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STUDIES ON INDIAN ECHINODERMS - 15. ON *PSOLUS MANNARENSIS* SP. NOV. AND OTHER DENDROCHIROTIDS FROM THE INDIAN SEAS*

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ABSTRACT

In this paper eleven species of Dendrochirotids belonging to eleven genera are described. *Psolus camplanatus* deposited in the Madras Museum on re-examination was found to be a new species and is described here as *Psolus mannarensis*. Notes on the habits of some of the species is given for the first time. Remarks on zoogeography are added at the end of the paper.

INTRODUCTION

INFORMATION on the Dendrochirotids is very scanty and scattered due to their restricted distribution. In this connection mention may be made of the papers of Bell (1889), Thurston (1890), Koehlar and Vaney (1908), Gravely (1927, 1941), Chhapgar (1962), James (1969, 1983, 1985) and Mary Bai (1980) where some Dendrochirotids are listed. The author has described four species in detail from the Gulf of Mannar (James, 1965, 1966, 1975). In the present paper detailed descriptions of the other species with notes on the habits are given. Some remarks on the zoogeography of the species are given at the end of the paper.

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ORDER : DENDROCHIROTIDA

Members of this Order have branched tentacles which lack conspicuous ampullae. Gonadial tubules are arranged in two tufts on either side of the dorsal mesentery. Respiratory trees present, but Cuvierian tubules are absent.

Members belonging to three Families are known from the Indian Seas. Species belonging to all the three Families have been collected.

KEY TO THE FAMILIES

1. Ventral surface modified into a creeping sole; dorsal surface naked with large scales; tentacles usually ten, two midventral ones small; calcareous ring simple without posterior prolongations..... *Psolidae*

1'. Ventral side not differentiated into sole; scales absent; tentacles 10-30 2

2. Tentacles ten in number arranged in a single circle; ambulacral appendages usually restricted to ambulacra; calcareous ring usually simple without posterior prolongations ..... *Cucumariidae*

2'. Tentacles more than ten arranged in two circles; ambulacral appendages usually distributed all over the body; calcareous

ring with many pieces and prolongations ..... *Phyllophoridae*

Family : Psolidae

This family has one genus *Psolus* represented in the Indian Seas.

Genus *Psolus* Oken

Psolus camplanatus Semper was reported from the Gulf of Mannar by Gravely (1927) and Satyamurty (1976). This specimen deposited in the Madras Museum, has been re-examined by the author and was found to be different from *P. camplanatus*. It is described here as a new species.

Psolus mannarensis sp. nov. (Fig. 1 a)

Psolus camplanatus Gravely, 1927, p. 166: Gulf of Mannar. Satyamurti, 1976, p. 38: Pamban (Gulf of Mannar.) (Non *P. camplanatus* Semper, 1868.

Material: Pamban (Gulf of Mannar) 1 specimen.

Description: Length 15 mm. Body very much flattened and depressed. Tentacles ten in number and fairly well extended. In lateral ambulacra there are four to six rows of pedicels and in the middle one, two or three complete rows. On dorsal side of body 14 to 16 scales across the body. Between mouth and cloaca 10 to 12 large and small scales. Scales slightly granulated.

Calcareous ring has ten pieces which are abruptly truncated at distal end. Radials are longer and deeply notched at middle. Interradials stout and pointed anteriorly.

Spicules (Fig. 1 a) are of three types : buttons, supporting plates and linear bodies.

Buttons: Both regular and irregular types, present in sole. Regular buttons oval in shape with 8 to 10 knobs. Usual number of knobs ten. At centre of buttons there are four holes. Length of regular buttons varies from 0.047 to 0.109 mm and breadth varies from 0.047 to 0.078 mm. Irregular buttons lack knobs. 4 to 11 holes at the centre of buttons, usually four.

Supporting plates: Present in pedicels; fusiform in shape with large holes at centre and smaller ones at ends. Usually four large holes at centre. Length of supporting plates varies from 0.125 to 0.251 mm and breadth varies from 0.047 mm to 0.094 mm.

Linear bodies: Fusiform in shape with four or five bands over them. Length of linear bodies varies from 0.062 to 0.125 mm and breadth 0.031 mm.

Gravely (1927) has stated that the colour is mottled dark greyish above and whitish on the ventral side.

Remarks: The present species is closely related to *P. complanatus* in its form and arrangement of pedicels. However the spicules are different. It also differs from *P. boholensis* in the absence of rosette like spicules. The regular buttons and the linear bodies are characteristic of the present new species. It is named after its area of collection.

Family : Cucumariidae

Twelve genera are known from the Indian Seas of which six are collected and described in the present paper.

KEY TO THE GENERA

1. Calcareous ring without posterior prolongations 2

1'. Calcareous ring with distinct posterior prolongations 4

2. Body elongated, curved and pentagonal with double rows of pedicels and single row of papillae along each ambulacrum; body wall firm..... .....*Leptopentacta* H. L. Clark, 1938.

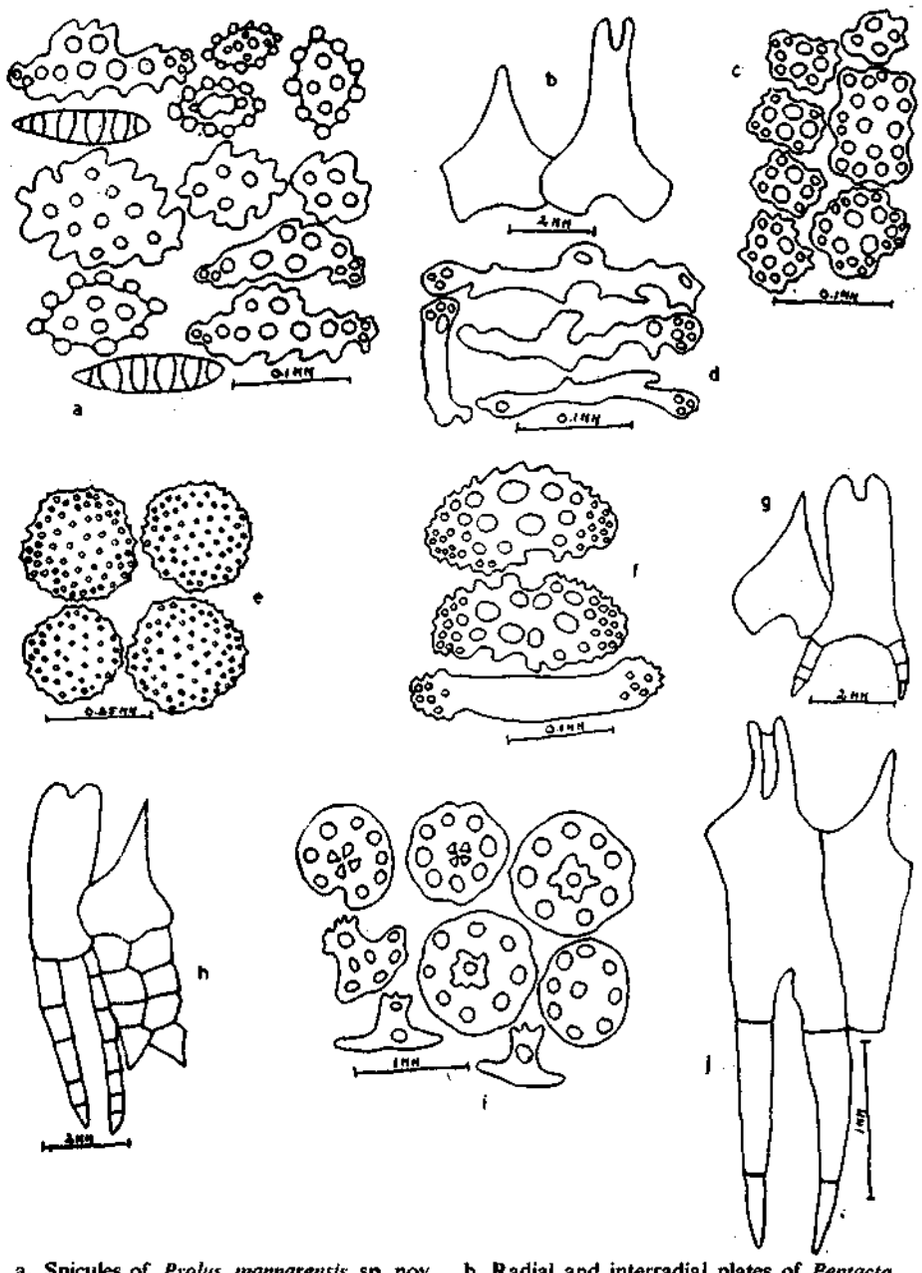

Fig. 1 a. Spicules of *Psolus mannarensis* sp. nov., b. Radial and interradial plates of *Pentacta quadrangularis*, c. Tubefeet, d. spicules of *P. quadrangularis*, e. Body wall spicules of *Afrocucumis africana*; Tubefeet spicules of *A. africana*; g. Radial and interradial plates of *A. africana*; h. Radial and interradial plates of *Phyrella fragilis*; i. Spicules of *P. fragilis* and j. Radial and interradial plates of *Havelockia versicolor*.

2. Body robust with pedicels arranged in three rows or bands on the ventral side; body wall not firm 3

3. Body quadrangular in cross section; pedicels in three bands on the flattened ventral surface; papillae usually large and conical

.....
.....*Pentacta* Goldfuss, 1820

3'. Body cucumber-like; pedicels in three distinct rows ventrally; papillae small and scattered dorsally.....
.....*Pseudocolochirus* Pearson, 1910

4. Pedicels generally restricted to double rows on the ventral side; body pentagonal in cross section.....
.....*Hemithyone* Pawson, 1963

4'. Pedicels and papillae not restricted to rows or bands body circular in cross section
.....5

5. Posterior prolongations of calcareous ring with many pieces.....
.....*Stolus* Selenka, 1867

5'. Posterior prolongations of calcareous ring with fewer number of pieces.....
.....*Havelo ckia* Pearson, 1903

Genus *Leptopentacta* H. L. Clark, 1938

Only one species is known from the Indian Seas.

Leptopentacta javanicus (Sluiter)
(Pl. I A; Fig. 2 a)

Oncus javanicus Sluiter, 1880, p. 9: Java. Ludwig, 1882, p. 134: Java. Bell, 1886, p. 27: Mergui Archipelago.

Oncus sp. Bell, 1884, p. 246: Port Darwin.

Leptopentacta javanicus H. L. Clark, 1938, p. 453. A. M. Clark & Rowe, 1971, p. 180. Mari Bai, 1980, p. 20. Price, 1982, p. 11: South East Arabia. James, 1985, p. 580: Lakshadweep & Maldives.

Material: Pamban (Gulf of Mannar) 1 specimen; Neendakara (West coast of India) 1 specimen.

Description: Length 30 and 45 mm. Body elongated and slender (Pl. I A). Both specimens stiff and curved. Body wall firm and rigid; posterior end more pointed than anterior end. Podia arranged in five rows, but not dense in distribution. In larger specimen 22 pedicels in a row. Tentacles ten in number of which ventral two small. Calcareous ring has no posterior prolongations.

Spicules (Fig. 2 a) consist of smooth buttons mostly with four holes. Some of buttons are roughly circular or irregular in shape with five to seven holes.

Distribution: It is known from the South East Arabia, Maldives, Bay of Bengal and East Indies. It is reported here for the first time from the Arabian Sea.

Genus *Pentacta* Goldfuss, 1820

Three species are known under this genus from the Indian Seas of which one has been collected and described in this paper.

KEY TO THE SPECIES

1. Dorsal papillae in regular longitudinal series on ambulacra.....
.....*P. quadrangularis* (Troschel 1846)

1'. Dorsal papillae not in regular longitudinal series on ambulacra.....2

2. Small baskets with knobs .....
....*P. robusta* (Ostergren, 1898)

2'. Small baskets without knobs.....
..... *P. cucumis* (Semper, 1868)

Pentacta quadrangularis (Troschel)
(Fig. 1. b – d)

Colochirus quadrangularis Troschel, 1846, p. 84. (Non *Holothuria quadrangularis* Lesson, 1830, p. 90). Selenka, 1868, p. 112. Semper, 1868, p. 60: Philippines. Theel, 1882, p. 121: Hong Kongt Siam, Australia. Ludwig, 1882, p. 131: East Indies. Bell, 1889, p. 7: Gulf of Mannar. Thurston, 1890, p. 113: Gulf of Mannar. Thurston, 1894, p. 115: Tuticorin (Gulf of Mannar). Pearson, 1903, p. 196: Sri Lanka. Ekman, 1918, p. 21: Cape Jaubert. Panning, 1949, p. 446: Australia.

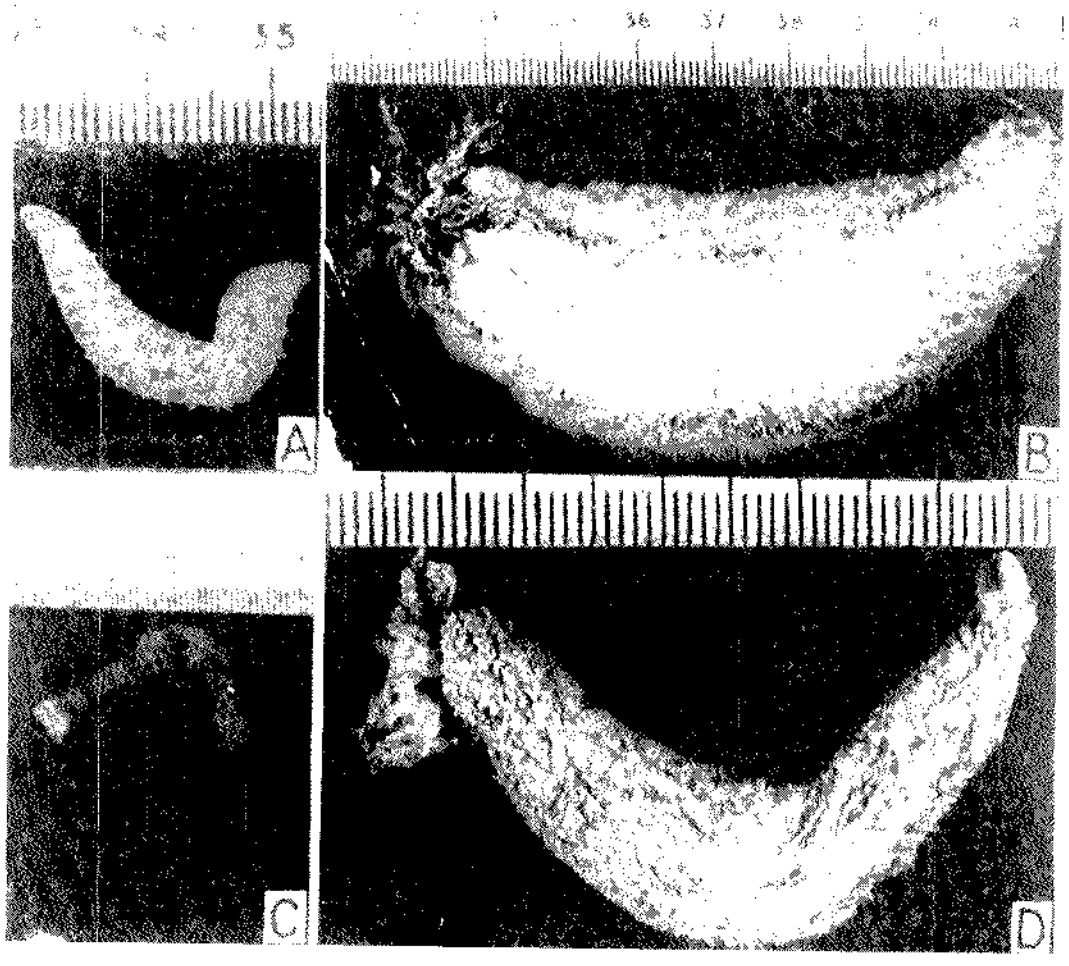

PLATE I A. *Leptopentacta javanicus*, B. *Havelockia versicolor*, C. *Afrocucumis africana* and D. *Phyllophorus (Phyllopharella) parvipedes*.

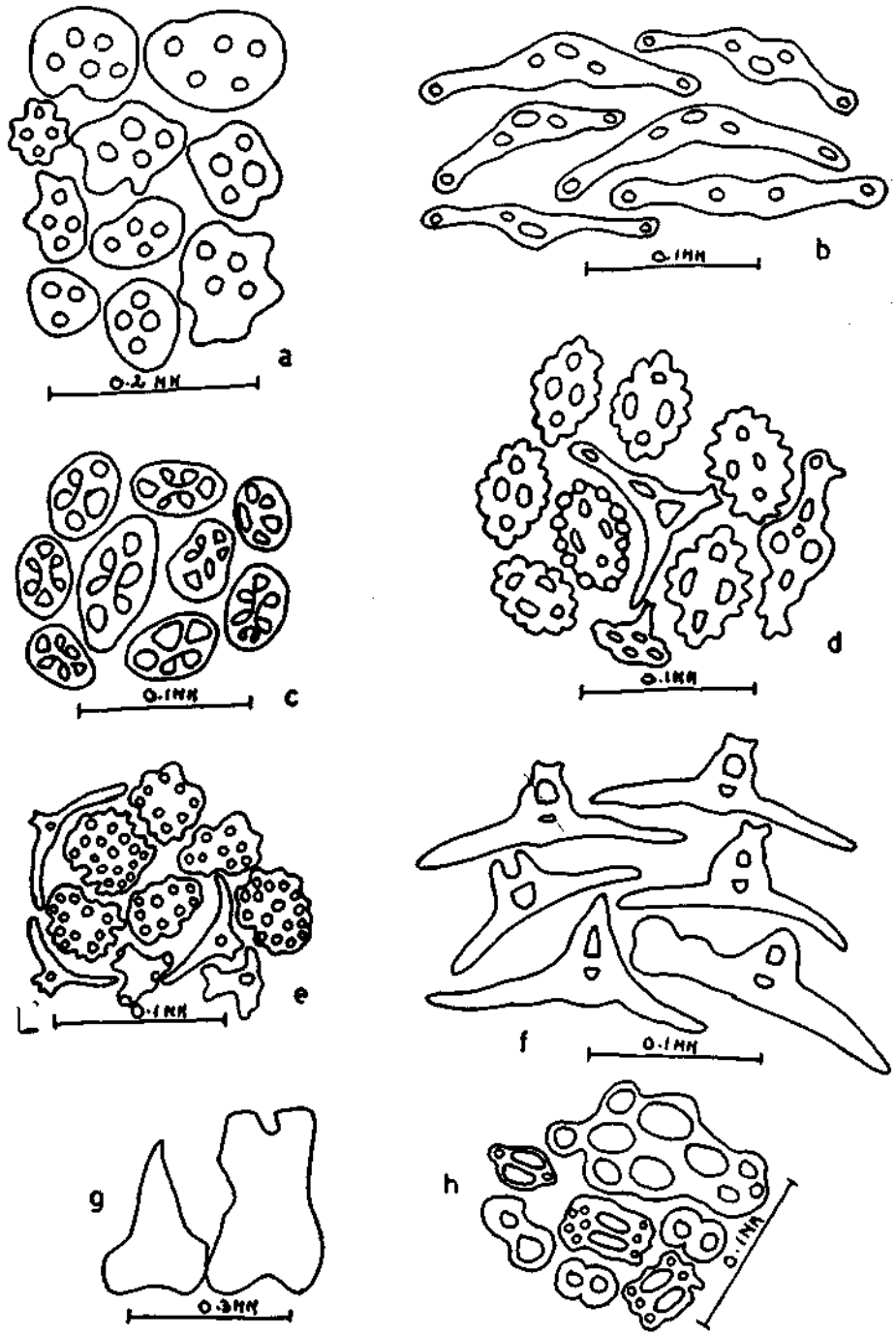

Fig. 2 a. Spicules of *Leptopentacta javanicus*, b. Spicules from tubefeet of *Hemithyone semperi*, c. Spicules from bodywall of *H. semperi*, d. Spicules from young specimen of *Stolus buccalis*, e. Spicules of *Stolus* sp., f. Spicules from tubefeet of *Actinocucumis typicus*, g. Radial and interradial plates of *A. typicus* and h. Spicules from the bodywall of *A. typicus*.

Colochirus coeruleus Semper, 1868, p. 59: Philippines.

Pentacta coerulea H. L. Clark, 1932, p. 227: Great Barrier Reef. H. L. Clark, 1938, p. 449: Australia.

Pentacta quadrangularis H. L. Clark, 1946, p. 391: Australia. James, 1969, p. 60: Vedalai (Gulf of Mannar). A. M. Clark & Rowe, 1971, p. 180. Satyamurti, 1978, p. 36: Tuticorin (Gulf of Mannar). A. M. Clark, 1980, p. 489: Hong Kong. James, 1985, p. 586: Gulf of Mannar, Sri Lanka.

Material: Vedalai (Gulf of Mannar) 4 specimens, 2-4 metres in depth.

Description: Body quadrangular in shape with anterior end much broader than posterior end. Ten tentacles of which ventral two small. Five blunt valves surrounding tentacles. Papillae conspicuous and arranged in four distinct rows, two rows on dorsolateral margins and two on ventro-lateral margins; arranged almost in a straight line. The size of the papillae varies in different specimens. Generally those present at anterior and posterior ends smaller than others. Each papilla with a small prominence which has a broad base and almost pointed tip. On ventral side pedicels arranged in three distinct bands. Pedicels are arranged from base of posterior-most papilla. Region of valves on anterior sides free from pedicels. Mid-ventrally at anterior and posterior ends a small papilla. In each transverse band four to six rows of pedicels. Anus dorsal in position and surrounded by four short papillae at four corners.

Calcareous ring (Fig. 1 b) devoid of any posterior prolongations. Three pieces on ventral side often narrow. Each radial piece is 5 mm and interradial piece is 4 mm in length in a specimen of 52 mm length. Base of interradial piece broader than base of radial piece. Basal margin of radial more curved than basal margin of interradial. Anterior end of interradial piece narrow and long and bifid at end. A large polian vesicle. Stone canal single and very short. Madreporic body hangs freely inside body.

A single bunch of gonadial tubules situated at left side of dorsal mesentery. Tubules simple elongations without any branchings. Numerous and long, opening into hollow gonadial base attached to mesentery. Gonoduct arises from this common base; very short and opens to outside by gonopores between tentacles and not mounted on agenital papilla.

Spicules (Fig. 1 c, d) consist of buttons and end plates. Inner layer consists of buttons with a varying number of holes. Each button has four large and some small holes. Length of buttons varies from 0.047 mm to 0.078 mm and breadth from 0.031 mm to 0.062 mm. End plates present in pedicels; a single or a few holes at either end.

In living condition uniform orange with dark brown tentacles having yellow mottles. Preserved specimens light brown in colour.

Remarks: The colour in this species seems to vary very much. However the specimens from the Gulf of Mannar appear to be uniform orange since Pearson (1903) also records the same colour from Sri Lanka. This species was never encountered in the intertidal region.

Distribution: It is distributed in Sri Lanka, Bay of Bengal, East Indies, North Australia, Philippines, Japan and China.

Genus *Pseudocolochirus* Pearson, 1910

Only one species is known under this genus from the Indian Seas.

Pseudocolochirus violaceus (Theel)

Colochirus violaceus Theel, 1882, p. 78: Philippines. Koehler & Vaney, 1908, p. 24: Bay of Bengal.

Cucumaria tricolor Pearson, 1903, p. 188: Sri Lanka (Non *Cucumaria tricolor* Sluiter, 1901, p. 81).

Pseudocolochirus violaceus Pearson, 1910, p. 172. James, 1969, p. 60: Mandapam, Pamban (Gulf of Mannar); 1976, p. 59: Gulf of Mannar, Kalingapatnam; Ganjam coast. Off Kalingapatanam; 1985, p. 586: Gulf of Mannar; Sri Lanka. A. M. Clark & Rowe, 1971, p. 180; 1980, p. 489: Hong Kong. Mary Bai, 1980, p. 19.

Material: Mandapam (Gulf of Mannar) 3 specimens, 15 metres depth; Off Kalingapatnam 1 specimen, 20 metres depth; Ganjam Coast 3 specimens, 34 metres.

Description: Detailed description of this species was published by the author in 1976.

Notes on habits: Two specimens of this species were kept alive in an aquarium tank at Mandapam for more than three months. In the living condition they often attach theselves to the corners of the tank with the tentacles withdrawn into the body. Sometimes they were seen with all the tentacles extended out from the introvert evidently to gather planktonic organisms in the water. At the slightest disturbance the tentacles retract into the body.

Distribution: It is reported from the Bay of Bengal, Sri Lanka, East Indies, Hong Kong, Northern Australia, Philippine Islands, China.

Genus *Hemithyone* Pawson, 1963

Only one species is known under this genus.

Hemithyone semperi (Bell) (Fig. 2 b, c)

Cucumaria semperi Bell, 1884, p. 147: Australia. Theel, 1886, p. 104. Bell, 1889, p. 7: Palk Bay. Thurston, 1894, p. 115: Pamban (Gulf of Mannar). H. L. Clark, 1938, p. 445: Australia; 1946, p. 388: Australia.
Cucumaria pigra Koehler & Vaney, 1908, p. 38: Karachi.

Heterothyone semperi Panning, 1949, p. 464.

Heterothyone pigra Panning, 1949, p. 464.

Hemithyone pigra Pawson, 1963, p. 28.

Hemithyone semperi Pawson, 1963, p. 28. James, 1969, p. 60: Pamban (Gulf of Mannar); 1985, p. 582: Gulf of Mannar. A. M. Clark & Rowe, 1971, p. 180. Mary Bai, 1980, p. 21.

Material: Pamban (Gulf of Mannar), 1 specimen, littoral, less than a metre in depth.

Description: Length of specimen 51 mm. Body pentagonal and curved upward at each end. Posterior end gradually tapers whereas anterior end blunt. Podia arranged in five distinct bands along each ambulacra. On ventral side each band consists of a single row of podia. Ten tentacles of which ventral two small.

Calcareous ring long with posterior prolongations. Radials have anterior notch and posterior paired projections composed of several rectangular pieces. Each interradial has two pieces, anterior one has a short projection and posterior one rectangular.

A single polian vesicle and a single stone canal. Genital tubules delicate and attached to dorsal mesentery at about middle of body. Retractors attached a little more than one third the whole length from anterior end.

Spicules (Fig. 2 b, c) consist of oval bodies with four holes at centre and two large holes at each end. Each oval body consists of a central bar connected at either end with peripheral encircling piece by two bars making an acute angle with each other. Some bodies irregular in shape with holes arranged in an irregular manner. Length of bodies varies from 0.035 to 0.070 mm and breadth varies from 0.045 to 0.052 mm. Supporting rods (Fig. 2 b) fusiform with one to three holes at centre and one hole at either end. Length of supporting rods varies from 0.141 to 0.204 mm and breadth *c* 0.031 mm.

In the living condition dull flesh coloured with the pedicels dusky brown.

Distribution: It is known from the East coast of Africa, Pakistan coast, Gulf of Mannar, Bay of Bengal, East Indies, North Australia.

Genus *Stolus* Selenka, 1867

Two species are known under this genus from the Indian Seas. Only *Stolus buccalis* has been collected.

KEY TO THE SPECIES

Podia not restricted to ambulacral areas..... .. ..*Stolus buccalis* (Stimpson, 1855)

Podia generally restricted to the ambulacral areas at least on the dorsal side ....*S. conjugens* (Semper, 1868)

Stolus buccalis (Stimpson) (Fig. 2 d)

Thyone buccalis Stimpson, 1885, p. 386. Theel, 1886, p. 136: Australia. H. L. Clark, 1921, p. 167: Torres Strait; 1938, p. 461: Australia; 1946, p. 401: Australia.

Stolus sacellus Selenka, 1867, p. 355: Zanzibar. Heding, 1940, p. 126: Persian Gulf. Panning, 1949, p. 462: East coast of Africa, Australia. Cherbonnier, 1955, p. 167: Red Sea.

Thyone rigida Semper, 1868, p. 66: Philippines.

Thyone sacellus Bell, 1884, p. 149: Torres Strait; 1886, p. 27: Mergui Archipelago. Sluiter, 1901, p. 33: East Indies. Pearson, 1903, p. 192; Sri Lanka. Ekman, 1918, p. 42: Australia. Gravely, 1927, p. 166: Pamban (Gulf of Mannar); 1941, p. 91: Madras.

Thyone sacella Mitsukuri, 1912, p. 227: Japan.

Stolus buccalis James, 1966, p. 285: Mandapam (Gulf of Mannar & Palk Bay); 1985, p. 586: Gulf of Mannar, Palk Bay, Sri Lanka. Sathyamurti, 1976, p. 28: Pamban (Gulf of Mannar), Rameswaram (Palk Bay). Mary Bai, 1980, p. 20. Price, 1982, p. 11: Arabian Gulf, SE Arabia, Red Sea.

Material: Mandapam (Gulf of Mannar) 3 specimens; Rameswaram (Palk Bay) 2 specimens; Ratnagiri (Arabian Sea) 2 specimens, all, collected from less than one metre depth.

Description: Detailed description of this species was published by James (1966).

Remarks: It is difficult to differentiate this species from *Holothuria (Halodeima) atra* in the field since all the tentacles are withdrawn and the colour looks alike in both the species. In small specimens of this species (15 mm length) the buttons (Fig. 2 d) are smooth without any knobs in most of the cases and also two pillared tables are present. It is interesting to note that small specimens show some resemblance to the genus *Neothyone* Deichmann, 1944 in the shape of their spicules.

Distribution: It is known from the East Coast of Africa, South East Arabia, Persian Gulf, Arabian Sea, Sri Lanka, Bay of Bengal, East Indies, North Australia, Philippines, Japan.

Stolus sp. (Fig. 2 e)

Material: Pamban (Gulf of Mannar) 1 specimen, intertidal.

Description: 15 mm in length. Body cylindrical with anterior end truncated and posterior end tapered. On ventral side pedicels numerous. Pedicels confined to ambulacra on dorsal side. Tentacles ten. Calcareous ring has posterior prolongations on radials which are made up of several small pieces.

Spicules (Fig. 2 e) consist of two pillared tables and plates. Margins of plates wavy in outline with several holes.

Genus *Havelockia* Pearson, 1903

Only one species is known under this genus from the Indian Seas.

Havelockia versicolor (Semper) (Pl. I B; Fig. 1 j)

Thyone versicolor Semper, 1868, p. 14: Philippines.

Thyone mirabilis Sluiter, 1902, p. 93: East Indies. Bell, 1884, p. 149: Australia. Satyamurti, 1976, p. 32: Rameswaram (Palk Bay).

Thyone (?) *calcarea* Pearson, 1903, p. 194: Sri Lanka.

Havelockia herdmani Pearson, 1903, p. 197: Sri Lanka. Koehler & Vaney, 1908, p. 25: Sri Lanka. Panning, 1949, p. 466.

Pentathyone versicolor Panning, 1949, p. 460.
Thyone herdmani James, 1969, p. 60: Mandapam (Gulf of Mannar).

Havelockia versicolor A. M. Clark & Rowe, 1971, p. 180. James, 1976, p. 55: Mandapam (Gulf of Mannar); 1985, p. 586: Gulf of Mannar, Palk Bay, Sri Lanka.

Material: Mandapam (Gulf of Mannar) 2 specimens, 2 metres in depth; Pamban (Gulf of Mannar) 1 specimen labelled as *Thyone mirabilis* in the Madras Museum.

Description: Detailed description of the species was published by James (1976) in which synonymy is discussed in detail.

Distribution: It is known from the Gulf of Mannar, East Indies, North Australia, Philippine Islands.

Family: Phyllophoridae

Four sub-families are known under this family. Species belonging to all the four sub-families have been collected and described in this paper.

KEY TO THE SUB-FAMILIES

1. Calcareous ring without posterior prolongations ..... THYONIDIINAE

1'. Calcareous ring with posterior prolongations 2

2. Posterior prolongations of calcareous ring very short.....CLADOLABINAE

2'. Posterior prolongations of calcareous ring long or moderately long 3

3. Posterior prolongations of calcareous ring modertely long.....PHYLLOPHORINAE

3'. Posterior prolongations of calcareous ring long ..... SEMPERIELLINAE

Sub-Family: Thyonidiinae

Only one genus is known under this sub-family from the Indian Seas.

Genus **Actinocucumis** Ludwig, 1874
(Fig. 2 f–h)

Actinocucumis typicus Ludwig, 1874, p. 91: North Australia. Theel, 1886, p. 84: Guam. Bell, 1889, p. 7: Palk Bay. Sluiter, 1901, p. 142: East Indies. Ekman, 1918, p. 45: North Australia. Gravely, 1927, p. 167: Gulf of Mannar. H. L. Clark, 1938, p. 479: Australia, 1946. p. 403: Australia. Heding & Panning, 1954, p. 72, Sanne & Chhapgar, 1962, p. 673: Bombay, James, 1969, p. 60: Pamban, Mandapam (Gulf of Mannar), Port Okha; 1985, p. 586: Gulf of Mannar, Andaman & Nicobar Islands. A. M. Clark & Rowe, 1971, p. 182. Satyamurti, 1976. p. 33: Pamban (Gulf of Mannar). A. M. Clark, 1980, p. 489: Hong Kong. Mary Bai, 1980, p. 22.

Actinocucumis difficilis Bell, 1884, p. 148: North Australia. Thurston, 1894, p. 115: Pamban (Gulf of Mannar). H. L. Clark, 1938, p. 477: Australia. 1946, p. 403: Australia.

Pseudocucumis quinquangularis Sluiter, 1901, p. 108: East Indies. Engel, 1933, p. 13: East Indies.

Actinocucumis longipeda H. L. Clark, 1938, p. 480: Australia; 1946, p. 404: Australia.

Actinocucumis quinquangularis H. L. Clark, 1946, p. 404: Australia.

Material: Mandapam (Gulf of Mannar) 5 specimens; Ratnagiri (Arabian Sea) 3 specimens; Port Okha (Gulf of Kutch) 1 specimen, all specimens collected from intertidal region.

Description: Length of specimens varied from 31 to 88 mm. Body quadrangular and curved with narrow ends. Podia arranged in five indistinct bands, each band with three to five pedicels arranged side by side. Body covered by well developed conspicuous stiff and non-retractile pedicels. 20 dark tentacles.

Calcareous ring (Fig. 2 g) consists of five radials and five interradials. Radials larger and more or less rectangular in shape with a small notch at anterior margin and with a concavity at posterior margin. Interradials triangular, anterior end of which is drawn to a point and posterior margin concave. A single polian vesicle and a single stone canal.

Spicules (Fig. 2 f, h) consist of plates supporting plates and tables. Plates more or less oval in shape with three or four perforations and between them pairs of elongated perforations. Length of each plate is c 0.046 mm

and the breadth 0.025 mm. In body wall knobbed 8-shaped bodies which are very common. Some of knobs united to form arches across middle line or sometimes longitudinally. Length of 8-shaped bodies varies from 0.037 to 0.050 mm. Tables also vary considerably in shape. Basal plate not straight, but curved slightly away from spire. It is slender throughout, broadest in middle with one or two perforations. Spire slender, conical and more or less incomplete. Apex of incomplete spire may be bifid or solid. The spire has four upright bars united by a single cross piece near its base. Length of basal plates varies from 0.13 to 0.21 mm and the height of spire varies from 0.037 to 0.063 mm.

Colour in living condition is uniform brown with dark tentacles.

Notes on habits: This species was found attached to dead coral stones. Sometimes small pieces of corals, algal branches were found to be attached to the pedicels.

Distribution: It is known from the West Coast of India, Sri Lanka, Bay of Bengal, East Indies, North Australia and China.

Sub-Family : Cladolabinae

Two genera are known under this Sub-Family from the Indian Seas. Only one genus is collected and described in this paper.

Genus *Afrocucumis* Deichmann, 1944
Only one species is known from the Indian Seas.

Afrocucumis africana (Semper)
(Pl. I C; Fig. 1 e–g)

Cucumaria africana Semper, 1868, p. 53: Philippines. Theel, 1886, p. 108.

Orcula cucumiformis Bell, 1884, p. 150: Port Molle.

Cucumaria assimilis Bell, 1886, p. 27: Mergui Archipelago.

Pseudocucumis africana Sluiter, 1901, p. 107: East Indies. Mitsukuri, 1912, p. 257: Japan. H. L. Clark, 1923, p. 417: South Africa; 1932, p. 226: Great Barrier Reef; 1938, p. 481: Australia. Engel, 1933, p. 16: Weim Island.

Afrocucumis africana Deichmann, 1944, p. 736: South Africa; 1948, p. 358: South Africa. Heding & Panning, 1954, p. 109: Zanzibar, Australia. James, 1969, p. 60: Port Blair (Andamans); Minicoy Island (Lakshadweep); 1983, p. 92: Port Blair Andamans); A. M. Clark, 1984, p. 99: Seychelles, 1985, p. 586: Lakshadweep, Andamans. A.M. Clark & Rowe, 197 1, p.182. Yulin, 1975, p. 202: Xisha Islands (China). Rowe, & Doty, 1977, p. 226: Guam. Sloan, A. M. Clark & Tylor, 1979, p. 124: Aldabra Islands. A. M. Clark, 1980, p. 489: Hong Kong. Mary Bai, 1980, p. 24. Mukhopadhyay & Samanta' 1983, p. 312: Lakshadweep.

Discucumaria africana H. L. Clark, 1946, p. 404: Australia.

Material: Port Blair (Andamans) several specimens, intertidal; Minicoy Island (Lakshadweep) 2 specimens, littoral.

Description: Length of specimens ranges from 35 to 75 mm. Specimens bottle-shaped with anterior end somewhat narrow. Pedicels arranged in five rows corresponding to ambulacral bands. On ventral side pedicels arranged in three bands each band has two rows of pedicels. On dorsal side pedicels arranged in two sparcely distributed rows. Pedicels in each row varies from 12 to 27. 20 tentacles arranged in two circlets. Outer circle consists of 15 tentacles of various sizes and inner circle consists of 5 small tentacles of which ventral two are small.

The calcareous ring consists of radials and interradials (Fig. 1 g). Radials are about three times longer than interradials and more or less rectangular in shape except for a notch at anterior border. Radials have two small posterior prolongations each of which consists of 8 or 9 pieces. Interradials roughly triangular in shape. Retractor muscles well developed and attached to radial pieces. A single polian vesicle and a single stone canal. Two respiratory trees of equal size and extend upto middle of body. Respiratory trees arise about one centimetre above cloacal aperture. Gonadial tubules in two bunches, transparent and attached to base of dorsal mesentery.

Spicules (Fig. 1 e, f) consists of large plates, supporting plates and end plates. Large plates coinlike, characteristic of species and round with several small holes; distributed throughout skin. In smaller plates there are a few larger holes. Margin of plates either wavy or coarsely serrated. On some of plates around each small hole is a concentric line. Diameter of plates are much longer than wide and more or less oval in shape. Each supporting plate has a number of holes, those at middle being much larger than those at either end. Length varies from 0.17 to 0.20 mm and breadth varies from 0.07 to 0.12 mm. Pedicels have an end plate with a number of holes and a wavy margin.

Notes on habits: This species is more or less gregareous in its occurrence. A number of specimens were seen in the crevices and crannies of huge rocks from where they are difficult to dislodge. When they are exposed during the low tide all the tentacles are withdrawn into the body and they lie in that state till the tide comes up. A few specimens were also collected from inside sponges. It often occurs in the supralittoral zone also.

Distribution: It is known from the Islands of Western Indian Ocean, East Coast of Africa, Mauritius, Maldives, Bay of Bengal, East Indies, North Australia, Japan and South Pacific Islands. It was recorded for the first time from Andamans and Lakshadweep by the author in 1969.

Genus *Phyllophorus* Grube, 1840

Three species are known under this genus from the Indian Seas. One of them was reported for the first time from Indian Seas by the author in 1965.

Key to the Species

1. Disc of the tables irregular or elongate, not circular.....*P. brocki* Ludwig, 1888

1'. Disc of tables circular 2

2. Disc symmetrical with eight marginal perforations and projecting points..... .....*P. cebuensis* (Semper, 1868)

2'. Disc more irregular, usually with marginal perforations..... .....*P. parvipedes* H. L. Clark, 1938

Phyllophorus (Phyllophorella) parvipedes H. L. Clark (Pl. I D)

Phyllophorus parvipedes H. L. Clark, 1938, p. 489: Australia; 1946, p. 409: Australia.

Phyllophorus (*Phyllophorella*) *parvipedes* Heding & Panning, 1954, p. 160: Singapore. James, 1969, p. 60: Vedalai (Gulf of Mannar); 1965, p. 325: Gulf of Mannar; 1985, p. 586: Gulf of Mannar. Clark & Rowe, 1971, p. 184. Mary Bai, 1980, p. 24.

Material: Mandapam (Gulf of Mannar) 2 specimens, 2 metres depth; Madras 2 specimens, 20 metres.

Description: Detailed description of this species was published by the author in 1965.

Distribution: It was known only from the Gulf of Mannar, Singapore, East Indies and North Australia. It is now recorded from Madras also. It was recorded for the first time from the Indian Seas by the author in 1965.

Genus *Phyrella* Heding & Panning, 1954

The genus Phyrella is reported for the first time from the Indian Seas. Only one species is known from the Indian Seas.

Phyrella fragilis (Oshima) (Fig. 1 h, i)

Phyllophorus fragilis Oshima, 1921, p. 81: Japan.

Phyllophorus tener Engel, 1933, p. 26: East Indies.

Phyrella fragilis Heding & Panning, 1954, p. 185: East Indies. A. M. Clark & Rowe, 1971, p. 184. Yulin, 1975, p. 203: China. James, 1983, p. 92: Port Blair; 1985, p. 586: Andamans.

Description: Length of specimens examined ranged from 40 to 150 mm. In completely narcotised forms both ends are narrow with central portion bulged. When dug out from sand, body immediately becomes round like a ball. Podia well developed and distributed all over body and arranged clearly on ventral side. 20 tentacles arranged in two circles. Outer circle has 15 large tentacles and inner circle five small tentacles.

Calcareous ring (Fig. 1 h) has posterior prolongations. Radials rectangular with a notch at anterior end. Each radial has two posterior prolongations with about five to seven pieces. Interradials roughly triangular in shape. At posterior end of interradials, eight pieces arranged in two rows.

Spicules (Fig. 1, i) consist of mostly tables. Disc of tables round with wavy margin and eight holes at margin of disc. Spire low with a few blunt spines at apex.

In living condition brown with blackish-brown shade on ventral side. Anal region whitish with five groups of anal papillae.

Notes on habits: It is fairly common species found from the supralittoral zone to the mid-littoral zone. The animals are always found under stones completely buried in coarse sand. On lifting the stone the presence of the animal is indicated by a jet of water ejecting from the cloaca. As soon as it is dug out from sand it becomes like a ball by contraction. On the surface of the body small pieces of shell, small coral bits and big sand particles are attached. It immediately eviscerates on collection. The intestine has fine mud. The animal lives among ordinary sand and muddy substratum. The presence of fine mud alone inside the alimentary canal indicates that it rejects all sand particles while feeding. It is interesting to note that not a single specimen of this species was found at South Point in Port Blair in 1965 when the author made intensive collection in the same area for two months. During the years (1975-'78) it appeared to be a common species in that area which indicates that this species would have settled down there after 1965.

Distribution: It is known only from the East Indies, Japan and China. It is reported here for the first time from the Indian Seas.

Zoogeography

The distribution of Dendrochirotids is more in temperate regions. The Order Dendrochirotida is well represented in the Gulf of Mannar and Palk Bay with eight genera *viz., Psolus, Pentacta, Pseudocolochirus, Hemithyone, Stolus, Havelockia, Actinocucumis* and *Phyllophorus*. From Andaman and Nicobar Islands only two genera *viz., Afrocucumis* and *Phyrella* are known the later being a new record to the Indian Seas. From Lakshadweep only *Afrocucumis* has been collected. Intensive collections are likely to encounter *Leptopentacta* and *Oshimella* known from the Maldives *Phyllophorus* (*Phyllophorella*) *parvipedes* earlier. known only from the Gulf of Mannar, East Indies, Singapore and North Australia is now collected from Madras on the East Coast of India.

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