

Chiridota durbanensis new species and a new record of *Neothyonidium arthroprocessum* from the east coast of South Africa (Echinodermata: Holothuroidea)

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Three fragments of a new species, referable to the apodid holothuroid genus *Chiridota*, and two specimens and 12 fragments of a phylloporid, referable to *Neothyonidium arthroprocessum*, first described by the writer from False Bay, Western Cape Province, are here described from shallow water off the Bluff in Durban, KwaZulu-Natal. The new apodid, described as *C. durbanensis*, appears to be quite close to *C. furruginea* (Verrill) from the north-west Atlantic waters, differing from it in the apparent absence of wheel papillae, absence of radial muscle deposits and the different form of tentacle deposits. Specimens of *N. arthroprocessum* are much smaller than the type material and show variations in the number and arrangement of tentacles, number of polian vesicles and the size of the spicules, perhaps indicating geographic and/or age variations. The characteristic U-shaped body wall deposits are here reported, for the first time, to be accompanied by their precursors, flat smooth buttons. The transformation of the latter to the U-shaped deposits is discussed. The occurrence of *N. arthroprocessum* from the warm KwaZulu-Natal waters is a noteworthy eastward extension of a species originally thought not to extend beyond False Bay, Western Cape Province.

Introduction

Three fragments of an apodid holothuroid, dredged from shallow water off the Bluff in Durban, are here described as a new species of *Chiridota*, namely *C. durbanensis*. The new species appears to be closely related to *C. furruginea* (Verrill) from the American north-west Atlantic waters and probably also to *C. pacifica* (Ohshima) from Japanese north-west Pacific waters.

Thandar (1989) described the phylloporid holothuroid, *Neothyonidium arthroprocessum*, based on two large specimens from False Bay, South Africa. Both specimens were eviscerated with the calcareous ring present only in the holotype (female). This unusual species is characterized by four series of transverse slits along the ventral and ventro-lateral interradii in the holotype, a tubular calcareous ring in which the posterior processes of each radial plate are linked to those of the neighbouring radial plates to form a calcareous ribbon-like structure beneath the water vascular ring, two rings (10 + 10) of tentacles with the inner ring placed deep within the oral cavity, the paired nature of each respiratory tree and the occurrence of somewhat U-shaped rods as body wall spicules.

It was originally thought that this species might have evolved in the unique conditions of False Bay where there is a seasonal mixing of warm and cold waters. However, two specimens and twelve fragments, collected together with *C. durbanensis*, are also referable to this species. They do differ from the type material in several respects, perhaps indicating age and/or geographic variations, thus necessitating a brief description of the material and amendment of the original diagnosis of the species.

Materials and methods

Material stems from collections done during sand-pumping operations off the Bluff in Durban. The new species, *C. durbanensis*, is in three fragments while *Neothyonidium arthroprocessum* is represented by two intact specimens and 12 fragments. A third species from the same collection was recently described by the writer as *Phylloporus (Phyllophorella) rosetta* (Thandar 1994). The material is deposited in

the South African Museum with SAM-A catalogue numbers.

The specimens were studied by conventional methods. The spicules were removed in household bleach, washed in distilled water, passed through a series of alcohols and illustrated with the camera lucida. For scanning electron microscopy the spicules were transferred together with a little alcohol onto a specimen stub, to which they normally adhere once the alcohol evaporates, sputter-coated with gold and photographed using a Philips SEM 500.

Chiridota durbanensis sp. nov. (Figures 1 & 2)

Diagnosis

Body cylindrical, length over 100 mm (?). Colour pinkish-grey in alcohol. Papillae numerous, crowded. Tentacles equal, with 7–8 pairs of digits. Polian vesicle and stone canal single. Deposits of body wall exclusively slender, curved rods (36–72 µm in length, mean 50.86 µm) with forked ends, not swollen in middle. No miliary granules in radial muscles. Tentacles with oval to elongate miliary granules.

Type

South African Museum, SAM-A 27712.

Type locality

Cave Rock, off Bluff in Durban, South Africa (30°S 31°E), 20 m.

Etymology

The species is named after its type locality.

Description

The three fragments measure 20 mm, 55 mm and 10.5 mm in length and about 6 mm in breadth. If they all belonged together, it can be assumed that the specimen was approximately 111 mm long. The anterior fragment (20 mm in length) is characterized by the presence of tentacles, some of which are visible through the mouth. Colour, in alcohol, pinkish to grey-brown. Body form cylindrical; body wall translucent, longitudinal muscles clearly visible through it. Papillae, well defined, numerous, crowded, evenly distributed in both radii and interradii. Wheel papillae absent. Mouth stellate.

Tentacles 12, equal, digits 7–8 pairs, sometimes unequal on both sides of a single tentacle. Internal organs lost except for calcareous ring and associated structures.

Calcareous ring as illustrated (Figure 1c), radial and interradial plates, with deep anterior concavities for insertion of tentacles, posterior margin of ring gently undulating; radial plates not perforated for radial nerves. Polian vesicle single, elongated, distally pyriform. Stone canal long, thin, convoluted, white. Madreporite not seen.

Spicules of body wall (Figures 1a & 2), exclusively slender, curved rods, measuring 36.0–71.4 μm in length (mean 50.86 μm) with forked or triforked ends and without a central thickening. No radial muscle deposits. Smooth, oval to elongate miliary granules in tentacles, up to 50 μm in length (Figure 1b).

Distribution

Known only from type locality.

Remarks

Because of the absence of wheels the new species was initially referred to *Toxodora*, a poorly known genus characterized by the presence of only *Chiridota*-like rods in the body wall. *Toxodora* was erected by Verrill (1882) for his *T. ferruginea*, first described from the coast of New England, USA. Théel (1886) considered the species to be a *Chiridota*, suspecting that the wheels might have dissolved in alcohol, and hence referred it to this genus. The species has subsequently been referred to *Anapta* by Ludwig (1892) and *Sigmodota* by Oestergren (1898), until Clark (1907) revived the name *Toxodora* for Verrill's species. Since then one other species, namely *T. pacifica*, was recorded from Suruga Bay, Japan, by Ohshima (1914) and described the following year (Ohshima 1915). Regrettably the paratypes of *T. ferruginea* are no longer extant but Pawson (personal communication) states that he had the opportunity at some time to study some specimens of this species in which he found scarce wheel papillae. He is therefore convinced that *T. ferruginea* is a *Chiridota* with few or no wheel papillae and I respect his judgement. Pawson (personal communication) is therefore of the opinion that his *Chiridota wigleyi*, described from the eastern USA (Pawson 1976) and characterized by sparsely scattered

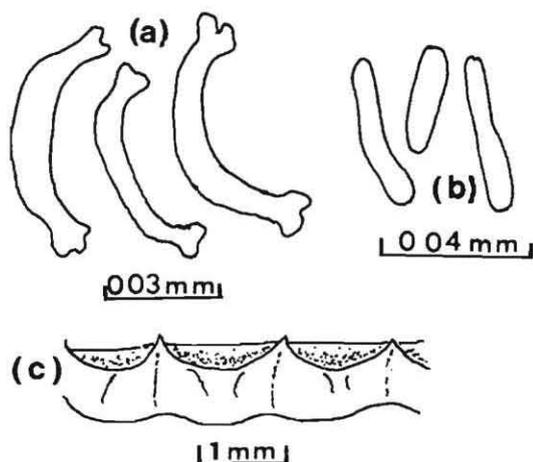


Figure 1 *Chiridota durbanensis* sp. nov. (a) rods from body wall; (b) miliary granules from tentacles; (c) part of calcareous ring.

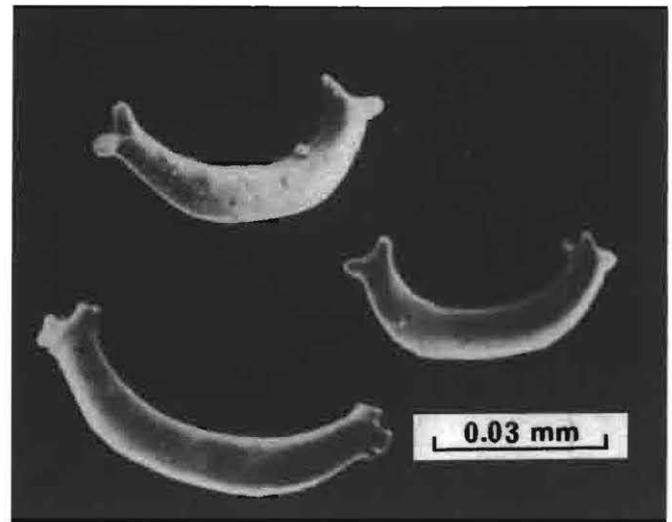


Figure 2 SE micrograph of body wall rods of *Chiridota durbanensis* sp. nov.

wheels in the dorsal interradial, is therefore a junior subjective synonym of *C. ferruginea*.

Verrill's (1882) description of his species is very brief. The type was described as being 30 mm long, reddish brown in colour, with rods measuring about 60 μm . Pawson's *C. wigleyi*, based on 21 specimens, measured 25–144 mm and possessed in addition to a few wheels, both curved rods up to 80 μm in length (mean 63 μm) in the body wall and elongate miliary granules, up to 100 μm , in the radial muscles. The tentacles had 5–7 pairs of digits and possessed curved rods, some resembling those of the body wall and others with more ramified terminal branchings. *Toxodora pacifica*, the other species lacking wheels, is described as purplish grey, with three pairs of tentacle digits and six polian vesicles. Its spicules are stated to be 370–665 μm in length, with a mean of 517 μm . These measurements are definitely typographical errors or a slip of the pen as Ohshima's original figure (1915: pl. 11, figure 35) depicts spicules of about 60 μm in length. This view is supported by the fact that Ohshima did not comment on differences in spicule size when he compared his species with *T. ferruginea*.

The body wall rods of *T. pacifica* all possess a central thickening and such rods also occur in the tentacles. Hence Ohshima's species must also be referred to the genus *Chiridota*. The new species described here differs from *C. ferruginea* in its colouration, the absence of radial muscle deposits and different type of tentacle deposits and from *C. pacifica* in the number of tentacle digits and polian vesicles, the absence of a central thickening in the rods and different type of tentacle deposits.

***Neothyonidium arthroprocessum* Thandar, 1989 (Figures 3 and 4)**

Neothyonidium arthroprocessum Thandar, 1989:637, Figures 1 & 2

Diagnosis (after Thandar 1989, amended herein)

A large, somewhat U-shaped phylloporid holothuroid, up to 270 mm long along ventral surface. Radial plates of calcareous ring prolonged posteriorly into bifurcate processes, each united with the adjacent process of the neighbouring plate.

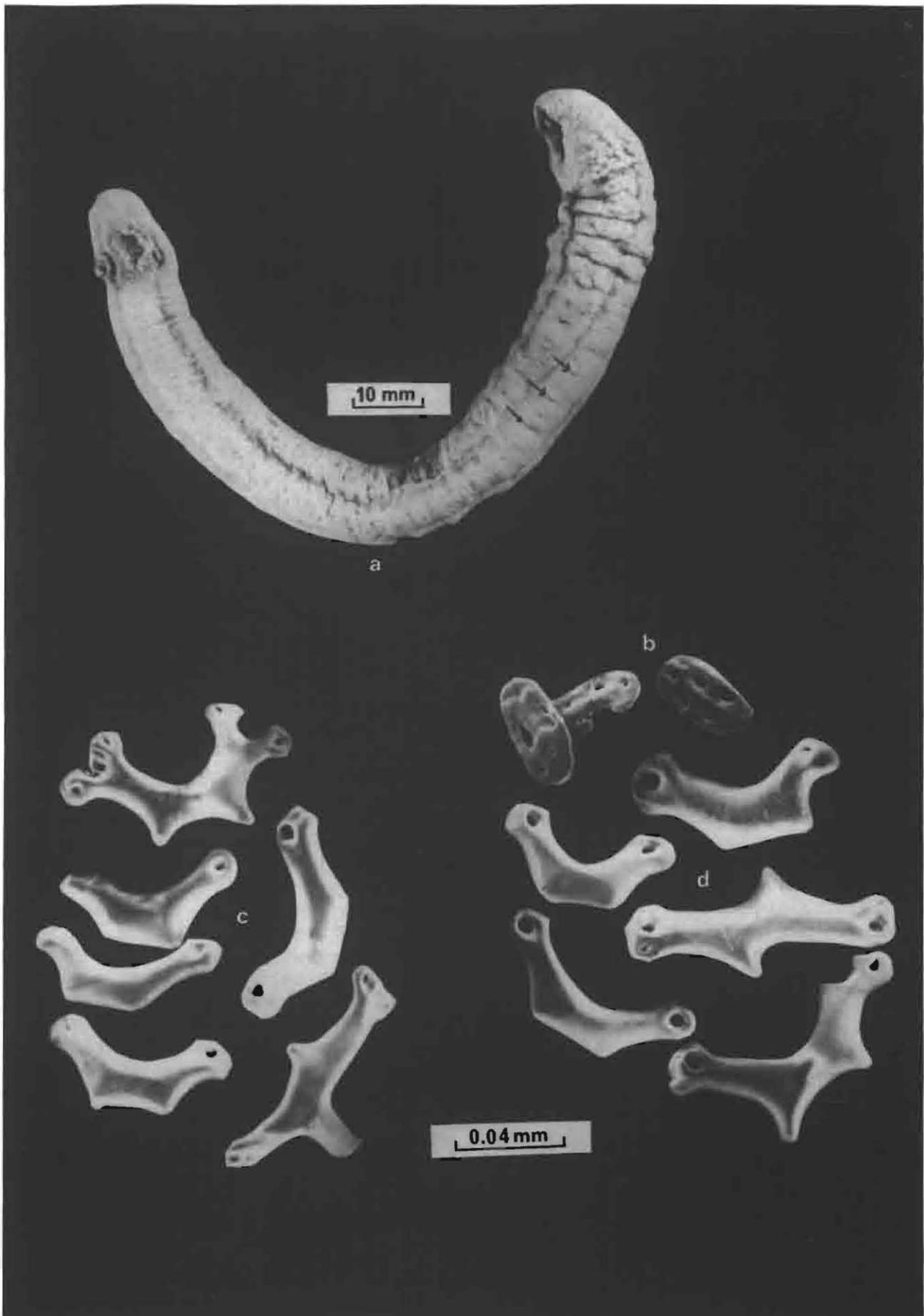


Figure 3 *Neothyonidium arthroprocessum* Thandar. (a) entire (lateral view), (arrows indicate transverse slits); (b–d) SE micrograph of body wall spicules; (b) buttons; (c) rods from dorsal surface; (d) same from ventral surface.

Spicules of body wall short, thick, somewhat U-shaped rods and their precursors regular, flat, smooth buttons with 3–5 pairs of holes. Introvert deposits as rods, rosettes and often low, two-pillared tables.

Material examined

Cave rock, off Bluff, Durban, South Africa (30°S 31°E), sand-pumping dredge Atlantique, 20 m, P. Fleischek, August 1982, deposited South African Museum (SAM), two specimens and 12 fragments; SAM-A27713; holotype (female), UCT, FAL 963W, 22 Dec. 1969, Fish Hoek Bay, False Bay, South Africa, 12 m, SAM-A 22654; paratype (male), 1 May 1963, Muizenberg Beach, False Bay, same number as holotype.

Description

Larger of two unfragmented specimens eviscerated, except for the retractor muscles and respiratory trees; smaller specimen intact but with tentacles withdrawn. The 12 fragments perhaps belonged to five other individuals, judging from the number of anterior fragments. Of the latter only two possess calcareous rings but these two fragments have turned inside out, either due to trauma the animals were subjected to during sand-pumping operations, or to their initial immersion in formalin while still alive.

Larger, intact animal (Figure 3a) U-shaped; length along ventral surface 155 mm, width in mid-body 11.5 mm. Smaller intact specimen straight, about 40.5 mm in length and 9.5 mm in diameter in mid-body. Length of 12 fragments as follows: 62.4 mm, 52.9 mm, 42.2 mm (with calcareous ring), 41.8 mm (with calcareous ring), 40.3 mm, 32.2 mm, 31.9 mm, 30.5 mm (anterior fragment), 28.6 mm, 25.1 mm (anterior fragment), 20.4 mm (anterior fragment), 19.2 mm.

All specimens, including fragments, a dull greyish-brown in alcohol. External morphology typical of species. Transverse slits observed only in larger of the two complete specimens (Figure 3a). Tentacles 17–23 (retracted in all three specimens with intact calcareous rings), in two closely set rings of approximately 10 + 10, outer ring comprising large bushy tentacles of unequal size; inner ring of minute, less bushy tentacles (Figure 4h). Calcareous ring as in holotype, posterior processes of radials linked to processes of adjoining radial plates. Polian vesicle single, ventral. Stone canal straight, free; madreporic body oblong, well calcified. Cloaca elongate. Respiratory trees, preserved only in the two unfragmented specimens, as in holotype.

Spicules of body wall of two types: large, stout, usually U-shaped rods with terminal perforations (Figures 3c, d & 4a, b & d) and their precursors — flat, button-shaped, two-dimensional deposits with one or two series of holes (Figures 3b & 4c). Pedicels with narrow, terminally perforated and digitated rods (Figure 4e), surrounding well-developed end plates. Tentacles with slender, straight or slightly curved rods with terminal perforations (Figure 4f). Introvert deposits (Figure 4g) reduced tables with low, two pillared spires and circular perforated discs, rosettes and rosette-shaped rods; tables absent in one specimen.

Changes in form of the body wall spicules with age (Figure 4i)

Of the two types of body wall spicules found in this species, it

is obvious that the buttons are the precursors of rods. The buttons are initially fairly regular with 3–5 pairs of holes. As development proceeds (Figure 4i) they become constricted in the middle producing spectacle-shaped rods with 3–5 holes at each end. With age, the rods increase in length and breadth, with the terminal ends becoming lobed or digitated owing to the disintegration of some of the holes. The rods now appear bone-shaped. Further development results in the curving of the rods to make them somewhat U-shaped with one or two perforations at each end. The perforations then become gradually occluded owing to more calcium deposition while the middle of each rod remains straight or becomes concave, usually leaving a sharp projection at each end. For the purpose of recording changes in the dimensions of the spicules with age, what appears significant is the increase in the width of the rods. Since the rods bend with growth a comparison of the lengths of the fully-formed rods is not significant. Therefore, although the length of the rods does increase from 61.6 μm in the 154.3 mm intact specimen, to 126.4 μm in the 250 mm paratype, this increase is not linear as the smallest intact specimen (40.5 mm) has rods with a minimum length of 70.8 μm . However, there are linear changes in the width of the rods with growth, ranging from a mean of 15.1 μm in the smallest specimen, to 23.2 μm in the 270 mm holotype, the largest specimen on record. Since buttons are the precursors of curved rods, the changes in length of these deposits are, however, regular or linear, varying from 23.3 μm in the smallest specimen to 64.4 μm in the paratype (250 mm).

No buttons were detected in a re-examination of the 270 mm holotype since, it is here assumed, growth has stopped and all the buttons have already been transformed to rods. From the dimensions here given it is apparent that buttons above 65 μm are transformed into rods, the transformation beginning at about 50 μm .

Remarks

The specimens at hand are clearly referable to *Neothyonidium arthroprocessum* Thandar, 1989. However, they differ from the type material in several respects, perhaps indicating geographic and/or age variations. These differences in the more recent material include the close proximity of the two circles of tentacles, the variation in the size of the tentacles of especially the outer ring, and the reduced number of polian vesicles. This may justify a subspecific separation of the two forms. However, owing to the poor quality and lack of a full size-range of specimens from the KwaZulu-Natal coast, the lack of more material from False Bay and the absence of material between these two localities which may reveal transitional forms, it was thought unwise at this stage to separate the two forms. The two types of body wall deposits also occur in the paratype from which the buttons were originally overlooked. Buttons are precursors of rods and their absence from the holotype is perhaps indicative of the advanced age of this specimen in which it is presumed that all have already been converted to rods. This is supported by the occlusion of the holes of the rods in this specimen when compared with the paratype. Contrary to what Thandar (1989) suspected, the rods are not table but button derivatives. Since tables are characteristic body wall deposits of the genus *Neothyonidium*, their absence may justify the erection of a new genus for the

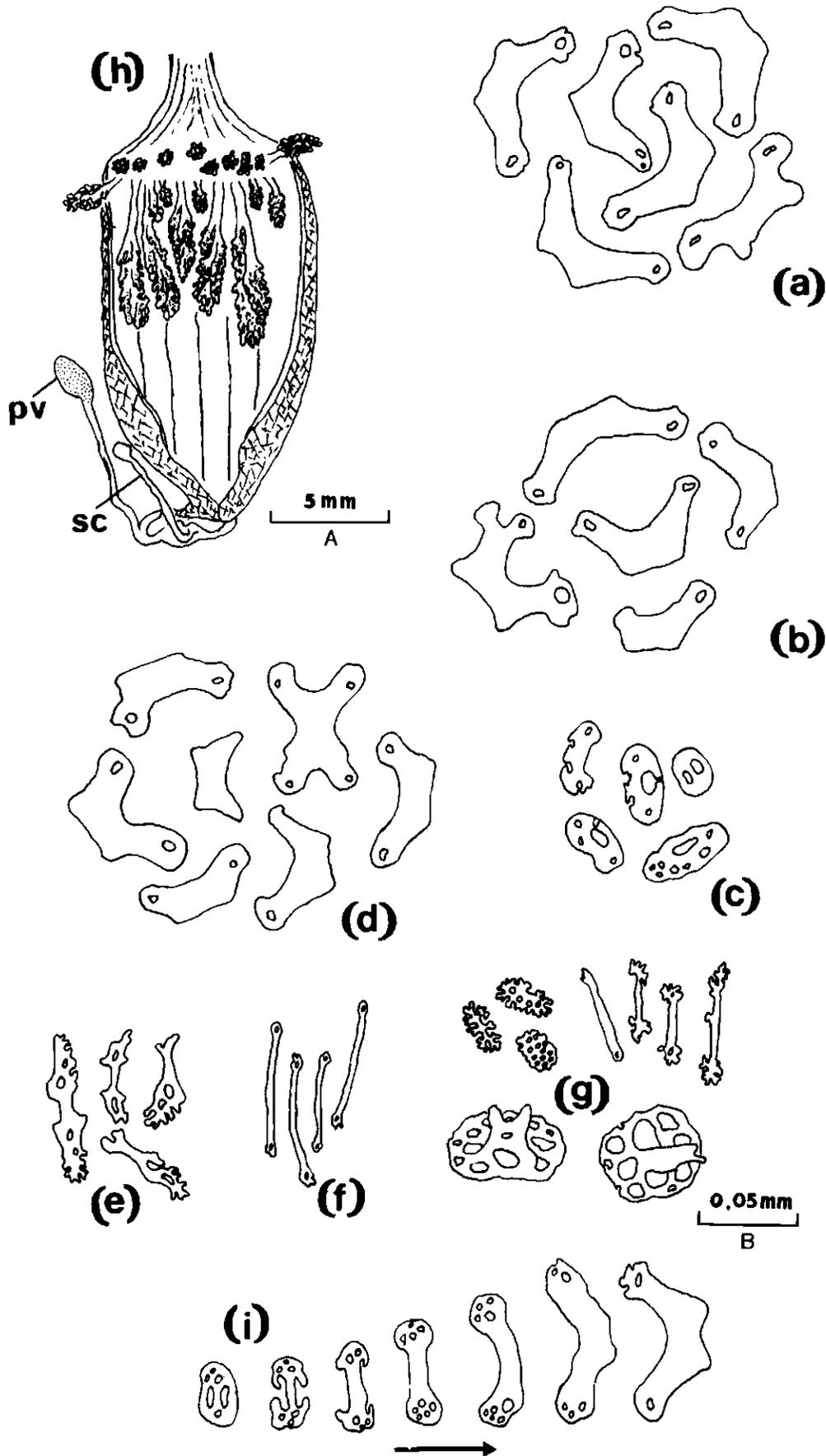


Figure 4 Oral structure and spicules of *Neothyonidium arthroprocessum* Thandar: (a) rods from dorsal body wall; (b) same from ventral body wall; (c) buttons from ventral body wall; (d) rods from anal region; (e) pedicel rods; (f) tentacle rods; (g) introvert deposits; (h) calcareous ring slit open to show tentacle arrangement; (i) stages in transformation of a button to rod; pv = polian vesicle; sc = stone canal: (a-g, i — scale B).

southern African material. However, since characteristic *Neothyonidium*-like tables are present in the introvert, this step is here not taken.

Acknowledgements

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