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STUDIES ON INDIAN ECHINODERMS - 11. ON *PROTANKYRA TUTICORENENSIS* SP. NOV. AND OTHER APODOUS HOLOTHURIANS FROM THE INDIAN SEAS*

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ABSTRACT

Ten species of apodous holothurians belonging to nine genera are described in detail with keys to various taxa. *Protankyra tuticorenensis* a new species collected from Tuticorin (Gulf of Mannar) is described here. *Anapta gracilis* Semper and the genus *Labidoplax* are recorded here for the first time from the Bay of Bengal. Notes on the habits of various species are given for the first time. Remarks on the zoogeography are also given at the end of the paper.

INTRODUCTION

VERY little is known about the apodous holothurians of the Indian Seas. The very few records available are scattered without giving any information on the species or their habits. In this connection mention may be made of the papers of Bell (1887, 1889, 1902), Koehler and Vaney (1908), Gravely (1927), Nair (1946), Sane and Chhapgar (1962), Nayar and Mahadevan (1965), James (1969, 1983, 1985), Rao (1973), Satyamurti (1976), Mary Bai (1980), Soota *et al.* (1983) and Mukhopadhyay and Samanta (1983) from the Indian Seas. Most of the above authors merely listed the species without giving any details.

Extensive collection of echinoderms from the Gulf of Mannar and Palk Bay (1963-1970) and also from the Andaman and Nicobar Islands (1975-1978) were made. Good collections were also examined from the various Islands of Lakshadweep and also from several places along the east and west coasts of India. Notes on the habits of many species observed with the help of mask and snorkel are given for the first time. Remarks on the zoogeography are also given at the end of the paper.

I am grateful to Dr. S. Jones, former Director of C. M. F. R. I. for suggesting the problem and supervising the work. I thank Dr. P. S. B. R. James, Director, C. M. F. R. Institute, Cochin for the kind interest and encouragement. I also thank Miss. A. M. Clark, British Museum (Natural History), London, Dr. F. W. E. Rowe, Australian Museum, Sydney and late Dr. Elisabeth Deichmann, Museum of Comparative Zoology, Harvard University, Cambridge, for their valuable comments on some of the species presented here.

ORDER: APODIDA

Members belonging to this order are free from tubefeet. They are modified vermiform holothurians with rough or warty surfaces. Tentacles are 20 or more simple, digitate or pinnate. Tentacular ampullae are wanting. Respiratory trees are absent and the haemal system is simple. Gonad consists of one pair of more or less branching tubules that are often hermaphroditic. Spicules consist of anchors and wheels.

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KEY TO THE FAMILIES OF THE ORDER

Spicules: wheels with not more than six spokes and sigmoid bodies; anchors and anchor plates absent; tentacles peltodigitate .....CHIRIDOTIDAE

Spicules: anchors and anchor plates, rods and granules; tentacles pinnate or digitate.....SYNAPTIDAE

FAMILY: CHIRIDOTIDAE

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

KEY TO THE GENERA OF THE FAMILY

Tentacles 12; ciliated funnels single or at most in small clusters.....*Chiridota* Eschscholtz, 1829

Tentacles 18; ciliated funnels in the form of large stalked clusters..... .....*Polycheira* H. L. Clark, 1907

Genus **Polycheira** H. L. Clark, 1907

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

Polycheira rufescens (Brandt) (Fig. 1 a, b)

Chirodota rufescens Brandt, 1835, p. 59: Bonin Island. Bell, 1886, p. 26: Mergui Archipelago. Theel, 1886, p. 36. Bell, 1887a, p.140: Andaman Island; 1887b, p. 653: Sri Lanka. Sluiter, 1901, p.133: East Indies. Koehler and Vaney, 1908, p. 48: Akyab.

Chirodota dubia Walter, 1885, p. 378: Sri Lanka.

Polycheira rufescens H. L. Clark, 1907, p. 120; 1926, p. 191: Queensland. Clark, 1946, 458: Australia. Heding, 1928, p. 306: Gulf of Siam, Saparoea Bay, Sunda Strait. James, 1969, p. 62: Port Blair, Rangat (Andamans); 1983, p. 93: Port Blair (Andamans); 1985, p. 587: Sri Lanka, Andamans and Nicobar Islands. Yulin, 1975, p. 221: Xisha Islands. Solan, A. M. Clark & Tylor, 1979, p. 125: Aldabra. Mary Bai, 1980, p. 4. A. M. Clark, 1980, p. 490: Hong Kong. Soota *et al.*, 1983 a, p. 518: Andaman and Nicobar.

Material: Port Blair (South Andamans), several specimens; Rangat Bay (Middle Andamans), several specimens; Campbell Bay (Great Nicobar), several specimens, all from the intertidal region.

Description: The specimens examined varied from 40 to 150 mm. in length. The body is vermiform. The anterior end is flat and surrounded by a crown of 18 tentacles. The skin is very thin and transparent. Bunches of wheels form 'papillae' on the surface of the body wall. The length of the tentacles varies from 3 to 12 mm. The number of pairs of digits varies from 6 to 8. The calcareous ring consists of 18 pieces. All the radials are perforated for the passage of nerves. The radials and interradials are rectangular in shape with concave lower margins and small projections on the upper margins. The radials are slightly larger than the interradials (Fig. 1 b).

In a specimen dissected there are seven polian vesicles of different sizes and a single stone canal. The madreporite is long and the calcification on it is folded. The alimentary canal has a large loop with large clusters of ciliated funnels on the mesenteries. The clusters are of varying shapes. The gonad is in two bunches.

Spicules (Fig. 1 a) consist of wheels and rods. In a fully expanded specimen the wheels can be seen as regularly arranged in groups in a single layer with small ones at the centre. Each wheel has six spokes. The diameter of the wheels varies from 0.038 to 0.115 mm. Rods are present in the tentacles and the body wall. The rods are either slightly curved or appear like C-shaped bodies with enlarged ends. The enlarged ends of the rods are either smooth or knobbed which appear as distinct transverse folds. In the longitudinal muscles there are small oval calcareous bodies. The length of the curved rods varies from 0.024 to 0.116 mm. and the breadth is *c.* 0.014 mm.

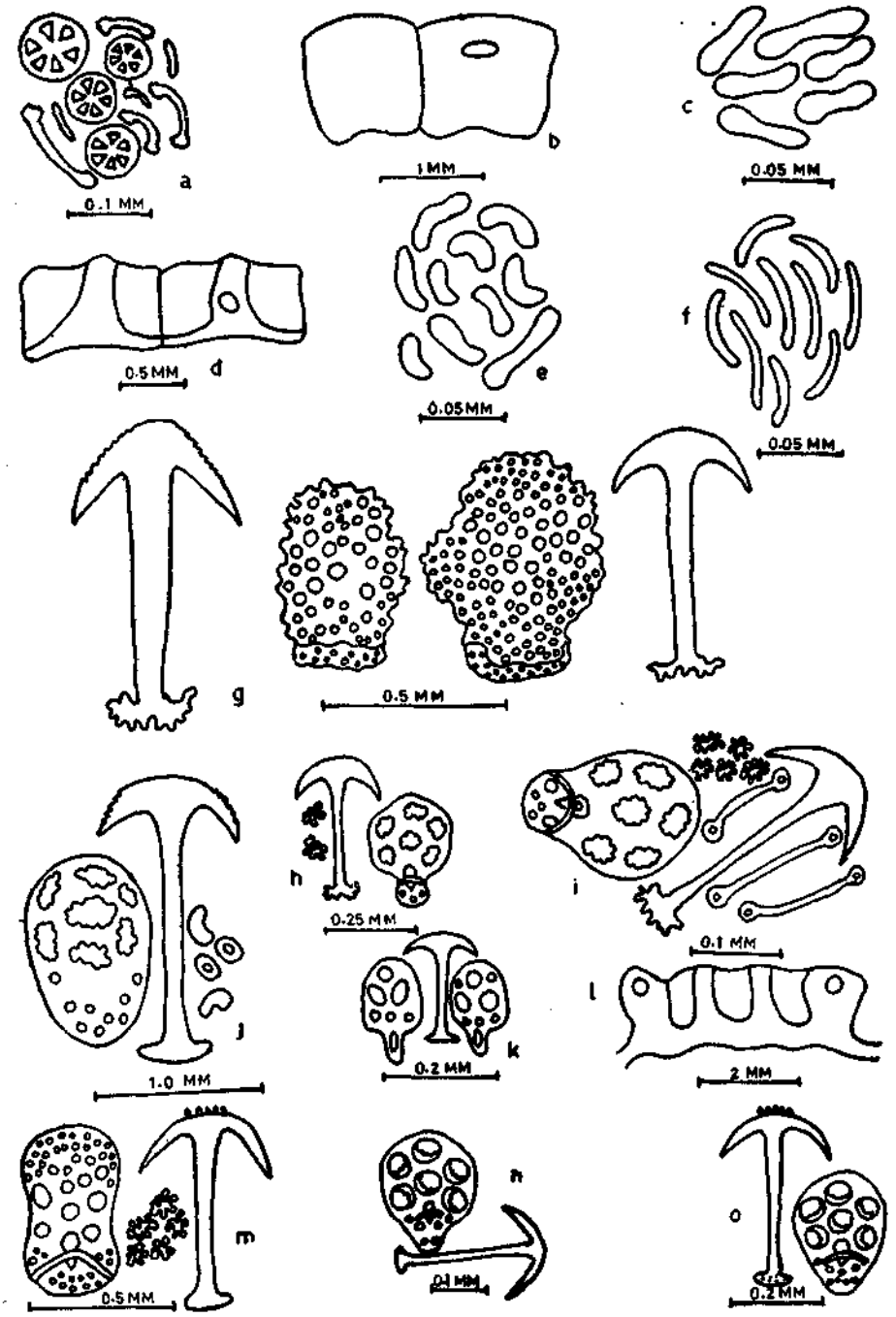

Fig. 1 a. Spicules of *Polycheira rufescens*, b. Radial and interradial plates of *Polycheira rufescens*, c. Spicules of *Anapta gracilis*, d. Radial and interradial plates of *Anapta gracilis*, e. Spicules from tentacle and tentacle digits of *Protankyra tuticorenensis*, f. Spicules from posterior portion of *Protankyra tuticorenensis*, g. Anchors and anchor plates of *Protankyra tuticorenensis*, h. Spicules of *Ophiodesma grisea*, i. Spicules of *Euapta godeffroyi*, j. Spicules of *Patinapta ooplax*, k. Spicules of *Labidoplax sp.*, l. Part of calcareous ring of *Synapta maculata*, m. Spicules of *Synapta maculata*, n. Anchor and anchor plate of *Synaptula recta* and o. Anchor and anchor plate of *Synaptula striata*.

In the living condition uniformly flesh coloured which appear as dark purple when contracted.

Notes on habits: It is one of the common inhabitants of muddy flats though a few were also collected from sandy beaches. It is found to be distributed in the supralittoral zone. It is a chiefly burrowing species living in the burrows located under stones. It is somewhat gregarious in habit. Often under the same stone three or four individuals may be found. On disturbing the stones over the burrows the holothurians slowly withdraw by contracting their bodies and at the same time letting out water from their bodies which flows at the entrance without force. Attempts to dislodge the specimens from the burrows only resulted in mutilation. Full specimens could be taken out from the burrows by digging to at least eight inches deep. Full specimens kept in the sea water in the laboratory resulted in breaking into three or four bits by constricting the body probably due to conditions entirely different from those in its natural surroundings. It is interesting to note that some of the specimens were found to live under stones without burrowing at Campbell Bay (Great Nicobar).

Distribution: It is distributed in Bay of Bengal, East Indies, North Australia, Philippines, Japan, China and South Pacific Islands. The specimens recorded as *Polycheira rufescens* from Sri Lanka in A. M. Clark and Rowe (1971) actually refer to *Chiridota stuhlmanni* (A.M. Clark, Per. comm.)

Family: Synaptidae

Seven genera are recorded under this Family from the Indian Seas. Species belonging to all the seven genera have been collected and described in this paper. An eight genus *Labidoplax* is recorded here for the first time from the Bay of Bengal.

Key to the Genera of the Family

1. Spicules never in the form of anchors or perforated plates; tentacles 12, pinnate with 5-13 digits.....*Anapta* Semper, 1868

1'. Spicules in the form of anchors and anchor plates.....2

2. Arms of anchors usually serrate, sometimes smooth, vertex without knobs.....*Protankyra* Ostergren, 1898

2'. Arms of anchors smooth, vertex usually with minute knob-like projections.....3

3. Stock of anchor branched irregularly.....4

3'. Stock of anchor not branched.....5

4. Calcareous ring with conspicuous anterior projections; anchor plates abruptly contracted posteriorly.....*Ophiodesma* Fisher, 1907

4'. Calcareous ring without noticeable anterior projections; anterior plates not abruptly contracted at posterior end but with large smooth hole on either side.....*Euapta* Ostergren, 1898

5. Anchor plates oval, body delicate and translucent.....*Patinapta* Heding, 1928

5'. Anchor plates not oval.....6

6. Anchor plates abruptly narrowed into a sort of handle.....*Labidoplax* Ostergren, 1898

6'. Anchor plates either subrectangular or rounded anteriorly and narrow posteriorly with a few holes.....7

7. Size very large, anchor plates sub-rectangular with numerous holes.....*Synapta* Eschocholtz, 1827

7'. Size not very large, anchor plates rounded in front, narrow behind, with a few holes.....*Synaptula* Orsted, 1849

Genus **Anapta** Semper, 1868

Only one species is known under this genus from the Indian Seas. It is collected and described below.

Anapta gracilis Semper (Fig. 1 c, d)

Anapta gracilis Semper, 1868, p. 17: Philippines. Theel, 1886, p. 18. H. L. Clark, 1907, p. 110. Sane & Chhapgar, 1962, p. 674: Bombay. A. M. Clark & Rome, 1971, p. 184.

Material: Machilipatnam (Bay of Bengal), several specimens from stake net collections; Ratnagiri (Arabian Sea), 1 specimen, intertidal.

Description: All the specimens collected are broken into small bits of 15-20 mm. length probably by constriction formation. There are 12 tentacles and each tentacle has 5 or 6 paired digits in addition to an unpaired one at the anterior end. The radials and interradials (Fig. 1 d) are of the same size. Both have slightly projecting anterior end with a slight depression at the posterior end. They are rectangular in shape with a median longitudinal ridge which has a narrow posterior base which is transverse in position. The radials have a small oval hole at the centre.

The spicules (Fig. 1 c) consist of small grains most of which are dumb-bell shaped. The length of the grains varies from 0.036 to 0.075 mm and breadth from 0.006 to 0.013 mm.

Colour in the fresh condition is purplish brown with white papillae.

Notes on habits: This species was collected only on one occasion from stake net collections from a depth of 2 metres at Machilipatnam (Bay of Bengal). The stake net catches were regularly examined for a period of three years. The bottom from which they were collected was muddy. The species appeard to be gregarious since a number of them were collected at a time. Probably due to very strong current the specimens were dislodged from the mud and swept into the stake net.

Distribution: It is known from the Arabian Sea, East Indies, Philippines and the South Pacific Islands. It is recorded here for the first ime from the Bay of Bengal.

Genus **Protankyra** Ostergren, 1898

Two species are known under this genus from the Indian Seas. A third species which is new to science is described in this paper. The author has recently examined *Protankyra similis* Semper from Sundarbans which is a new record to the Indian Ocean, through the courtesy of Prof. A. Choudhury, Department of Marine Science, University of Calcutta. A detailed description of the same will be published eleswhere.

Key to the Species of the Genus

1. Anchors asymmetrical; accessory spicules in the form of small cruciform or branched rods..... *P. petersi* (Semper, 1868)

1¹. Anchors symmetrical.....2

2. Anchors and anchor plates of two types differing in size, small anchor arms smooth and large anchor arms serrate; anchor plates with less than 100 holes; accessory spicules in the form of small cruciform or branched rods..... .....*P. pseudodigitata* (Semper, 1868)

2¹. Anchors and anchor plates more or less of the same size; some of the anchor plates with more than 100 holes; accessory spicules in the form of elongated or bean-shaped rods..... .....*P. tuticorenensis* sp. nov.

Protankyra tuticorenensis sp. nov.

(Pl. A, B; Fig. 1 e–g)

Material: Tuticorin (Gulf of Mannar), 4 specimens, 15 metres in depth. Holotype ZSI Regd. No. E 1813/1 deposited in the Indian Museum (Pl. I).

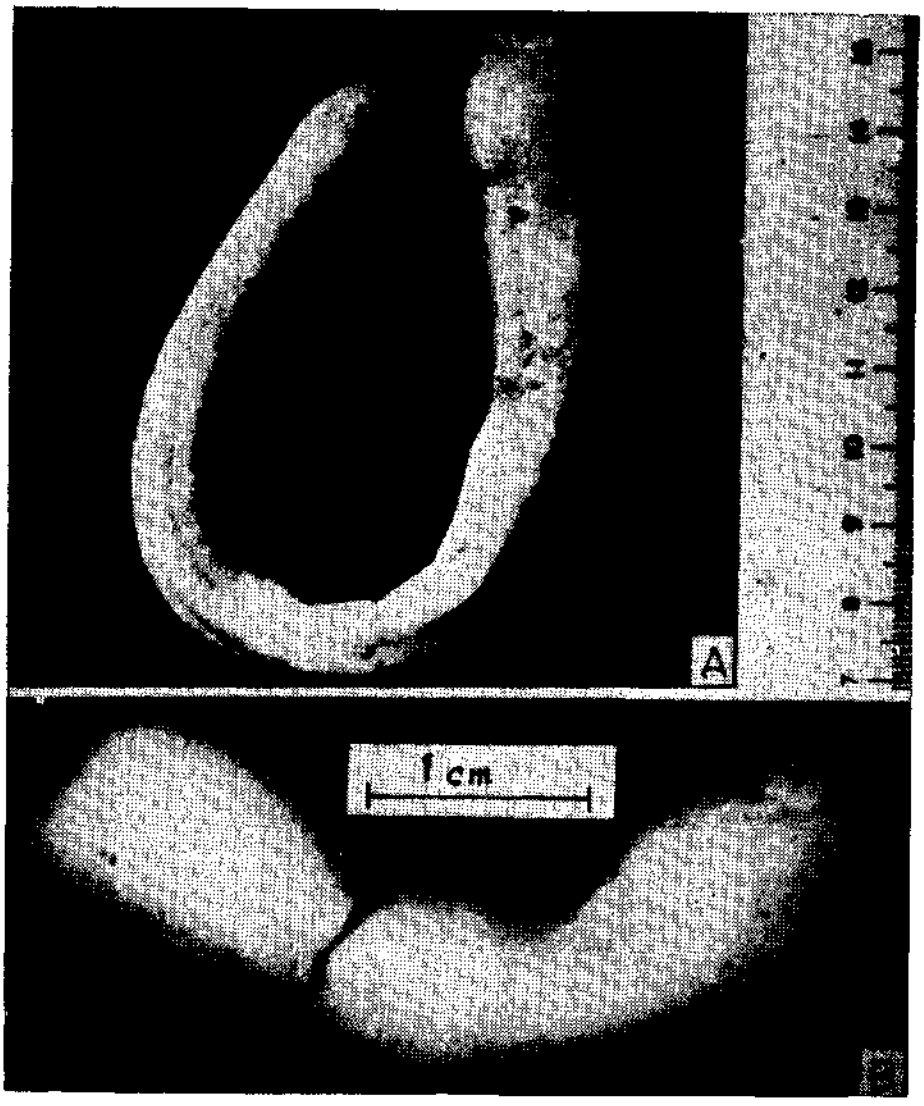

PLATE I. A. *Protankyra tuticorenensis* sp. nov. (Holotype) and B. *Protankyra tuticorenensis* showing constriction before breaking into two bits.

Description: The specimens examined ranged in length from 27 to 194 mm. Some of the specimens have constrictions (Pl. II) on the body. In the two specimens the interradial bands are raised with anchors projecting out. There are 12 tentacles in each specimen.

Spicules (Fig.1 e - g) consist of anchors, anchor plates and rods. Anchors are symmetrical with moderately large and pointed flukes. The serrations vary from 0 to 26 in number. The distance between the flukes varies from 0.2 to 0.4 mm. Stalk of the anchor is branched. Length of the anchors varies from 0.3 to 0.7 mm. Width of the anchor shafts varies from 0.07 to 0.09 mm. Anchor plates are oval in outline with the posterior margin slightly concave. Length of each plate varies from 0.3 to 0.6 mm and the breadth varies from 0.3 to 0.4 mm. Perforations are many (53 to 139 per plate) with large holes at the centre. Indentations are absent. True bridge is absent but supporting area is clear. Radial longitudinal muscles have large curved and elongated rods (Fig. 1, f) the length of which varies from 0.01 to 0.10 mm and the breadth varies from 0.01 to 0.02 mm. Tentacles and tentacle digits have bean-shaped rods (Fig.1, e) which vary in length from 0.02 to 0.03 mm and the breadth from 0.005 to 0.010 mm.

Colour: in rectified spirit is flesh coloured.

Discussion: H.L. Clark (1907) in his monograph on the apodous holothurians listed 25 species. A. M. Clark and Rowe (1971) included eight species from the shallow-water Indo-west Pacific region. Of these *P. petersi* and *P. pseudo-digitata* are known from the Bay of Bengal. The present species differs from *P. similis* in having 12 tentacles instead of 10 tentacles. It differs from *P. petersi, P. ludwigi* and *P. asymmetrica* in having symmetrical anchors and also it differs from *P. pseudo-digitata* and *P. bankensis* in having only one type of anchors and anchor plates. It also differs from *P. challengeri, P. duodactyla* and *P. sluiteri* in having the anchor plates more or less elliptical with numerous holes (53-139). Finally it differs from *P. verrilli, P. bidentata* and *P. autopsita* by the characteristic calcareous bodies. The present species can be separated from all the known species by the presence of bean-shaped bodies and elongated rods in the spicules. This species is named after the locality from which it was collected.

Out of the four specimens two specimens showed constriction. The specimens after they were collected were kept alive in the laboratory. When the water becomes stale they have a tendency to constrict their bodies (Pl. I B) and break into small bits. Such a type of behaviour was noticed in *Anapta gracilis* and *Polycheira rufescens* also.

Genus **Ophiodesma** Fisher, 1907

Two species are known under this genus from the Indian Seas. Only one species has been collected and described in this work.

KEY TO THE SPECIES OF THE GENUS

Madreporic canals numerous.....
.....*O. grisea* (Semper, 1868)

Madreporic canal single.....
.....*O. radiosa* (Lesson, 8130)

Ophiodesma grisea (Semper) (Fig. 1 h)

Synapta grisea Semper, 1868, p. 11: Philippines. Theel 1886, p. 21: Queensland. Bell, 1889, p. 388: Bay of Bengal.

Anapta grisea Sluiter, 1901, p. 124: East Indies.

Anapta (*Synapta*) *grisea* Koehler & Vaney, 1908, p. 48: Mergui Archipelago.

Ophiodesma grisea Fisher, 1907, p. 723. H. L. Clark, 1907, p. 75; 1921, p. 159: Torres Strait; 1946, p. 449: Australia. Cherbonnier, 1955, p. 449: Red Sea. James, 1969, p. 62: Andaman and Nicobar; 1983, p. 93: Port Blair (Andamans); A. M. Clark & Rowe, 1971, p. 186. Rowe & Doty, 1977,: Guam. Tortonese, 1979, p. 316: Saudi Arabia. Mary Bai, 1980, p. 4. Price, 1982, p. 12: SE Arabia, Red Sea, Gulf of Aqaba. 1985, p. 587: Sri Lanka, Andaman and Nicobar. Soota *et al*, 1983 a, p. 512: Andaman and Nicobar.

Material: Port Blair (South Andamans), 1 specimen; Nancowry (Little Nicobar), 1 specimen, both from intertidal region.

Description: The specimens examined were 200 and 250 mm. in length. In the living condition the body is thrown into pouches. Cartilaginous ring is absent. There are 12 tentacles which are not united by a web. Polian vesicles and madreporic canals are numerous.

Spicules (Fig. 1 h) consist of anchors, anchor plates and miliary granules. The arms of anchors are smooth. The base of the stalk is branched. The length of the anchors varies from 0.03 to 0.04 mm. The anchor plate is more or less round with wavy outline. The posterior portion is narrow with five small holes. One hole is median and on either side a pair of holes are present. The main portion of the anchor plates has seven large holes with a distinct bridge. The length of anchor plate is 0.03 mm.

The colour in the living condition is uniformly deep chocolate brown.

Notes on habits: On both the occasions this species was collected from reef flat during the low tide.

Distribution: It is known from East Africa, Red Sea, Bay of Bengal, East Indies, Australia, Philippines and Hawaii. It was recorded for the first time from Andaman and Nicobar Islands by the author in 1969.

Genus **Euapta** Ostergren, 1898

Under this genus only one species is known from the Indian Seas. It has been collected and described in this work.

Euapta godeffroyi (Semper) (Fig. 1 i)

Synapta godeffroyi Semper, 1868, p. 231: Navigator Islands. Theel, 1886, p. 22: Pelew Islands.

Euapta godeffroyi Sluiter, 1901, p. 123: East Indies. Fisher, 1907, p. 721: Hawaiian Islands. H. L. Clark, 1907, p. 72; 1946, p. 447: Australia. Heding, 1928, p. 137: Hawaiian Islands. Cherbonnier, 1951, p. 52: Gulf of California, San Jose Island. A. M. Clark & Davies, 1966, p. 600: Maldives. James, 1969, p. 62: Lakshadweep; 1985, p. 587: Lakshadweep A. M. Clark & Rowe, 1971, p. 184. Yulin, 1975, p. 221: Xisha Islands. Rowe & Doty, 1977, p. 235: Guam. Sloan, A. M. Clark, & Taylor, 1979, p. 124: Aldabra. Mary Bai, 1980, p. 4. Price, 1982, p. 12: Red Sea, Gulf of Aqaba. Mukhopadhyay and Samanta, 1983, p. 312: Lakshadweep. A. M. Clark, 1984, p. 99: Seychelles.

Material: Minicoy Island (Lakshadweep), one specimen, littoral, less than a metre in depth.
Description: The length of the specimen examined was 78 mm. The body is vermiform with the anterior end narrow and posterior end blunt. There are 14 tentacles each of which are 8 mm in length. There are 52 digits united by a web in each tentacle.

The spicules (Fig. 1 i) consist of anchors, anchor plates and rods. Each anchor plate is more or less circular in outline with a broad blunt handle. There are seven large dentate holes and three small smooth holes in the handle. There is a distinct bridge near the handle for the attachment of the anchor. The length of the anchor plates varies from 0.21 to 0.25 mm and the breadth from 0.17 to 0.20 mm. The stalk of the anchor is branched. Generally there are eight protuberances at the posterior end of the stalk. The flukes of the anchors are smooth and are of equal size. The length of each anchor varies from 0.32 to 0.36 mm. There are miliary granules in the skin which vary in size from 0.015 to 0.047 mm. Rods are present in the tentacles. The two ends of the rods are slightly expanded, with a hole at the centre. The length of the rods varies from 0.14 to 0.26 mm.

Colour in alcohol creamy white with broad brown bands equally spaced across the dorsal side. The dorsal radii are darker than the general body colour. Ventral side is uniformly light creamy-white.

Distribution: It is known from Mauritius to Hawaii. It was recorded for the first time from the Lakshadweep by the author in 1969.

Genus **Patinapta** Heding, 1928

Only one species is known under this genus from the Indian Seas. This has been collected and described in this work.

Patinapta ooplax (von Marenzeller) (Fig. 1 j)

Synapta ooplax von Marenzeller, 1881, p. 122: China, Japan. Theel, 1886, p. 25. Sluiter, 1901, p. 124: East Indies.

Leptosynapta ooplax H. L. Clark, 1907, p. 90: Japan Zanzibar.

Patinapta ooplax Heding, 1928, p. : East Indies. A. M. Clark & Rowe, 1971, p. 186. Rao, 1973, p. 225: Andamans. James, 1983, p. 93: Port Blair (Andamans); 1985, p. 587: Andaman & Nicobar Islands.

Material: Port Blair (South Andaman), several specimens, intertidal.

Description: The length of the specimens examined varied from 110 to 150 mm. The body is long, thin and vermiform. Tentacles are 12 in number. Each tentacle has four to five digits. There is a single polian vesicle and a madreporic canal.

The spicules (Fig. 1 j) consist of anchors, anchor plates and miliary granules. The anchors have a few indistinct serrations on the arms. The posterior end of the stalk is not branched. The anchor plates are oval in outline with usually seven large holes at the anterior end. The central one is the largest and the surrounding holes which are six to eight are of different sizes. At the posterior end of the anchor plate there are about 10 smaller holes of different sizes which are not arranged according to any order.

Colour in living condition is translucent white with very small red mottles. The five radial bands are opaque and distinct.

Notes on habits: This species is found to be distributed in the supralittoral zone. It is found to be loosely burried in the sand under stones. On lifting the stones they slowly withdraw their bodies into sand.

Remarks: This species is easily overlooked in collection due to its small size,colour and habit. It may be widely distributed in the Indo-Pacific region. Rao (1977) has recorded juveniles from north, middle and south Andamans.

Distribution: It is known from East Africa, Maldives, Andamans, East Indies and Japan.

Genus **Labidoplax** Ostergren, 1898

Three species are known under this genus from the Indo-West Pacific region. This genus is recorded here for the first time from the Bay of Bengal.

Labidoplax sp. (Fig. 1 k)

Material: A few pieces of this holothurian were collected from the stomach of the fish *Nemipterus japonicus* (Bloch).

Description: Anchor plates with narrow ends looking like handles and characteristic of the genus are seen. Each anchor plate has three large holes in addition to two small holes at the anterior end and three small holes at the posterior end. The 'handle' has a hole which is elongated. The one or two anchors observed did not have serrations on the arms.

Genus **Synapta** Eschscholtz, 1827

Only one species is known under this genus from the Indian Seas. The same has been collected and described in this paper.

Synapta maculata (Chamisso & Eysenhardt) (Fig. 1 l, m)

Holothuria maculata Chamisso & Eysenhardt, 1821, p. 325.

Synapta beselii Selenka, 1867, p. 361: Celebes. Theel, 1886, p. 9: Zebu, Amboina, Papiete. Bell, 1887b, p. 652: Sri Lanka; 1888, p. 389: Bay of Bengal. Pearson, 1903, p. 187: Sri Lanka.

Synapta maculata Selenka, 1867, p. 361: Radack Island. H. L. Clark, 1907, p. 78; 1921, p. 160: Torres Strait. 1932, p. 221: Great Barrier Reef. 1946, p. 450: Australia. Heding, 1928, p. 113: St. Crux Island, Cherbonnier, 1955, p. 170: Red Sea. Domantay, 1962, p. 104: Philippines. A. M. Clark & Davies, 1966, p. 603: Maldives. James, 1969, p. 62: Andamans, Lakshadweep, 1983, p. 93: Port Blair (Andamans) 1985, p. 587: Lakshadweep, Maldives, Sri Lanka, Andaman & Nicobar Islands. Yulin, 1975, p. 220: Xisha Islands. A. M. Clark, 1976, p. 112. Rowe & Doty, 1977, p. 234: Guam. Sloan, A. M. Clark & Tylor, 1979, p. 124: Aldabra. Tortonese, 1979, p. 316: Saudi Arabia. Mary Bai, 1980, p. 4. Price, 1982, p. 12: SE Arabia, Red Sea, Gulf of Aqaba. Soota *et.al.* 1983, p. 517: Andaman & Nicobar. Mukhopadhyay & Samanta, 1983, p. 587: Kavarathi Island (Lakshadweep) A. M. Clark, 1984, p. 99: Seychelles.

Synapta doreyana Theel, 1886, p. 23. Cherbonnier, 1952, p. 13.

Chondrocloea beselli Sluiter, 1901, p. 12: East Indies' Pearson, 1903, p. 18: Sri Lanka. Koehler & Vaney, 1908, p. 46: Lakshadweep, Andamans.

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

Description: The specimens examined ranged in length from 136 to 927 mm. The body is long and snake-like. The number of tentacles may be either 14 or 15. The tentacles are about 10 mm in length. Each tentacle has 30 to 40 digits which are not united by a web. At the base of each tentacle there is a large pigment spot.

The calcareous ring (Fig. 1 l) is weak and buried in the voluminous cartilaginous ring. The radial pieces are perforated by large holes for the passage of nerves. Polian vesicles are numerous, long and arranged round the circular canal. There is a single stone canal which is branched. The gonads are long. The anterior portion of the alimentary canal is thick and glandular and distinctly different from the rest which is a large loop. The ciliated funnels are found at the base of the mesenteries.

The spicules (Fig. 1 m) consist of anchors, anchor plates and miliary granules. The stock of the anchor is not branched but finely toothed. The flukes are of equal size and are smooth. On the vertex there are minute knobs. The length of each anchor is 0.14 mm and the distance between the flukes is 0.10 mm. The anchor plate is large, elongated and slightly dumb-bell shaped. Its articular end is slightly narrower than the free end. Each anchor plate has a number of holes. Large holes are present at the centre and small ones more or less in regular rows at either end. Bridge of the plate has a small knob at the middle. There is a fine net work across any hole. The length of the plate varies from 0.110 to 0.118 mm. and the breadth at the broadest point varies from 0.072 to 0.075 mm. Rods are wanting in the skin and the tentacles. Miliary granules are of different sizes and shaped. The usual size varies from 0.015 to 0.025 mm.

Colour in the living condition is light yellow with a number of brown patches over the body. The whole body surface has small white rings which are closely arranged.

Notes on habits: It is found in places where water collects in the intertidal region. It shovels sand into the mouth with its relatively large pinnate tentacles. The tentacles are seen to be in active movement during feeding. It crawls along by holding on to solid objects by its anchors.

Distribution: This species is widely distributed in the Indo-Pacific region. It occurs from the east African coast to South Pacific Islands but not reported from the Persian Gulf and from the west coast of India.

Genus **Synaptula** Orsted, 1849

Two species are known under this genus from the Indian Seas. Both the species are collected and described in the present paper.

KEY TO THE SPECIES OF THE GENUS

Colour variable, usually some shade of violet or pink; length not exceeding 400 mm anchor plates little longer than wide with three small holes at the posterior margin..... .....*P. recta* (Semper, 1868)

Colour uniformly white; length reaching upto 600 mm, anchor plates definitely wider than long with four to nine holes at the posterior margin.....*S. straita* (Sluiter, 1901)

Synaptula recta (Semper) (Fig. 1 n)

Synapta recta Semper, 1868, p. 14: Philippines. Bell 1886, p. 26: Mergui Archipelago. Theel, 1886, p. 24. Bell, 1888, p. 389: Bay of Bengal. Pearson, 1903, p. 186: Sri Lanka. Gravely, 1927, p. 168: Gulf of Mannar. Satyamurti, 1976, p. 66: Gulf of Mannar.

Chondrocloea recta Sluiter, 1901, p. 125: East Indies. H. L. Clark, 1938, p. 545: Australia. H. L. Clark, 1946, p. 453: Australia. James, 1969, p. 62-: Palk Bay.

Synaptula recta H. L. Clark, 1907, p. 84. H. L. Clark, 1921, p. 160: Torres Strait. A. M. Clark & Rowe, 1971, p. 188. Mary Bai, 1980, p. 4. Soota *et al.* 1983, p. 157: Port Blair. James, 1985, p. 587: Lakshadweep, & Maldives, Gulf of Mannar & Palk Bay (S. E. coast of India, Andaman and Nicobar Islands.

Chondrocloea varians Nair, 1946, p. 361: Madras.

Material: Mandapam (Palk Bay), several specimens; Tuticorin (Gulf of Mannar), several specimens, littoral less than a metre in depth.

Description: The length of the specimens examined varied from 21 to 254 mm. The body is long, thin and vermiform. The mouth is terminal and is in the form of a circular opening at the centre of the oral disc around which tentacles are arranged in a single circle. The number of tentacles varies from 9 to 15, majority of the specimens having 10 tentacles. The number of pairs of digits in each tentacle varies from 8 to 29. The number of digits depends on the size of the specimens. The outerside of the tentacles is studded with numerous rounded adhesive papillae. All the digits are webbed. The skin is transparent with the anchors and anchor plates as small specks.

The calcareous ring is situated just below the circlet of tentacles. The highly convex anterior end of the radial piece is provided with fairly large holes through which radial nerves pass out after emerging from the nerve ring. There is a median conical projection on each interradial piece. The posterior end of all the plates are concave. There are 10 to 14 polian vesicles and a single stone canal.

The spicules (Fig. 1 n) consist of anchors and anchor plates and miliary granules. The anchors have two smooth and equal sized flukes. The vortex is free from knobs. The length of the anchor is 0.26 mm. The anchor plates are symmetrical structures having more or less oval shape. The broad anterior end has six large toothed holes of uniform size. The posterior end has three small holes of which the central one is the largest. The connecting bridge is smooth. The length of each anchor plate is 0.21 mm and the breadth is 0.18 mm. The miliary granules are small and regular. Their size is about 0.01 mm.

The colour in the living condition is pink with red longitudinal interrupted stripes.

Notes on habits: This species was found to be gregarious in the Palk Bay. They were found to live on algae in shallow water. Specimens of large and small sizes were found to live at the same place. They were found to crawl on the algae with the help of the tentacles and anchors which stick to the algal branches.

Remarks: Nair (1946) has described a new species of *Synaptula* from Madras harbour. He based his new species on the variation in the number of tentacles and named it *S. varians*. The number of tentacles increased with size in the present species. In the specimens (length 21 to 254 mm) examined during this study the tentacles were found to vary in number from 9 to 15. The tentacle number given by Nair (*op.cit*) falls within the range for *S. recta* and also no other differences are present between

his specimens of *S. varians* and *S. recta*. Therefore *S. varians* is considered in this work as a synonym of *S. recta*.

Distribution: It is known from Red Sea, Maldives, Sri Lanka, Bay of Bengal, East Indies, North Australia, Philippines and South Pacific Islands.

Synaptula striata (Sluiter) (Fig. 1 o)

Synapta striata Sluiter, 1888, p. 216: East Indies. Pearson, 1903, p. 186: Sri Lanka.

Chondrocloea albo-punctata Sluiter, 1901, p. 127: East Indies.

Chondrocloea striata Koehler & Vaney, 1908, p. 47: Mergui Archipelago, Strait of Malacca. Nayar & Mahadevan, 1965, p. 199: Gulf of Mannar. James, 1969, p. 62: Gulf of Mannar. Bakus, 1973, p. 357.

Synaptula striata A. M. Clark & Rowe, 1971, p. 188. Mary Bai, 1983, p. 4. James, 1985, p. 587: Gulf of Mannar and Palk Bay (S. E. coast of India), Sri Lanka.

Material: Tuticorin (Gulf of Mannar), 5 specimens, 17 to 20 metres in depth.

Description: Thes pecimens examined varied in length from 190 to 600 mm. The body is slender and elongated. There are 13 tentacles in all the specimens examined. Each tentacle has *c.* 20 pairs of digits which are not united by a web. The surface is rough to touch because of the anchors.

The cartilaginous ring is voluminous and completely encloses the calcareous ring. The radials of the calcareous ring are smaller than the interradials. The posterior margins of both the radials and interradials are concave. Each radial piece has a perforation for the passage of nerves. There are about 18 polian vesicles and a single stone canal. On the exterior there are muscular impressions. The gonads are large and branched. The intestine has a loop and the mesenteries possess ciliated funnels.

Spicules (Fig. 1 o) consist of anchors, anchor plates and miliary granules. The stalks of the anchors are finely dented and on the vertex there are minute knobs. The two flukes of the anchors are of the same size. The length of each anchor is 0.35 mm and the breadth is *c.* 0.22 mm. The anchor plates are more or less oval in shape. The articular hole and the bridge are distinctly serrate. The posterior end of the plates from the anterior region have four holes and the posterior end of the plates from the posterior region have nine holes of which the median one is the largest. The length of each anchor plate is *c.* 23 mm. and the breadth is *c.* 0.17 mm. The miliary granules are arranged in groups, each group with a diameter of 0.031 mm.

Colour in the livng condition is white.

Notes on habits: Nayar and Mahadevan (1965) have given an account of its habits. It was found to live always in association with the sponge *Petrosia testudinaria* at a depth of 17-22 metres. It was found to occupy the meandering grooves on the irregular surface of the sponge by their anchor-like spicules. It is not clear why *Petrosia* alone should be preferred as host when other types of substrata are available for them. The hard body of the sponge serves only as firm attachment for the holothurian. Pearson (1903) has also reported that this species lives in association with sponges but did not specify the sponge on which they are found.

Remarks: H. L. Clark (1908) has treated this species as a synonym of *S. recta*. This species is distinct from *S. recta* and the differences are presented in the following Table.

Distribution: It is known from Sri Lanka, Bay of Bengal and the East Indies.

Differentiating Characters of S. recta *and* S. striata

Character	*Synaptula recta*	*Synaptula striata*
Size	Not exceeding 400 mm.	Length upto 600 mm.
Habitat	Found to occur on algae and on different sponges	Found to occur only on *Petrosia testudinaria*
Tentacle number	9 to 15	Only 13
Tentacle digits	United by web	Not united by web
Cartilaginous ring	Not voluminous	Voluminous
Anchors	Vertex of anchor without knobs; posterior end of anchor stalk smooth	Vertex of anchor with knobs; posterior end of anchor stalk dented
Anchor plates	Anchor plates a little longer than wide; posterior border of anchor plates with three holes	Anchor plates distinctly longer than wide; posterior border of anchor plates with four to nine holes

ZOOGEOGRAPHY

James (1985) in a recent paper on the zoogeography of the shallow-water echinoderms of the Indian Seas has noted the poor representation of echinoderms in the Gulf of Mannar and Palk Bay on the Indian side when compared to the shores of Sri Lanka. Possible reasons for this are also given. Among the ten species of apodous holothurians considered here only two species *viz., Synaptula recta* and *S. striata* are collected from the Indian side in the Gulf of Mannar and Palk Bay. *Synapta maculata* which is widely distributed in the Indo-West Pacific is collected from the Lakshadweep, Sri Lanka and Andaman and Nicobar Islands but not on the Indian side of the Gulf of Mannar and Palk Bay. *Patinapta ooplax* is recorded from Lakshadweep and Andamans whereas *Ophiodesma grisea* is known from Andamans and Sri Lanka but again not from the Gulf of Mannar and Palk Bay on the Indian side. *Euapta godeffroyi* is known only from Lakshadweep and *Polycheira rufescens* only from Andamans in the Indian Seas.

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