovered as a well-supported clade by both Kerr & Kim (2001), based on cladistical analysis of morphological characters, and by Miller *et al.* (2001), based on detailed morphological and molecular evidence, both works found little support for the various taxa included within it. A broad molecular study of the currently included taxa within the order is currently underway at the Florida Natural History Museum but what will make this task onerous is that the order Dendrochirotida, the largest order in the class, is notoriously endemic and hence much needed materials will be difficult and many were described from age-old museum materials, often based on one or few specimens. Nevertheless, once such an analysis is completed, it will throw much awaited light on the current classification of this order and the taxa attributed to it.

Materials and methods

The USNM material used in this study, emanates from various localities including Japan, Venezuela, Philippines, the Mediterranean Sea, Panama, Equador, Mexico and Florida (USA). It is scanty both in terms of the number of specimens (only 20) and number of species it contains. Only 4 determined and one undetermined species are here reported on. The study of the name-bearing type materials of *Thyone vilis* (Sluiter, 1901) and *T. uniannulata* Sluiter,1914 was conducted at the ZMUA. All materials were examined by conventional methods, both macro- and microspically. For the study of the ossicles, various organs (body wall, tube feet, tentacles and introvert) were excised and placed in household bleach in a watch glass in order to dissolve the soft tissue. Once the ossicles are released the supernatant was discarded and the sediment washed in several changes of distilled water and first examined under a compound microscope. Line-drawings were done using the camera lucida. For SEM study, were pertinent, the extracted ossicles were dehydrated through several changes of alcohol through to absolute alcohol and then transferred, with a fine pipette, onto a specimen stub to which they normally adhere once the alcohol evaporates. The stub was then coated in gold for 5–15 mins. using a Polarin SC500 sputter-coater, and viewed and photographed with the Jeol LEO SEM. The holotype of *H. nozowai* was not available for direct study but was kindly photographed and the SEM micrographs of its ossicles generously prepared and made available to the writer by Drs. Akito Ogawa and Rei Ueshima of the University of Tokyo.

Acronyms:

NHMUK	Natural History Museum, London, United Kingdom
USNM	United States National Museum, Washington D.C. (Smithsonian Institution).
ZMUA	Zoological Museum, University of Amsterdam.

Systematic account

Order Dendrochirotida Grube, 1840

Family Sclerothyonidae Thandar, 1989

Sclerothyonidae Smirnov, 2012: 820; Thandar, 2018: 69.

Subfamily Sclerothyoninae Thandar, 1989

Sclerothyoninae Thandar, 1989: 294; 2008: 14; Martinez & Brogger, 2014: 64 (passim); Martins & Tavares, 2018: 158 (passim); 2019: 376.

Diagnosis (see Thandar 1989, amended Martins & Tavares 2019).

Remarks. This family was originally erected as a subfamily of the *Sclerodactylidae* for only the southern African, then monotypic genera *Sclerothyone* Thandar, 1989 and *Temparena* Thandar, 1989. Thandar (2006) added one more species to *Sclerothyone*. Later, Martinez & Brogger (2012) added the new genus *Thandarum*, when describing their new species from Argentina and Martins & Tavares (2018), when designating a neotype for the south-western

Atlantic *Neopentamera anexigua* Deichmann, 1941, which they transferred to Sclerothyoninae. In addition, Martins & Tavares (2018) modified the diagnosis of *Sclerothyoninae* while describing within it their new species with their new genus *Paulayellus*, and provided a key to the genera then known. Later they [(Martins & Tavares (2019)], re-amended the diagnosis of *Sclerothyone* while describing their two new West Atlantic species, provided a key to the 5 genera and 9 species then known, and discussed the possible referral of three other dendrchiroids to either *Sclerothyone* or *Temparena* (viz. *Havelockia nozawai* Mitsukuri, 1912; *Thyone adinopoda* Pawson & Miller, 1981 (as suggested by Arumugam 2011) and *Thyone neofusus* Deichmann, 1941. *H. nozawai* and *T. adinopoda* are herein transferred to *Sclerothyone* but no action is taken over *T. neofusus* as it is a homonym and requires an objective or critical analysis. Although the subfamily was elevated to full family rank by Smirnov (2012), this action is not fully supported by WoRMS (791923, accessed 16 June 2021) which publishes it as an alternative representation which is here used.

Genus *Sclerothyone* Thandar, 1989

?*Cucumaria* (partim) Ludwig & Heding, 1935: 192.
Sclerothyone Thandar, 1989: 296; 2008:14; Martinez & Brogger, 2014: 64 (passim); Martins & Tavares, 2018: 158 (passim); 2019: 376.

Type species. ?*Cucumaria velligera* Ludwig & Heding, 1935 (by original designation Thandar 1989).

Type locality. Cape of Good Hope, South Africa, 318 m.

Diagnosis (from Thandar 1989, amended Martins & Tavares 2019).

A genus of the family Sclerothyonidae comprising small dendrochirotid holothuroids up to 35 mm long, with a barrel- to U-shaped body covered by thin but rigid skin. Tentacles 10, ventral pair reduced. Calcareous ring delicate, radial and interradial plates compact, meeting at base only, not forming a tube but with the radial plates carrying long, mostly undivided, paired processes several times the height of ring. Body wall ossicles comprise two-pillared tables and sometimes also plates. Tables with usually a 4-holed or multilocular, oval or lozenge-shaped disc with a short, often distorted and/or reduced spire, with or without teeth; plates smooth, elongate, also multilocular, representing reduced, spire-less stables.

Remarks. The genus is here again amended to take in the Japanese species *Havelockia nozawai* (Mitsukuri, 1912), which does not differ much from the type and other species of the genus. Although the genus may be characterised by both tables and plates in the body wall, the plates, occurring in combination with tables in *S. nozawai* at least, are clearly table discs which have lost their spire (an observation also made by Mitsukuri (1912) and by the reviewer).

Sclerothyone nozawai (Mitsukuri, 1912) n. comb.

Figures 1–3

Cucumaria nozawai Mitsukuri, 1912; 249, text fig 50.
Havelockia nozawai Panning, 1949; 466 (passim, transferred to *Thyone* in addendum but accepted in *Havelockia* by WoRMS (529494, accessed 16 June 2021).

Material examined. USNM E2285, North Pacific Ocean, Japan, Hokkaido, Hakodate Bay, 41° 45’ N 140° 40’ E, USFC, Albatross R/V, 19 IX 1896, 21 m, det. W.K Fisher as *Havelockia nozawai*, 2 spec.

Distribution. Japan, shallow.

Remarks. This species was originally based on a single specimen and judging from available literature has not been recorded since. Despite the singularity of the specimen the type is well described and illustrated by Mitsukuri (1912). The two current specimens in the Smithsonian collection are clearly referable to this species but both have been previously dissected, the larger one (35 mm) lacks the calcareous ring whereas, in the smaller specimen (30 mm), the ring is intact and quite conspicuous, displaying the characteristic features of the calcareous ring of the type species of the genus. The tube feet are distinctly serially arranged in two distinct rows per ambulacrum with naked interambulacra, a feature not characteristic of *Havelockia* which has scattered podia. The body wall ossicles

comprise tables (Figure 2 & 3A) with an elongated disc perforated by many holes and an ill-formed 2-pillared spire as well as multilocular spire-less plates which obviously are reduced tables. The introvert deposits (Figure 1B & 3C ex holotype) comprise only well-formed tables with an irregular smooth disc perforated by six or more holes (up to 16), a well-formed spire of moderate height with a single cross-bar, terminating in few short teeth. The tentacle deposits are of two types: tables with an elongated, sometimes spinose, curved disc with four central perforations and several at each end and a short spire ending in several teeth (Figure 1A), as well as minute, thin-walled, usually multilocular plates with or without a serrated margin (Figure 1C). The tube feet ossicles comprise tables with a slightly curved disc and a short, multi-dentate spire (as in holotype -Figure 3A). The tube feet end plates are remarkably reduced or mostly absent.

The ambulacral restriction of the tube feet, the form of the calcareous ring and body wall ossicles strongly suggest that the species can neither be ascribed to *Thyone* nor to *Havelockia*.

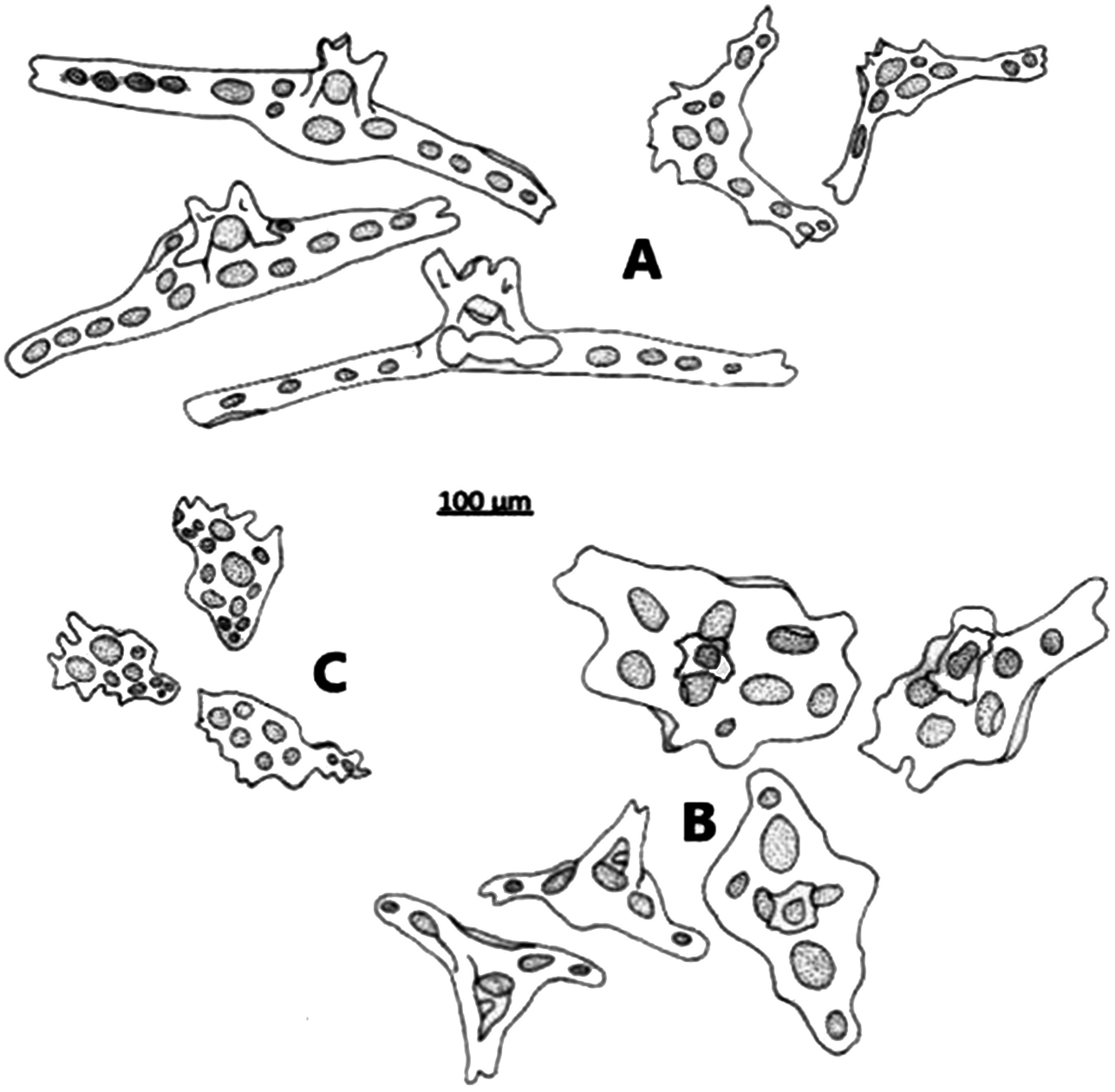

FIGURE 1. *Sclerothyone nozawai* (Mitsikuri, 1912) n. comb. USNM E2285. A. Tables from tentacles; B. Introvert tables; C. Tentacle plates. (All to same scale).

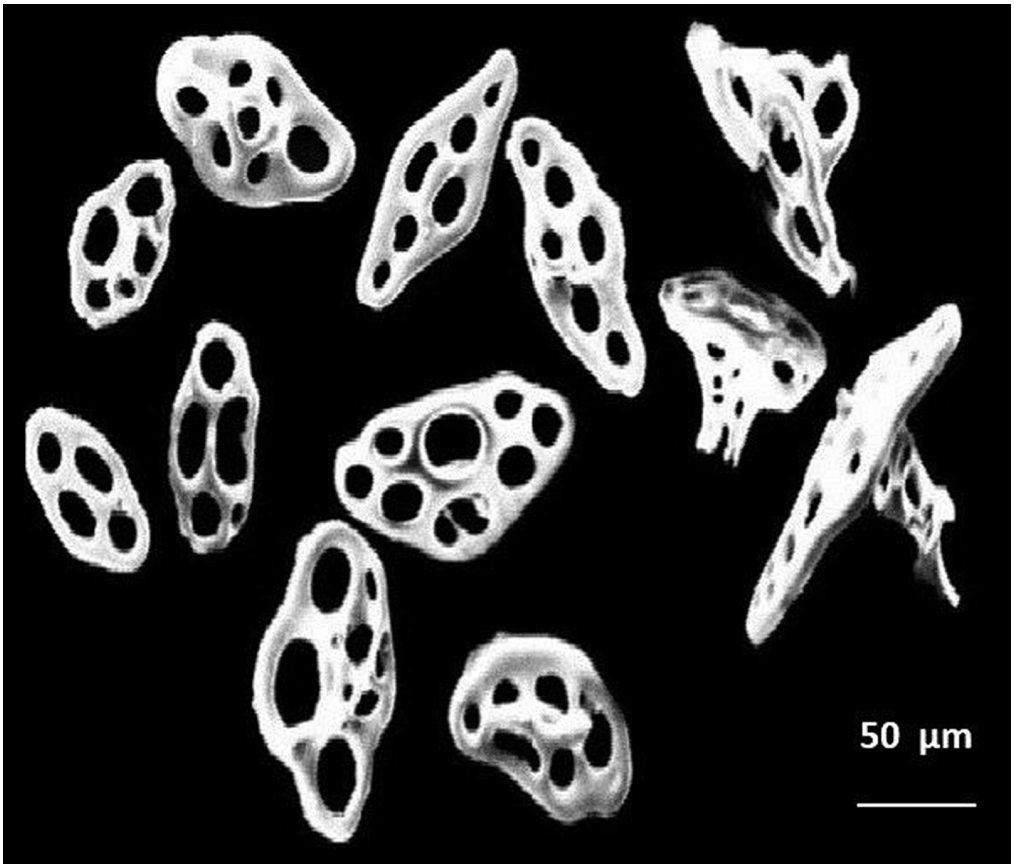

FIGURE 2. *Sclerothyone nozawai* (Mitsikuri, 1912) n. comb. USNM E2285, SEM of body wall ossicles.

It is therefore now transferred to the genus *Sclerothyone* in the family *Sclerothyonidae.* Arumugam (2011), in a yet unpublished work and on my advice, transferred the species to *Temparena*. Now having looked at the ossicles of the holotype of *C. nozawai*, this view cannot be upheld as there are no distinct plates in the body wall but just reduced tables resembling plates, although the calcareous ring does resemble that of the type species of *Temparena*. *Sclerothyone nozawai* n. comb. differs from the type species of *Sclerothyone* in possessing distinct tables in the tube feet, tentacles and introvert, whereas the type species (*S. velligera*) possesses only plates in the introvert and tentacles and some sort of reduced tables in the tube feet. The ossicles of the USNM specimen are illustrated in Figures 1 & 2 and those of the holotype in Figure 3.

Family Thyonidae Panning, 1949

Subfamily Thyoninae Panning, 1949

Remarks. Smirnov (2012) raised Panning's (1949) subfamily Thyoninae to family rank and this classification is here utilised. Within the family three species currently classified in the genus *Stolus* (sensu Panning 1949) do not strictly belong in it. These include the Caribbean *Stolus cognatus* (Lampert, 1885) with usually equal or subequal tentacles and simple, smooth plates in the body wall, and *S. rapax* (Koehler & Vaney, 1908) from the Bay of Bengal and *S. kilberti* Rajpal & Thandar, 1999 from the east coast of South Africa, both with smooth, reticulated plates in the body wall. While the writer was tempted to revive Deichmann's (1954) genus *Thyoneria* (unaccepted by WoRMS, 732056, accessed 16 June 2021) for *S. cognatus* this step is here not taken (see Remarks under this species) but the latter two species are here assigned to a new genus *Pseudostolus* **n. gen.** In addition, three other species, currently standing in *Thyone* (*T. pseudofusus* Deichmann, 1930; *T. parafusus* Deichmann, 1941 and *T. uniannulata* Sluiter, 1914) are here transferred to the genus *Stolus,* whose diagnosis is herein amended to take in these forms.

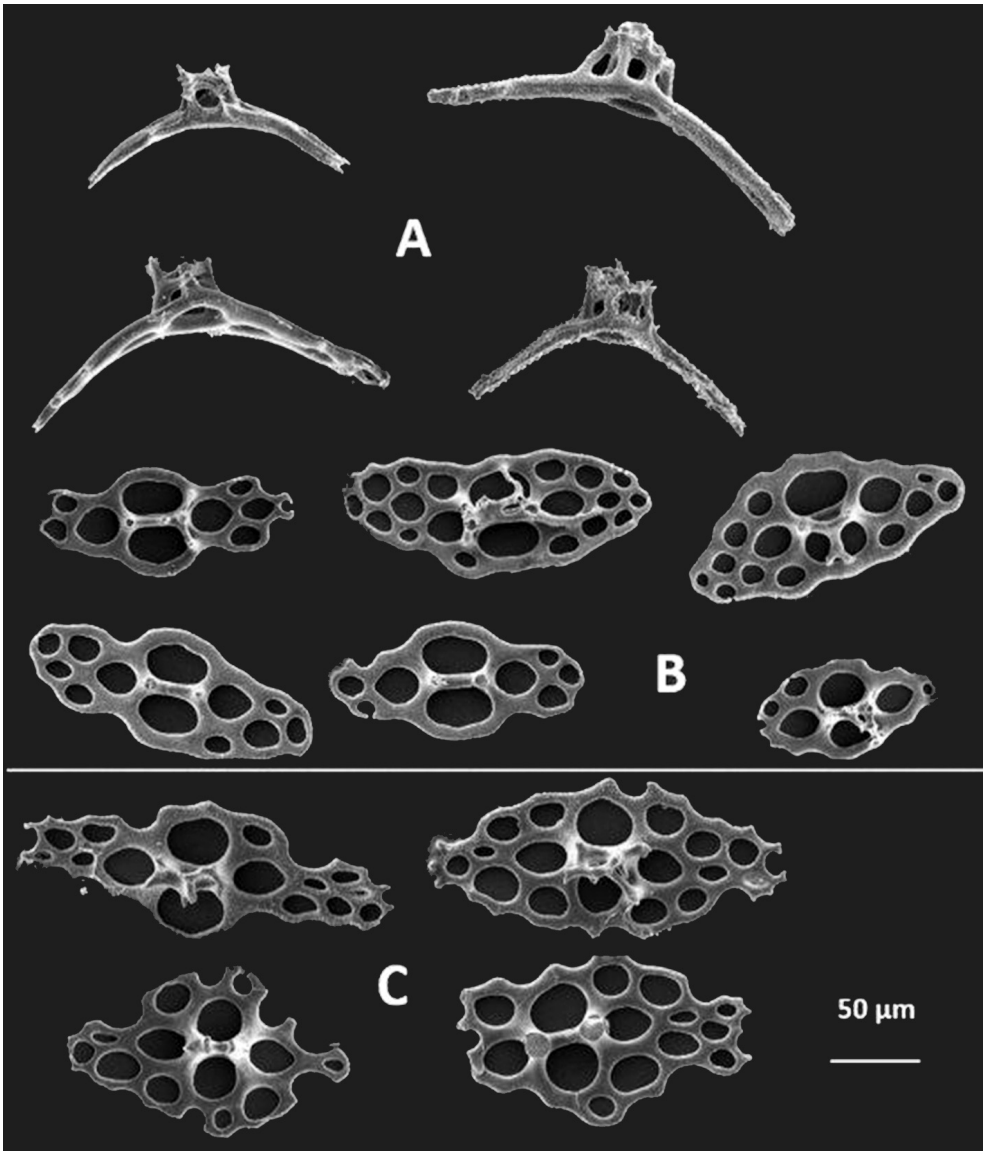

FIGURE 3. *Sclerothyone nozawai* (Mitsikuri, 1912) n. comb. Holotype. SEM of table ossicles of A. Tube feet; B. Body wall; C. Introvert.

Pseudostolus n. gen.

Stolus (partim) Selenka, 1867: 355; Panning, 1949: 462; Clark & Rowe, 1971: 204; *Pseudothyone* (partim) Panning, 1949: 456.

Diagnosis. A genus of Thyonidae with body wall comprising tables and complex, multilayered or reticulated, smooth plates; no knobbed buttons/plates in body wall.

Type species. *Stolus kilberti* Rajpal & Thandar, 1999.

Type locality. N.E. of Lieveldt's Rock, KZN, South Africa, 27° 42.9' S, 32° 39.1' E.

Other species included. *Stolus rapax* Koehler & Vaney,1908.

Remarks. Both *Pseodostolus kilberti* (Rajpal & Thandar, 1999) and *P. rapax* (Koehler & Vaney, 1908) are well described and hence there is no need for further descriptions. They are well characterised by the presence of smooth reticulated plates in the body wall, made up of more than one layer of calcareous material, although some plates may be simple (non-reticulate) they are still smooth. Those of *P. rapax* are rounded, up to 1 mm in length, whereas those of *P. kilberti* are elongated, up to 0.5 mm in length. The deposits in the former also include tables with a reduced spire whereas those of the latter also include tables which, in contrast, possess an elongated, spine-like spire. The

podia of the former species (*P. rapax*) are better developed ventrally as hair-like outgrowths while those of the latter are shorter, villose and evenly distributed. Another species with ossicles like those of *P. rapax* is *Pseudothyone mosaica* (Koehler & Vaney 1910) from the Arabian Sea but since the calcareous ring of this species consists of compact, unfragmented plates it is left to stand in *Pseudothyone*. The differences between the three species are well tabulated by Rajpal & Thandar (1999). Panning (1949) considered *S. punctatus* Ohshima, 1915 from Japan as being also a form with smooth plates and this error was reiterated by Rajpal & Thandar (1999) and Thandar (2005) in their key. Although Ohshima (1915) does not illustrate the ossicles of his species he does state that they resemble those of *T. belli* Ludwig, 1887 (now *Pseudothyone belli*) and *Thyone similis* Ludwig, 1887 [(now a junior synonym of *Neothyone gibber* Selenka (1867)]. It is therefore here left to stand in *Stolus* as accepted by WoRMS (529676, accessed 16 June 2021).

Genus *Stolus* Selenka, 1867

Stolus (partim) Selenka, 1867: 355; Panning, 1949: 462; Clark & Rowe, 1971: 204.
Type species. *Thyone buccalis* Stimpson, 1885.

Diagnosis (from Panning, 1949, restricted herein). Tentacles 10, ventral two nearly always reduced; calcareous ring fragmented into a mosaic pattern with the radial plates carrying long, paired, subdivided posterior processes; body wall ossicles primarily as knobbed plates/buttons, often provided with a handle on one side and a spire on the opposite side, rarely plates/buttons smooth, but never reticulate.

Remarks. Panning's (1949) diagnosis is here modified and restricted to contain species with mostly simple, knobbed, unreticulated plates in the body wall since those species with smooth, reticulated plates are now removed and assigned to the new genus *Pseudostolus* **n. gen.**, while a few others originally described in *Thyone* or *Havelockia*, but agreeing with the amended diagnosis of *Stolus*, are herein transferred to *Stolus*. The genus *Thyone*, now containing about 80 species, has for some time now, assumed the status of a "supergenus" (sensu Pawson & Miller 1981), serving as a receptacle for any dendrochirotid holothuroid with 8+2 tentacle arrangement, scattered tube feet, a complex subdivided (mosaic-like) calcareous ring and 2-pillared tables as body wall deposits. It is therefore in need of thorough revision. While it may be argued that such an action should await a broad phylogenetic analysis based on both morphological and molecular characters, one cannot await such an analysis indefinitely. Panning's system was initially questioned by Cherbonnier (1952) but completely ignored by Deichmann in her 1954 and subsequent papers. However, it is currently widely utilised but with some caution and many of his originally designated congenerics finding new homes, while others still await re-assignment.

Arumugam (2009), in her broad, yet unpublished research, transferred several *Thyone* species to *Stolus* or other genera, on my advice and with the concurrence of Rowe (pers. comm), as they did not correspond with *T. fusus*, the type species of *Thyone*. Some of these changes are herein published for the first time. Hence, *T. uniannulata* Sluiter, 1901, *T. pseudofusus* Deichmann, 1930, *Thyone parafusus* Deichmann, 1941 [(overlooked by Panning (1949)] and *T. axiologa* H.L. Clark, 1938, are now re-assigned to *Stolus*. The assignment of *T. pseudofusus, T. parafusus* and *T. uniannulata* is discussed below. *Thyone axiologa*, on the other hand, has tables with a very prominent spiny handle on one side, typical of *T. pseudofusus* as Clark (1938) himself commented, but the disc of the table illustrated by him, appears smooth. It is here stated that *T. crassidisca* Pawson & Miller, 1981, whose ossicles and calcareous ring resemble those of *Stolus canescens* (Semper, 1867) and *T. pawsoni* Tommasi, 1972 may one day suffer the same fate.

Stolus cognatus (Lampert, 1885)

Figures 4 & 5

Semperia cognata Lampert. 1885: 67.
Thyone cognita Deichmann, 1930: 169, pl. 15, figs. 1–4 (lapsus calami).
Thyone cognata H.L. Clark, 1933: 115; Deichmann, 1938:134.
Stolus cognatus Panning, 1949: 462 (passim); Pawson & Miller 1981: 393. Prata et al, 2017: 7, fig. 9 a–f; Prata *et al.* 2020: 417, fig. 8.
Thyoneria cognata Deichmann 1954: 398; Deichmann 1963: 110; Tikasingh 1963: 97, figs.70–72, Caycedo 1978: 165, pl. 4, fig. 4.

Diagnosis (according to Deichmann 1954, amended herein). A species of *Stolus* up to 140 mm long, fairly delicate, spindle or U-shaped with the oral and anal ends often turned up. Tentacles 10, of equal or unequal size, mid-ventral pair sometimes reduced or even absent. Tube feet in double rows, a few also scattered in interambulacra. Calcareous ring tubular (Figure 4E), with or without any obvious fragmentation; radial plates shorter than interradials, both fused forming a distinct tube with the radial plates carrying short posterior processes broken into a few pieces. Body wall ossicles comprise numerous elongated, smooth plates with mostly a double series of holes (Figures 4A, 5A) plus a varying number of small plates with several, often reduced holes (Figure 5B). Tube feet with perforated rods with or without the third arm (Figure 4B); end plates mostly absent, when present small, almost rudimentary, except in young individuals. Introvert with rosettes (Figure 4D & E). Tentacles with heavy rods in stalk and delicate ones in branches.

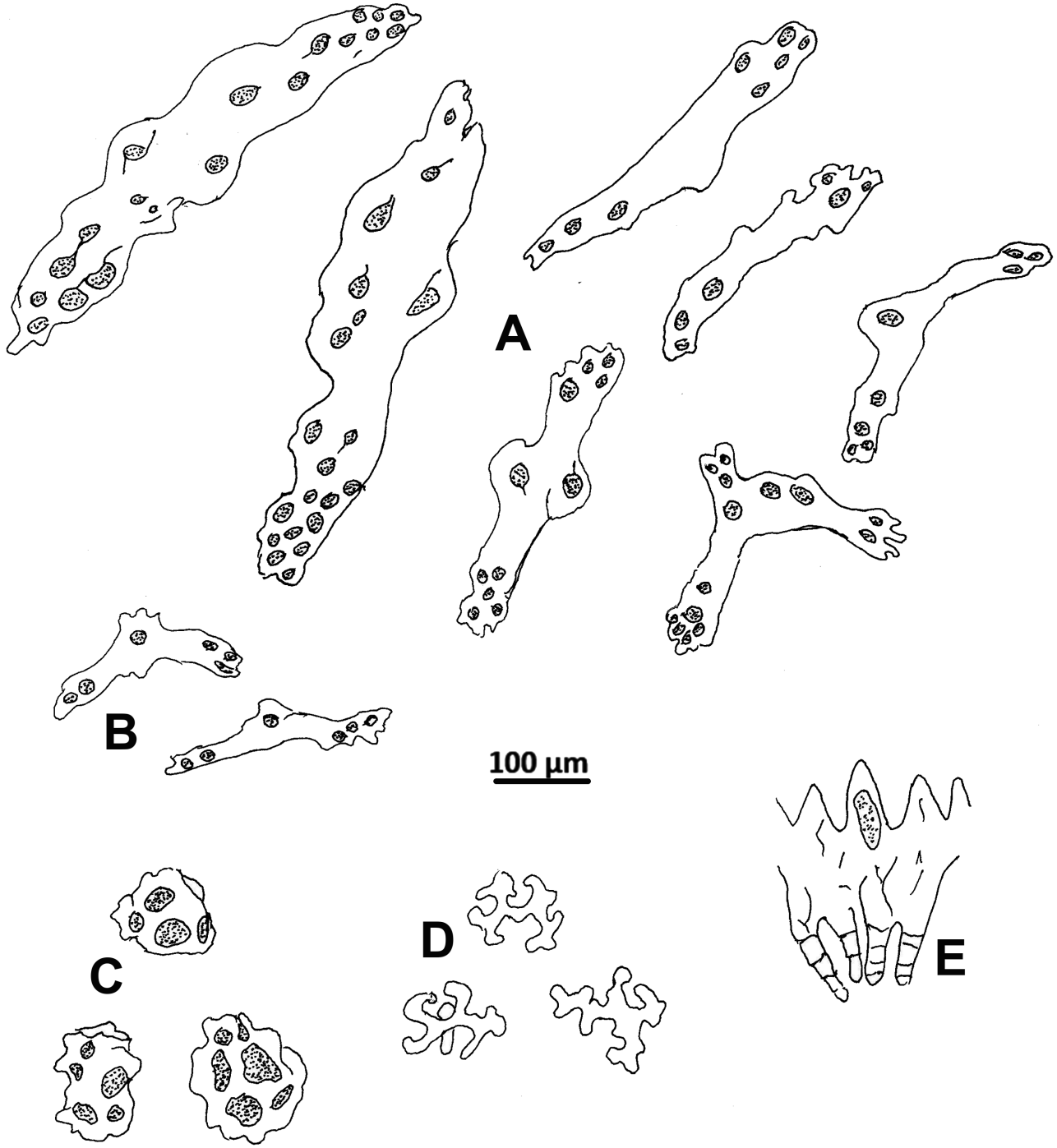

FIGURE 4. *Stolus cognatus* (Lampert, 1885) USNM- E22532. A. Body wall ossicles; B. Tube feet ossicles; C. Introvert rosettes (closed); D. Introvert rosettes (open); E. Calcareous ring (mid-dorsal view). (All ossicles to same scale).

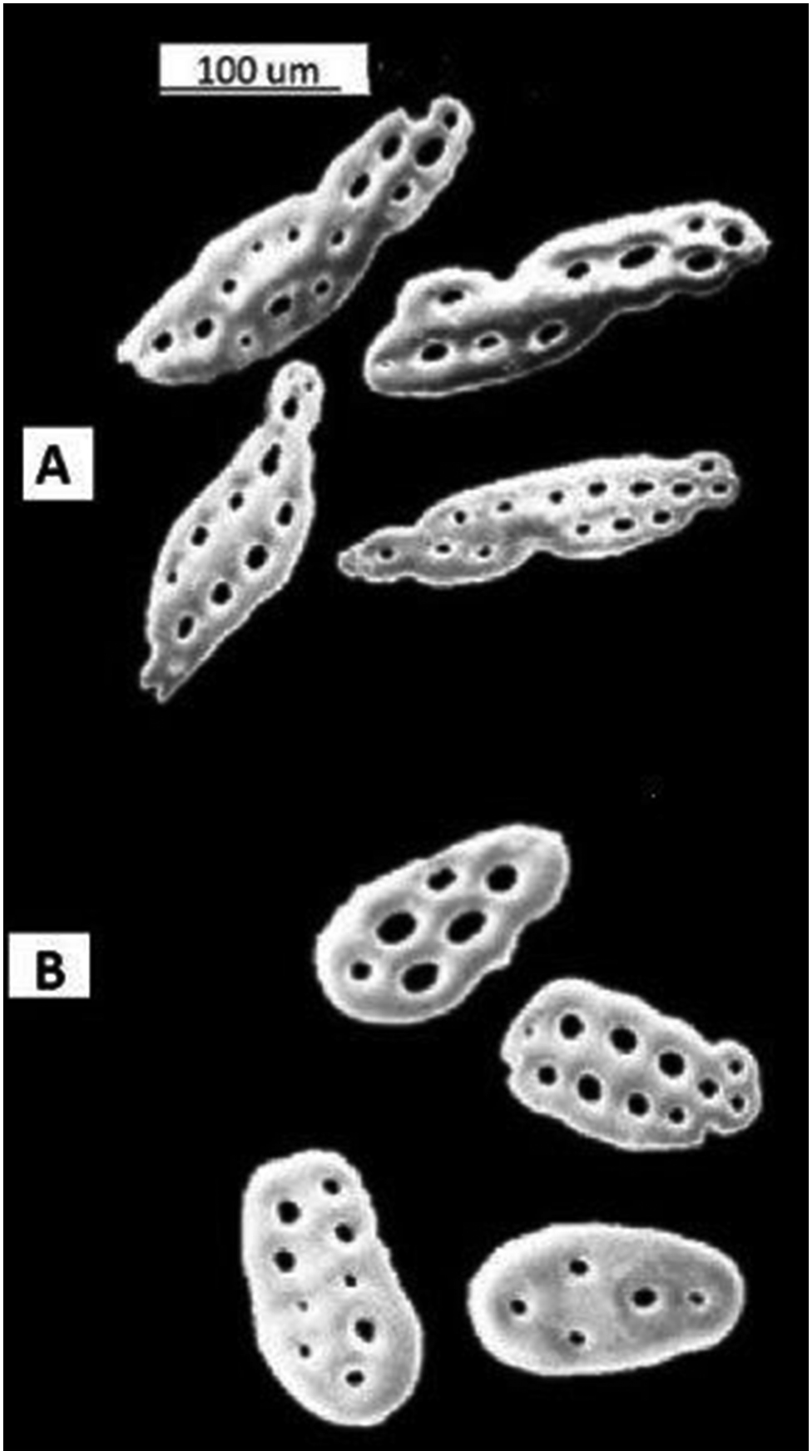

FIGURE 5. *Stolus cognatus* (Lampert, 1885) USNM- E22532. SEM of elongated rods from body wall; B. Oval rods from body wall, some with occluded or minute holes. (All to same scale).

Material examined: USNM- E22532, North Atlantic Ocean, Caribbean Sea, Venezuela, Isla Margarita, 14 I 78, Jones M.L., det. Miller, J., 1 spec.; USNM- E22528, North Atlantic Ocean, Caribbean Sea, Venezuela, Isla Margarita, Jones M.L., date not recorded, det. Miller, J., 2 spec.

Habitat. Soft bottom to eel grass.

Distribution. Caribbean region, shallow-water.

Remarks. This species, well characterized by smooth, multilocular plates in the body wall, is unique amongst the Caribbean holothuroids. Of the three specimens here examined, all from Venezuela and determined by J. Miller, the two smaller ones, on the basis of their ossicles, are undoubtedly referable to *Solus cognatus*. They look identical, fusiform to Ushaped, uniformly beige without any blotches or other markings and with the skin rough to the touch. The remaining specimen is barrel-shaped with dark blotches on a rather smooth skin. Its calcareous ring is simple, cucumariid-like and its ossicles are slender rods, quite different from the robust ones of the former two specimens. It is obvious that this third specimen is a cucumariid but was not determined any further. While other writers record equal tentacles in *S. cognatus*, Deichmann (1954) records both equal and unequal tentacles, the latter as four large, four medium and two small (mid-ventral), or only four large and four small with the mid-ventral absent.

Deichmann (1954) was the first to recognise that this species stands apart from other species and hence erected the genus *Thyoneria* to accommodate it but without diagnosis or comments, nor designation of the type species. Since then, the combination *Thyoneria cognata* was used a few times but also without any comments [(see Caycedo (1978), Deichmann (1963) and Tikasingh (1963)] – the latter perhaps on Deichmann's advice). Pawson & Miller (1981) rejected the new genus and accepted Panning's (1949) combination *Stolus cognatus.* All subsequent authors from Hendler *et al.* (1995) to Prata *et al.* (2020), amongst others, continued to use the combination *Stolus cognatus*. Although *Thyoneria* Deichmann, 1954, is rejected by WoRMS (732056, accessed 16 June 2021) the writer was tempted to revive the name because of the presence of both equal or subequal tentacles, with the ventral two rarely reduced or altogether absent, and the occurrence of only smooth plates in the body wall. However, this action was not taken because of the writer's dislike for monotypic genera [(see Thandar & Samyn (2004)] and the fact that holothuroid ossicles are reputed to be very homoplastic. It is here opined that this species is perhaps still experimenting with the reduction of its two ventral-most tentacles, consistently present in its congenerics (i.e. 8+2 arrangement), with the subdivision of its calcareous ring and perhaps also in the modification of its body wall ossicles since the differences in size and shape of these deposits and their perforations vary considerably within the species. Therefore, while the genus *Stolus*, characterized by its type species (*S. buccalis*) should be restricted to include only forms with the two mid-ventral tentacles consistently reduced, a complex subdivided calcareous ring and body wall ossicles as usually knobbed, single-layered buttons/plates with/without a handle on one side, *S. cognatus* is still retained within it.

Stolus parafusus **(Deichmann, 1941) n. comb.**

Figure 6

Thyone parafusus Deichmann, 1941: 106–107, pl. 18, figs. 7–12; Solis-Marin *et al.* 2009: 80–81, pl. 15; Jacobson, et al 2015:84.

Diagnosis (see Deichmann, 1941).

Material examined. USNM E2221, North Pacific Ocean, Mexico, Baja, California, det. M. Wright, 1977, 1 spec.

Remarks. This species was established on the basis of two specimens a few cm long, collected from Tenacatita Bay, Mexico, at about 45 m. The current specimen is elongated, about 155 mm long, with a bloated middle but attenuated ends. The tentacles are well branched and the calcareous ring incised, with deeply cleft radials. The body wall ossicles (Figure 6A), as described by Deichmann (1941) and Jacobson *et al.* (2015), comprise tables with a four- holed disc with often a short handle on one side and a spire of moderate height, terminating in a few teeth. Deichmann described the tube feet tables in the type as possessing a three-pillared spire, but in the current specimen this is not clearly evident. The introvert possesses numerous tables with a multilocular disc with the spire well-developed or reduced. The tentacle deposits comprise numerous rosettes but at the bases adjoining the introvert, there are numerous tables with a reduced disc. Deichmann (1941), however, described the tentacles as being packed with perforated, multilocular plates of different sizes – perhaps referring to the reduced table discs. The delicate

rods described by Deichmann to be present in the terminal branches were not detected in the specimen at hand nor by Jacobson *et al.* (2015).

This species comes very close to Deichmann's (1930) *T. pseudofusus* originally described from Yucatan, as a tapering form with mouth and anus directed upwards. This is the shape of the current specimen. According to Deichmann (1930), *T. pseudofusus* has tables with a short robust spire with numerous teeth and the tentacles lack the perforated plates present in the tentacles of *T. parafusus*. This is well illustrated by Jacobson *et al.* (2015). The placement of both these species in the genus *Thyone* is doubtful. Hence, due to the often presence of heavily knobbed table discs and handles or half-rings to most of the body wall tables (Figure 6A), both these species are here transferred to *Stolus*. *S. parafusus* n. comb. strongly resembles *S. crassus* Liao & Pawson, 2001, from China, not only in body wall ossicles but also in the presence of tables in the introvert and rosettes in the tentacles. Hence, there is little justification in retaining these species in *Thyone* as none corresponds with the characters of the type species (*T. fusus*) of this genus.

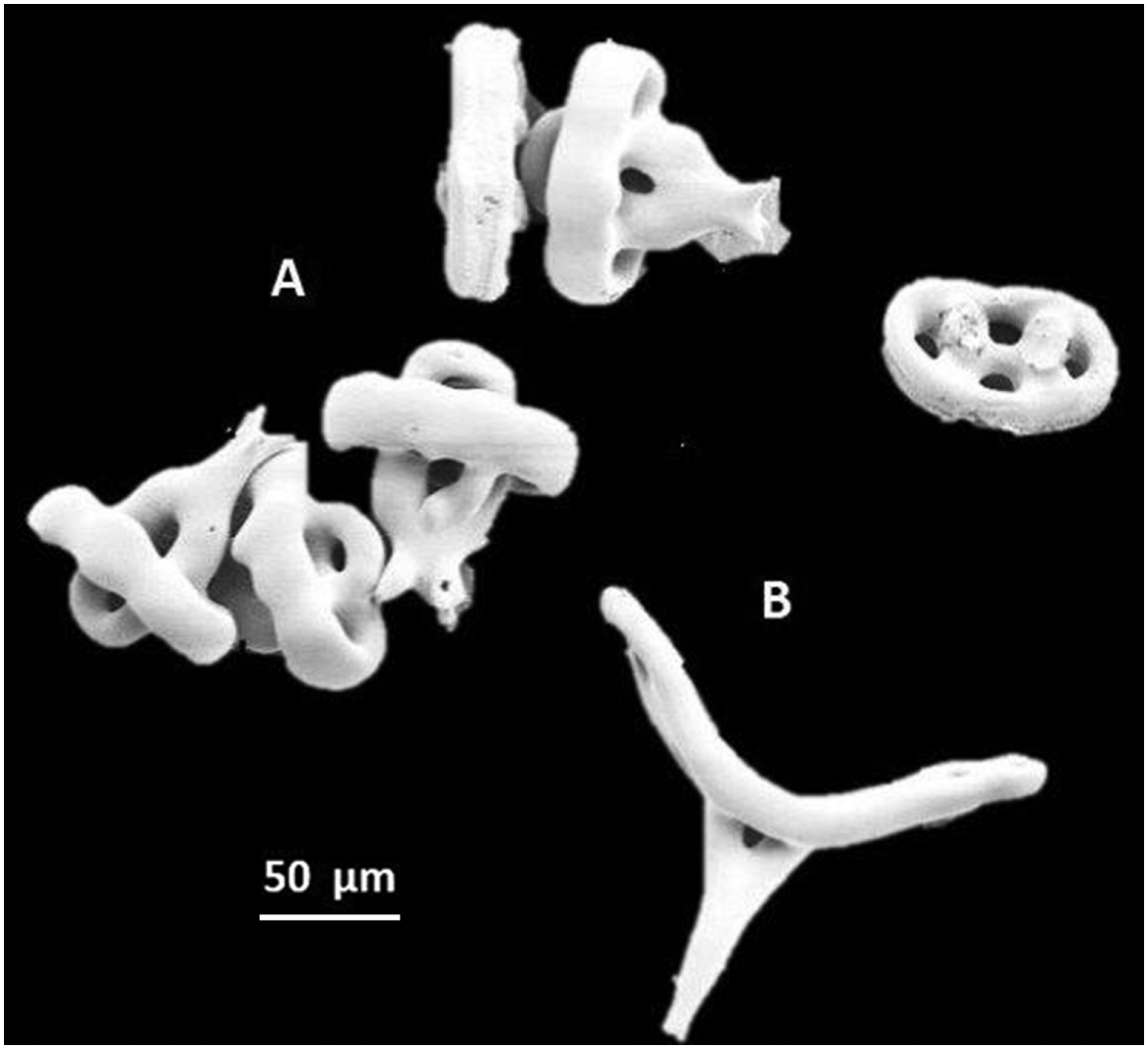

FIGURE 6. *Stolus parafusus* (Deichmann, 1941) n. comb. USNM E2221. Knobbed tables/buttons from body wall; B. Table from tube foot. (All to same scale).

***Stolus uniannulatus* (Sluiter, 1914) n. comb.**
Figure 7

Thyone uniannulata Sluiter, 1914: 10, fig. 3 a, b.

Diagnosis (see Sluiter, 1914).

Material examined . ZMUA (H. 2194), northern Java, 6 19 S, 110 50 E, 50 m.

Remarks. This species was assigned to *Havelockia* by Panning (1949), transferred back to *Thyone* in his addendum, but currently assigned to *Havelockia* by WoRMS (529501, accessed 16 June 2021). The writer concurs with Sluiter (1914) that its calcareous ring (Figure 7A) is close to that of *Stolus sacellus* (= *S. buccalis*) and surprisingly the specimen also feels as rigid as a young *S. buccalis*. In addition, there are regular four-holed knobbed buttons/plates in the body wall, resembling those of *S. buccalis,* although some of them have up to eight holes. In the introvert there are elongated, smooth to spinous perforated plates and some rosettes (Figure 7B). In *S. buccalis*, on the other hand, the introvert possesses multilocular knobbed plates and rosettes. James (1966) describes the introvert deposits in his specimens of *S. buccalis* as thin smooth buttons. Hence, there are some similarities between *S. uniannulatus n. comb.* and *S. buccalis* but they are definitely not conspecific but perhaps congeneric. The structure of the calcareous ring and the presence of knobbed plates in the body wall preclude the inclusion of this species in *Havelockia*. Hence, the species is here transferred to the genus *Stolus* without any hesitation.

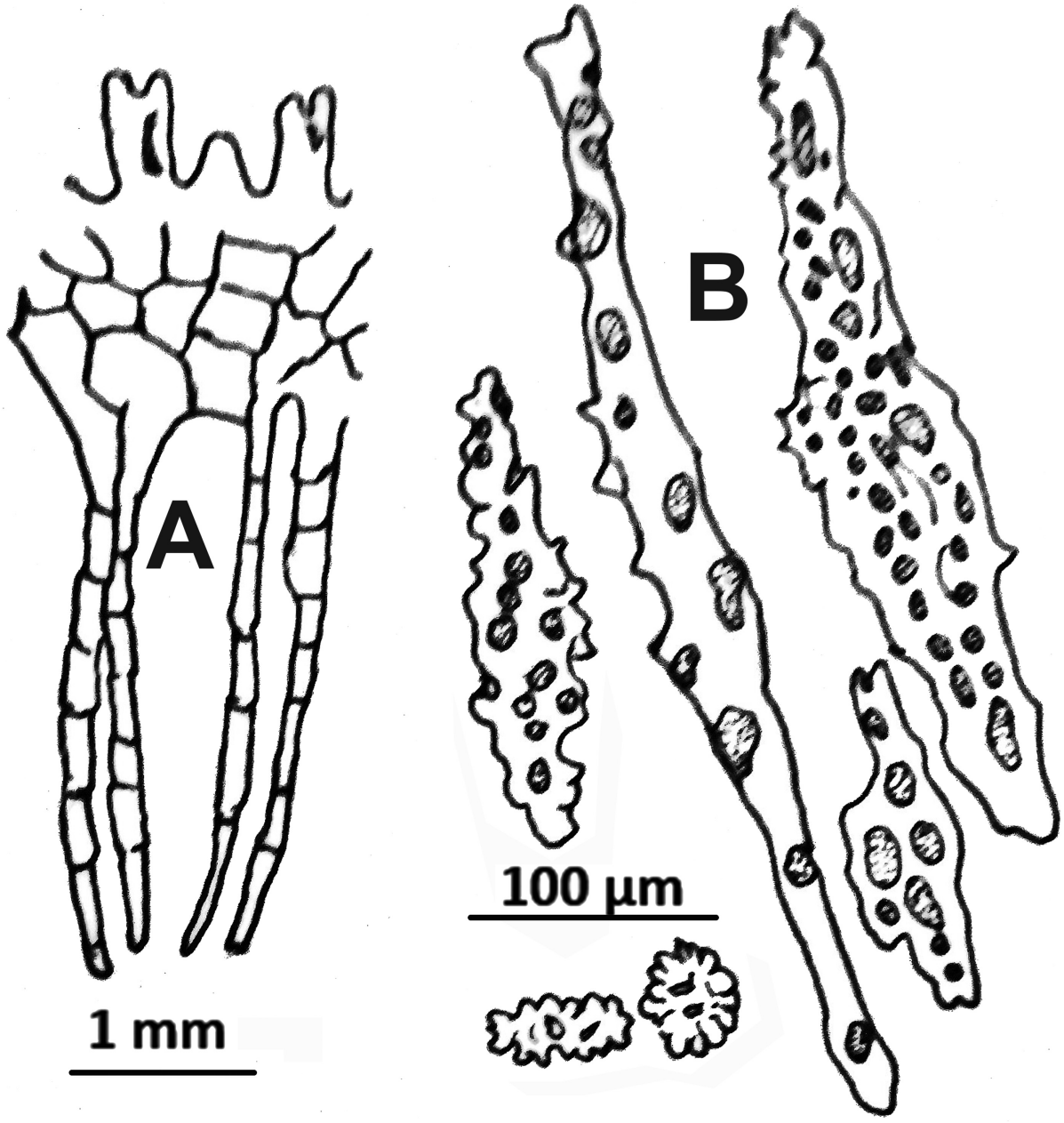

FIGURE 7. *Stolus uniannulatus* (Sluiter, 1914) n. comb. A. Calcareous ring (mid-dorsal); B. Plates and rosettes from the introvert.

Genus *Thyone Oken,* 1815

***Thyone vilis* (Sluiter, 1901)**
Figures 8 & 9

Cucumariia vilis Sluiter, 1901: 86, pl 7, fig. 5.
Thyone villis Panning, 1949: 467 (lapsus calami).

Diagnosis (see Sluiter 1901).

Material examined. ZMUA, H1114, Banda, herein designated as lectotype, 1 spec.; Molo Strait, ZMUA, H1109 (not conspecific with former), 1 spec.**;** USNM E48738, North Pacific Ocean, Philippines, La Union, Luzon Island, San Fernando, Sta. 5442 (16° 30' N, 120° 11' E), 45 m, 10 May 1909, Albatross R/V, Philippines Expedition, det. Deichmann, E., 1 spec.

Description. Specimen (USNM E48738) small, barrel-shaped, about 33 mm long and 11 mm wide in mid-body; calcareous ring and associated structures absent. Colour, in alcohol, uniformly greyish white. Tube feet mostly retracted, usually in ambulacra but few also scattered in interambulacra, 1.5 mm long when extended, suckers well- developed. Anal teeth present. Body wall wrinkled, soft, smooth, fairly thick. Gonad (testis) well- developed, mature, tubules unbranched. Respiratory trees well-branched, one extending to about three quarter of body length. Longitudinal muscles unpaired, cylindrical. Ossicles of the body wall comprise plates and tables. Plates small, smooth, spire-less, circular to triangular, with thin margins and three or more holes of varying size (Figure 9A & B). Tables also with a thin-margined disc with usually four large holes (Figure 9C), sometimes more with a reduced two-pillared spire, ending in two clusters of teeth or teeth absent, transverse bar lacking. Table discs 73–95 μm long, 53–71 μm wide, holes 25–33 μm wide. Tube feet ossicles (Figure 9D) as rods, up to 237 μm long, swollen in the middle, perforated by four large central holes and a few holes at each end. End plates with large marginal and smaller medial holes.

Distribution. West Pacific (Indonesia and Philippines).

Remarks. Despite the absence of the calcareous ring and its associated structures the identity of this specimen is in no doubt. It does possess the characteristic thin-walled tables and plates reminiscent of those of one of the syntypes of *Thyone vilis* (cf. Figure 8B & 9A–C). In support of this, the tube feet rods (Figure 9D), which Sluiter (1901) refers to as tables, are identical to those illustrated by him for his species (Figure 8C) and so is also the spire of the body wall tables. I have had the opportunity to study both Sluiter's syntypes at the ZMUA. The two specimens, one from Banda (H1114) and the other from Molo Strait (H1109), are well preserved. However, the calcareous ring and its associated structures are only present in the Banda specimen (Figure 8A); the Molo Strait specimen lacks the calcareous ring. The calcareous ring and ossicles of the Banda specimen illustrated in Figure 8 are copied from Sluiter's figure, whereas those from the current specimen are illustrated in Fig. 9. It is apparent from Sluiter's figure that all his illustrated ossicles came from the Banda specimen, except for a single large plate (Figure 8G) which presumably came from the Molo Strait specimen. The large plate of the Molo Strait specimen I examined is here illustrated in Figure 8F). From this it is apparent that both Sluiter's specimens are not conspecific and the Molo Strait specimen may represent another species but its lack of the calcareous ring prevents any identification. The Banda specimen is therefore here designated the lectotype. The plate illustrated by Sluiter (1901) (Figure 8G) and herein from the Molo Strait specimen (Figure 8F) are larger, overlapping and often broken. The calcareous ring (Figure 8A) of the Banda specimen is of the typical Thyonidae type with a tube broken into a mosaic and processes of the radial plates long, distally coiled and also subdivided. The present USNM specimen appears to be a true *Thyone vilis* and there is no doubt that it is the second record of this species, judging from the literature at hand. Although correctly identified by Deichmann, it is regrettable this record was not published.

***Thyone* ?n. sp.**
Figure 10

Material examined: USNM E51306, North Pacific Ocean, Gulf of California, Mexico, Sonora; Choya; sta 67149 (31° 19' N, 113° 41' W), 65 ft, 21 Oct 1967, Col: Burch, B. & Burch T., Acc. no: 300062, det. *Thyone* sp.?, C. Gust Ahearn, 1 spec.

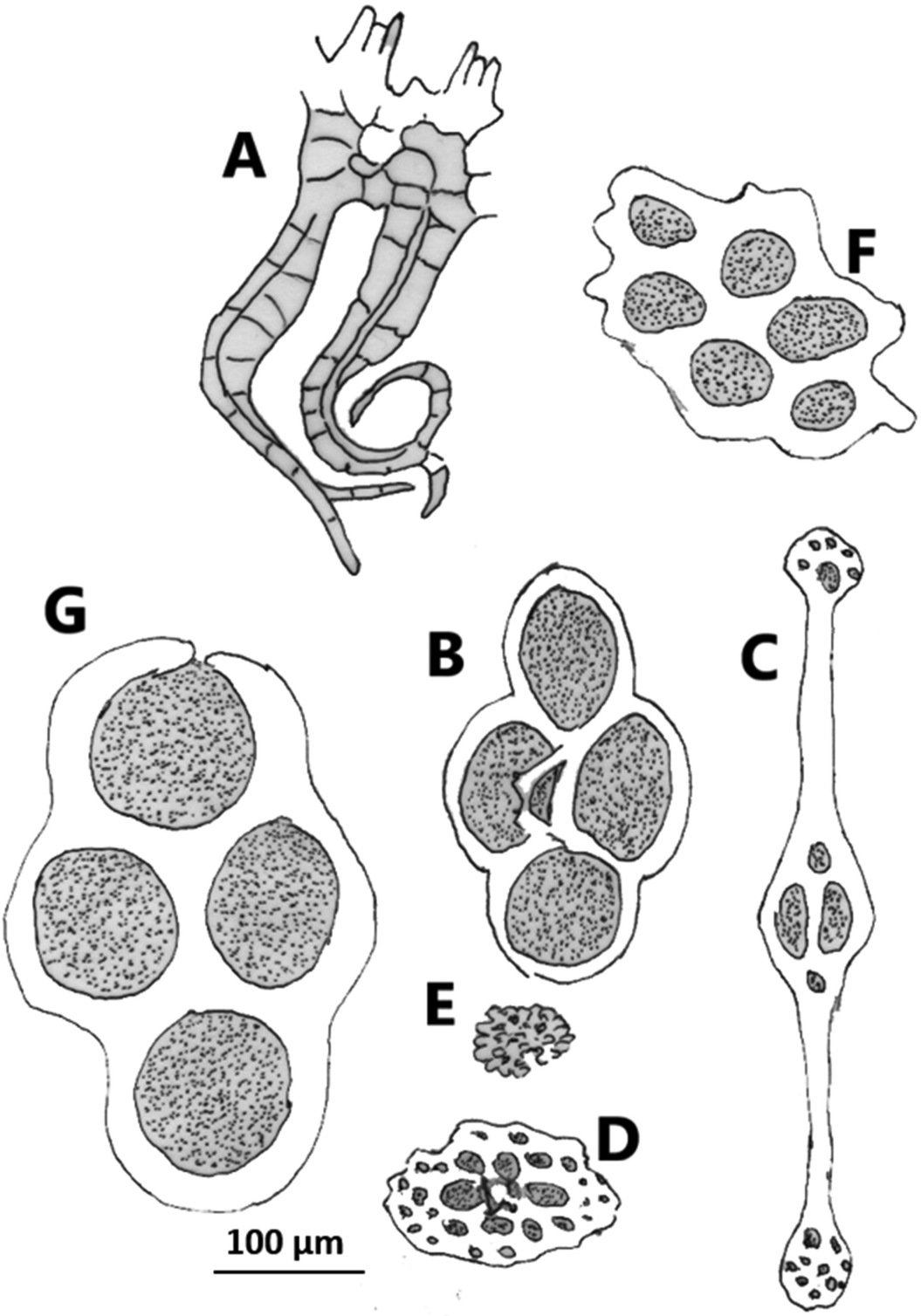

FIGURE 8. *Thyone vilis* Sluiter, 1910. Lectotype, ZMUA, H1114. A. Calcareous ring (middorsal view); B. Table from body wall; C. Rod from tube foot.; D. Table from introvert; E. Rosette from introvert; G. Plate of ?Molo Strait specimen. (A–G copied from Sluiter 1910); F. Plate from Molo Strait specimen (author's examination). (All ossicles to same scale).

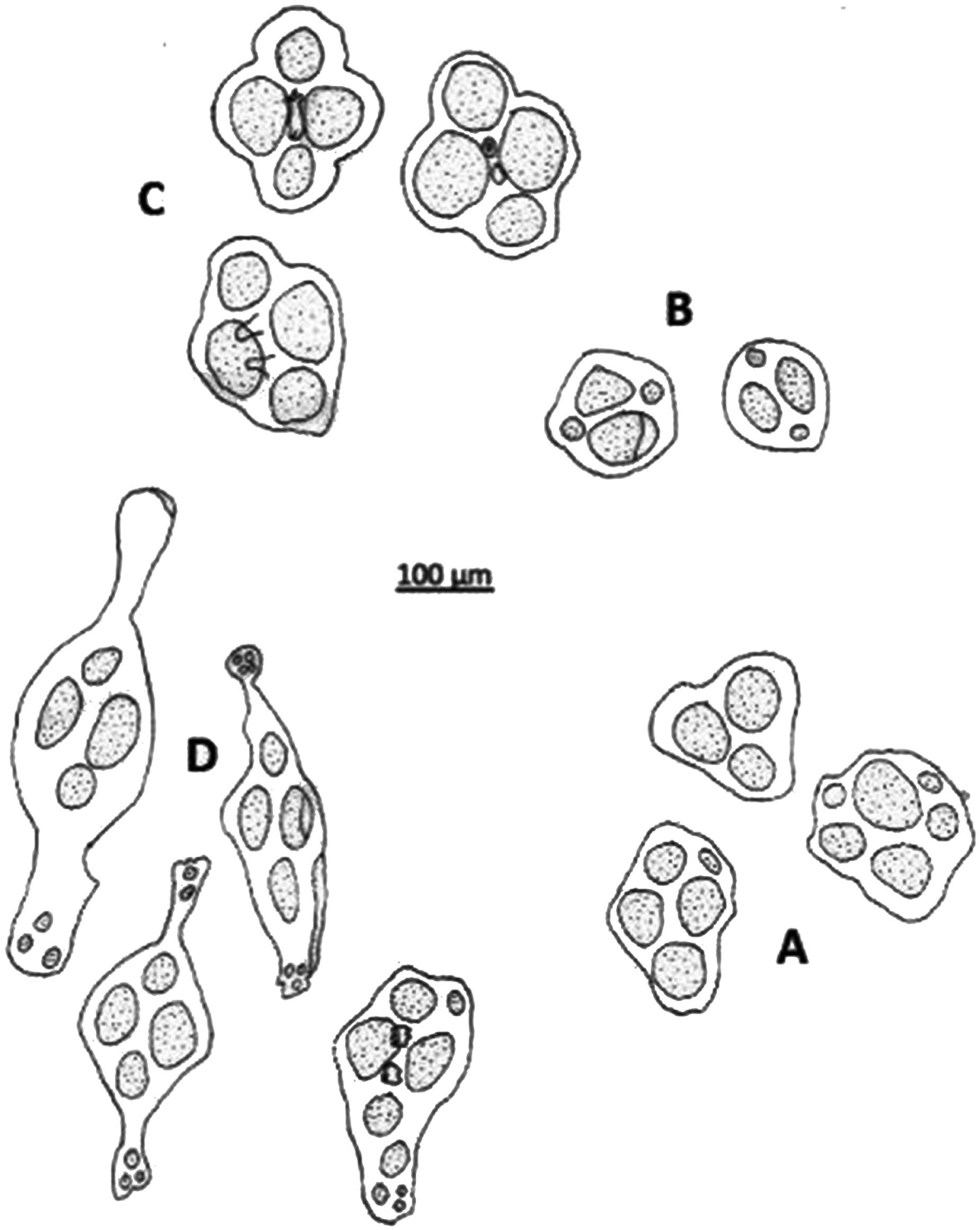

FIGURE 9. *Thyone vilis* Sluiter, 1910. USNM E48738 A, B & C. Regular, irregular and round tables of body wall; D.Tube feet deposits.

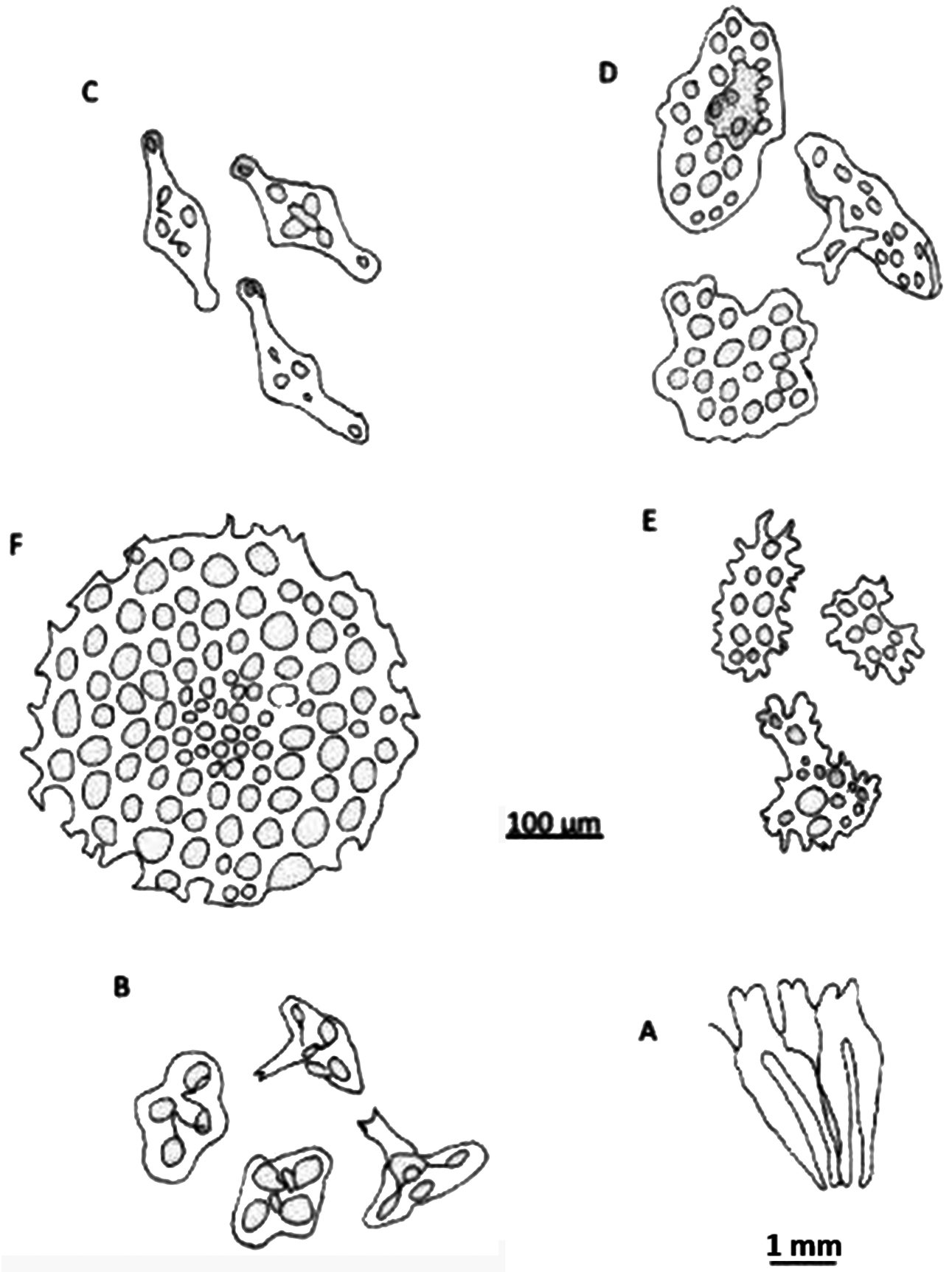

FIGURE 10. *Thyone* **?n.sp.** A. Calcareous ring; B. Body wall tables; C. Tube feet deposits; D. Introvert tables; E. Tentacle ossicles; F. Tube foot end plates.(All ossicles to same scale).

Description. Specimen small, perhaps juvenile, previously dissected, with introvert and tentacles expelled but still attached to body. Length 10 mm, breadth in mid-body about 5 mm, preserved colour whitish. Body somewhat barrel-shaped with mouth and anus at opposite ends with the mid-ventral ambulacrum appearing as a sole lacking tube feet. Tube feet elsewhere well-developed, mostly confined to the remaining four ambulacra with a few also scattered in the inter-ambulacra, short, suckers more or less of the same diameter as tube feet. Anal teeth present. Calcareous ring (Figure 10A) well calcified with deeply cleft radial plates and both radial and interradial plates anteriorly bifid with the latter slightly fused to radial plates. Tube of calcareous ring short, fragmentation of the ring and the processes not discernible perhaps because of the presumed juvenility of the specimen. Polian vesicle single, sac-like; stone canal short, straight, free; madreporite kidney-shaped. Other internal organs lost, perhaps due to evisceration or previous dissection.

Ossicles of body wall comprise tables (Figure 10B) with disc of usually four holes, spire short or elongated, ending in two teeth, some with a spire diverging into two denticulate arms (note by first examiner Gust Ahearn). Tube feet tables (Figure 10C) typically of the *Thyone* type with the disc straight or slightly curved and the spire, when present, reduced or elongated, terminating in two diverging teeth; disc with four central holes and one at each extremity. End plates present (Figure 10F), well-formed with few minute central holes and several concentric circles of larger holes around these. Introvert deposits (Figure 10D) comprise well-developed tables with multilocular disc and short bidentate spire, spire sometimes absent, then tables resembling multilocular plates. Tentacle deposits as minute plates with several holes and a jagged margin (Figure 10E).

Remarks. Because of the singularity and presumed juvenility of the specimen it was not possible to determine its exact identity. The calcareous ring is clearly like all East Pacific species of *Thyone* in being deeply cleft but the tentacle and introvert deposits indicate that the current specimen perhaps belong to a species not yet described. Since many holothuroids can lose or modify their deposits with age (see Thandar 1987, 1991, Massin 1992, Martins 2019), describing the single, perhaps juvenile individual as a new species is not here exercised. Although the body wall table discs may match those of *Thyone bidentata* Deichmann, 1941, known from California to Columbia, it differs in the spire of the tables and the absence of rosettes in the tentacles, unless by some stretch of imagination the minute plates were considered to be rosettes by Deichmann (1941) but regrettably they were not illustrated. The tube feet table discs are also less curved in the current material and their spire short and not bidentate. The specimen also comes quite close to *T. benti* Deichmann, 1937 from the Californian coast but differs in the absence of any bifurcations to the anterior tips of the plates of the calcareous ring, the presence of a taller spire to the body wall tables and the absence of rods in the tentacles. One anomaly in the current specimen is the occurrence of the sole-like ventral ambulacrum. Whether this is a consistent feature or an abnormality will have to be determined from new material. It does not seem likely that it is due to preservation.

Conclusions

The nomenclatural changes herein described are as follows: *Havelockia. nozawai* (Mitsukuri, 1912) is transferred to the genus *Sclerothyone* Thandar, 1989, together with *Thyone adinopoda* Pawson & Miller, 1981, based on the structure of the calcareous ring and body wall ossicles; a new genus *Pseudostolus* is erected to accommodate *Stolus rapax* Koehler & Vaney (1908) from Indonesia and *S. kilberti* Rajpal & Thandar, 1999 from South Africa, both characterised by smooth reticulated plates in the body wall, instead of single-layered knobbed deposits; *Thyone parafusus* Deichmann, 1941, *T. pseudofusus* Deichmann, 1930 and *Havelockia uniannulata* (Sluiter, 1914) are transferred to the genus *Stolus*. In addition, a lectotype is designated for *Thyone vilis* (Sluiter, 1901), based on name-bearing type material from Indonesia in the ZMUA and an unpublished record from the Philippine Islands in the USNM; the Caribbean *Stolus cognatus* (Lampert, 1885), is also briefly described and commented on. Finally, a single perhaps juvenile *Thyone* sp. from the Gulf of California is briefly described as *Thyone* ?**n. sp.** as it is quite unlike any currently known species of this genus.

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