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**STUDIES ON INDIAN ECHINODERMS - 10. *OPHIOCOMA ANAGLYPTICA* (OPHIUROIDEA : OPHIOCOMIDAE), A NEW RECORD FROM THE INDIAN OCEAN WITH NOTES ON OTHER SPECIES OF *OPHIOCOMA* FROM INDIAN SEAS \***

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ABSTRACT

Little known species *Ophiocoma anaglyptica* Ely collected from the Lakshadweep is recorded for the first time from the Indian Ocean. A detailed description of the same is given along with notes on five other species collected from the Andamans and Lakshadweep.

INTRODUCTION

THE GENUS *Ophiocoma* enjoys wide distribution and where ever coral reefs are present the species of *Ophiocoma* are expected to be present. Eleven species are known from the Indo-West Pacific region (A. M. Clark and Rowe, 1971) of which five are known from the Indian Seas. The sixth species *Ophiocoma anaglyptica* Ely collected from the Chetlat Island (Lakshadweep) is recorded for the first time from the Indian Ocean. James (1971) listed this species from the reference collections of the Central Marine Fisheries Research Institute. This is a little known species; therefore a detailed description of the same is given here. Notes on the other five species viz., *O. scolopendrina*, *O. erenaceus*, *O. pica*, *O. brevipes* and *O. dentata* collected from the Andaman and Nicobar Islands and also from the Lakshadweep are given.

I am grateful to Dr. S. Jones, former Director of the Central Marine Fisheries Research Institute for his guidance and encouragement. I thank Dr. E. G. Silas, Director, Central

Marine Fisheries Research Institute, Cochin for the facilities provided and for his kind interest. I thank Miss A. M. Clark, British Museum (Natural History) for the critical comments on the species.

KEY TO THE INDIAN SPECIES OF THE GENUS

- 1. Interbrachial areas on the ventral side with a number of conspicuous circular scales (Pl. I B).....*O. anaglyptica* Ely, 1944
- 1'. Interbrachial areas on the ventral side with no enlarged circular scales.....2
- 2. Disc marked with beautiful pattern of radiating golden lines on a dark background.....*O. pica* Muller and Troschel
- 2'. Disc either uniformly dark or variegated or light green.....3
- 3. Disc sparsely covered by granules.....4
- 3'. Disc densely covered by granules.....5
- 4. Colour uniformly dark dorsally and ventrally.....*O. erinaceus* Muller and Troschel, 1842
- 4'. Colour variegated, sometimes dark brown dorsally but always lighter ventrally .....*O. scolopendrina* Lamarck, 1816

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5. Disc pale in colour (brown or yellow) often with a shade of light green .....*O. brevipes* Peters, 1851
- 5'. Colour of the disc either uniformly dark or variegated with reticulated pattern or spots.....*O. dentata* Muller & Troschel, 1842

***Ophiocoma anaglyptica* Ely, 1944 (Pl. I A, B)**

*Ophiocoma anaglyptica* Ely 1944, p. 373: Canton Island. A. H. Clark 1954, p. 260: South Pacific Islands James 1969, p. 56: Lakshadweep. Devaney 1970, p. 34. A. M. Clark and Rowe 1971, pp. 86, 118.

**Material:** Chetlat Island (Lakshadweep) 8 specimens from reef flat.

**Description:** The diameter of the disc varies from 13 mm to 25 mm. The arms are 4.9 to 5.6 times the diameter of the disc. The disc is round with small rounded granules over it. There are *c.* 23 to 30 granules at the centre and *c.* 35 to 46 granules at the margin of the disc per square millimetre. In larger specimens the granules at the margin of the disc are longer than wide.

There are four oral papillae on each side of the jaw. The basalmost papilla is narrow and the one next to it is the broadest of all. At the tip of the jaw there are *c.* 6 to 14 tooth papillae. The oral shields are large, four-sided with distal margin wider than the proximal. The ratio of length to breadth of each oral shield is 6:5. The adoral shields are small and three-sided.

The interbrachial areas on the ventral side are characteristic of the species. A small area at the margin of the disc is covered by granules and the rest of the area is covered by scales. The scales are of two types. The first type of scales are small and imbricating and the second type are large, circular and mostly non-imbricating (Pl. I B). The number of circular scales varies from *c.* 21 to 41 in the eight specimens examined with an average of 29 scales for

each specimen. In smaller specimens these enlarged scales occupy more or less the whole interbrachial area to the exclusion of the usual imbricating scales.

The dorsal arm plates are fan-shaped with a convex distal edge and a short straight truncated proximal edge appearing so because of overlapping. The sides are straight. The ratio of length to breadth is 1:2.

The ventral arm plates are roughly four-sided with the proximal and distal edges convex and the sides concave. The proximal edge of each plate is slightly overlapped by the preceding plate. The ratio of length to breadth is 4:3. Each tentacle pore bears two flat tentacle scales for each segment. The largest specimen bears three tentacle scales on most of the pores.

The first lateral arm plate bears five spines. The first four proximal plates bear five and the rest four spines. The spines are short and smooth. The uppermost spine on each proximal arm segment is swollen at the base.

In the dried specimens the dorsal side is dark grey with no markings either on the dorsal arm plates or spines. The ventral side is grey. In some specimens the enlarged scales of the interbrachial areas of the ventral side are white in colour.

**Distribution:** This species was known only from Canton and South Pacific Islands. It is recorded for the first time from the Indian ocean.

***Ophiocoma pica* Muller and Troschel, 1842 (Pl. I C)**

*Ophiocoma pica* Muller and Troschel 1842, p. 101. Bell 1882, p. 221: Sri Lanka. Walter 1885, p. 370: Sri Lanka. Bell 1887, p. 648: Sri Lanka. H. L. Clark 1921, p. 127: Torres Strait. Engel 1938, p. 27: Banda Sea. Ely 1942, p. 54: Hawaii. H. L. Clark 1938, p. 333: Australia. Ely 1942, p. 54: Hawaii. Murakami 1943 b, p. 218: Japan. H. L. Clark 1946, p. 244: Australia. A. M. Clark 1952, p. 207: Gulf of Aqaba. Balinsky 1957, p. 26: Inhaca Island. A. M. Clark and Davies 1966; 599: Maldives. Pope 1967, p. 312: Great Barrier Reef. James 1969, p. 56;

Lakshadweep, Nicobar, Red Sea. James and Pearse 1969, p. 88; Red Sea. Devaney 1970, p. 25. A. M. Clark and Rowe 1971, pp. 86, 118. Devaney 1974, p. 169; Southeastern Polynesia. A. M. Clark and Courtman-Stock 1976, p. 173; South Africa. Yulin 1978, p. 88; Xisha Islands. Sloan, A. M. Clark and Tylor 1979, p. 106; Aldabra Island. Tortonese 1979, p. 318; Saudi Arabia. Price 1982, p. 8; Saudi Arabia. A. M. Clark 1984, p. 94; Seychelles.

*Ophiocoma lineolata* Muller and Troschel, 1842, p. 102. Koehler, 1922, p. 324; Philippines.

*Ophiocoma samio* Lyman, 1861, p. 81; Sandwich Island, Kingsmill Island.

**Material:** Chetlat Island (Lakshadweep), 1 specimen, 2 m in depth; Nancowry (Nicobar), 2 specimens, 1 m in depth.

**Habitat:** This species appears to live beyond the low tide mark. Not a single specimen was collected at Andamans on the reef flat despite intensive search. Both the specimens studied were taken at a depth of 1-2 metres. It appears to be associated with live corals. Devaney (1970) has reported that specimens with disc diameter less than 15 mm. are most common in the coral habitat. He also stated that it is commonly found between the branches of the scleractinian coral *Pocillopora meandrina* var *nobilis*.

**Distribution:** It is known from the Islands of Western Indian Ocean, Mauritius, East Africa, Red Sea, South East Arabia, Maldives, Sri Lanka, East Indies, North Australia, Philippine Islands, Japan, South Pacific Islands, Hawaiian Islands. It was recorded for the first time from the Lakshadweep and Nicobar by the author in 1969.

***Ophiocoma erinaceus* Muller and Troschel, 1842  
(Pl. I D)**

*Ophiocoma erinaceus* Muller and Troschel 1842, p. 98; Red Sea. Bell 1882, p. 221; Sri Lanka. Walter 1885, p. 369; Sri Lanka. Bell 1887, p. 648; Sri Lanka; 1888, p. 384; Gulf of Mannar. Doderlein 1889, p. 831; Sri Lanka. Thuston 1895, p. 115; Pamban (Gulf of Mannar). Bell 1902, p. 228; Maldives, Lakshadweep. H. L. Clark 1921, p. 127; Torres Strait. Engel 1938, p. 27; Banda Sea. Murakami 1943, p. 217; Japan. H. L. Clark 1946, p. 224; Australia. Balinsky 1957, p. 25; Inhaca Island. A. M. Clark 1967 a, p. 47; Red Sea. James 1969,

p. 56; Andamans, Lakshadweep, Mauritius, Red Sea. James and Pearse 1969, p. 86; Red Sea. Devaney 1970, p. 34. A. M. Clark and Rowe 1971, pp. 86, 119. Devaney 1974, p. 155; Southeastern Polynesia. A. M. Clark and Courtman-Stock 1976, p. 173; Southern Africa. Yulin 1978, p. 87; Xisha Islands. Sloan, A. M. Clark and Tylor 1979, p. 106; Aldabra Island Tortonese 1979, p. 318; Saudi Arabia. Price 1982, p. 8; Saudi Arabia. A. M. Clark 1984, p. 100; Seychelles.

**Material:** Port Blair (Andamans), 6 specimens; Minicoy and Bitra Islands (Lakshadweep) 4 specimens, all specimens collected near low water mark.

**Habitat:** This species is usually found near the low water mark under huge stones. Often under a single stone two specimens are collected. This species has very limited distribution in the intertidal region unlike *O. scolopendrina* which occurs almost from the supralittoral zone to the infra littoral zone. This species does not exhibit autotomy to a marked degree like *O. scolopendrina*.

**Distribution:** This species is known from the Islands of Western Indian Ocean, Mauritius, Madagascar, Red Sea, South East Arabia, Maldives, Sri Lanka, Bay of Bengal, East Indies, North Australia, Philippine Islands, Southern Japan, South Pacific Islands, Hawaiian Islands. The author has recorded this species for the first time from Andamans and Lakshadweep in 1969.

***Ophiocoma scolopendrina* (Lamarck) (Pl. II A)**

*Ophiura scolopendrina* Lamarck 1840, p. 223; Mauritius.

*Ophiocoma scolopendrina* Muller and Troschel 1842, p. 101. Bell 1882, p. 122; Sri Lanka. Walter 1885, p. 369; Sri Lanka. Bell 1887a, p. 140; Andamans; 1887b, p. 648; Sri Lanka; 1902, p. 228; Lakshadweep. Herdman and Herdman 1904, p. 146; Ceylon (Sri Lanka). Matsumoto 1917, p. 345; Japan. Gravelly 1927, p. 170; Gulf of Mannar. Engel 1938, p. 26; Banda Sea. Mortensen 1940, p. 73. Persian Gulf. Ely 1942, p. 52; Hawaii. Murakami 1943b, p. 218; Japan. H. L. Clark 1938, p. 329; Australia; 1939, p. 95; Red Sea, Maldives; 1946, p. 243; Australia Tortonese 1949, p. 38; Somaliland. A. M. Clark 1952, p. 207; Red Sea; 1967, p. 47; Red Sea. James 1969, p. 56; Andamans, Lakshadweep, Red Sea, Mauritius,

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James and Pearse 1969, p. 86: Gulf of Suez Northern Red Sea. Devaney, 1970, p. 34. A. M. Clark and Rowe 1971, pp. 86, 119. Devaney 1974, p. 161: Southeastern Polynesia. A. M. Clark and Courtman-Stock 1976, p. 174: South Africa. Yulin 1978, p. 87: Xisha Islands. Sloan, A. M. Clark and Tylor 1979, p. 106: Aldabra Is. Price 1982, p. 8: Saudi Arabia. James 1983, p. 90: Andamans. A. M. Clark 1984, p. 100: Seychelles.

**Material:** Port Blair (Andamans), 54 specimens, intertidal; Minicoy Island (Lakshadweep), 4 specimens, intertidal.

**Habitat:** This species occupies a very extended zone in the intertidal region from almost the supra-littoral region to the low water mark. It is somewhat gregarious and in rock pools with fissures there are as many as 80 to 120 specimens in one square metre. When the tide rises two or three arms are seen waving in the water, a feature noted by H. L. Clark (1921) also. In places where the water completely recedes during the low tide small forms (10-15 mm disc diameter) are found under small stones with all the arms drawn near the disc. At the slightest touch all the arms spread out and the brittle star tries to get away. It is always found either under a dead coral or seen through the crevices in the rocks. On very hot days when the water in the intertidal region especially the rock pools becomes hot the specimens completely come out of the crevice or from the under side of stones and move about with the five arms completely spreading out. This species exhibits autotomy to a great extent. While handling if one arm gets detached others also quickly get detached one by one if the specimen is caught by the arms. It appears that some nerve impulse triggers off autotomy. When once this sets in all the arms are lost in quick succession. If there is no such impulse no arm is lost by handling. Usually large forms (over 20 mm in disc diameter) are found near the low water mark.

**Distribution:** It is known from the Islands of Western Indian Ocean, Mauritius, East African coast, Red Sea, South East Arabia, Persian Gulf,

Maldives, Sri Lanka, Bay of Bengal, East Indies, North Australia, Philippines, Southern Japan, South Pacific Islands, Hawaiian Islands.

**Ophiocoma brevipes Peters (Pl. II B)**

*Ophiocoma brevipes* Peters 1851, p. 465: Mozambique. Bell 1882, p. 221: Sri Lanka. Walter 1885, p. 371: Sri Lanka. Bell 1887b, p. 648: Sri Lanka; 1888, p. 388: Bay of Bengal. Doderlein 1889, p. 831: Sri Lanka. Bell 1902, p. 225: Maldives, Lakshadweep. Matsumoto 1917, p. 343: Japan. H. L. Clark 1921, p. 129: Torres Strait; 1938, p. 328: Australia. Ely 1942, p. 34: Hawaii. Murakami 1942, p. 34: Japan. H. L. Clark 1946, p. 245: Australia. James 1969, p. 56: Andamans, Lakshadweep. Devaney 1970, p. 12. A. M. Clark and Rowe 1971, pp. 86, 119. Devaney 1974, p. 151: Southeastern Polynesia. Yulin 1978, p. 89: Xisha Islands. Sloan, A. M. Clark and Tylor 1979, p. 104: Aldabra Islands. James 1983, p. 90: Port Blair (Andamans) A. M. Clark 1984, 100: Seychelles.

*Ophiocoma brevispinosa* Smith 1876, p. 40: Rodriguez Island.

**Material:** Port Blair (Andamans), 8 specimens, intertidal; Minicoy Island (Lakshadweep), 2 specimens, intertidal.

**Growth changes:** Specimens which range from 10 to 12 mm in disc diameter have c. 200 to 310 granules at the centre and c. 160 to 250 granules at the margin of the disc per square millimetre. In larger specimens, the lowermost spines on the proximal arm segments are flat and expanded at the base whereas in smaller specimens the spines are pointed.

**Habitat:** This species is much rarer than *O. scolopendrina* and *O. erinaceus*. It is very secretive in its habits unlike the other species of the same genus. Often there are two or three specimens of the same size under a coral stone. It can draw all its arms and fold them closely over the disc and hide in a small crevice. The lowermost spines of the proximal arm segments are flat and slightly expanded at the tip. They help in shovelling the sand. It can withstand long hours of exposure for it is found near the high water mark. There is not much of autotomy in this species.

**Distribution:** It is known from the Islands of Western Indian Ocean, Mauritius, East Africa, Maldives, Sri Lanka, Bay of Bengal, East Indies, North Australia, Philippine Islands, Southern Japan, South Pacific Islands, Hawaiian Islands (A. M. Clark and Rowe, 1971). It was recorded for the first time from Andamans by the author in 1969.

***Ophiocoma dentata* Muller and Troschel**  
(Pl. II C, D)

*Ophiocoma dentata* Muller and Troschel 1842, p. 99. H. L. Clark 1921, p. 121. Devaney 1970, p. 13. A. M. Clark and Rowe 1971, pp. 86, 119. Devaney 1974, p. 153: Southeastern Polynesia. Yulin 1978, p. 89: Xisha Islands.

*Ophiocoma insularia* Lyman 1861, p. 80: Sandwich Islands, Kingsmill Island; 1874, p. 225. Ely 1942, p. 57: Hawaiian Islands.

*Ophiocoma ternispina* Lyman 1874, p. 225.

*Ophiocoma brevipes* Lyman 1874, p. 225 (Part); 1882, p. 172 (part): Great Ocean. Matsumoto 1917, p. 343 (part).

*Ophiocoma variegata* Smith 1876, p. 39: Rodriguez Island.

*Ophiocoma brevipes* var. *variegata* H. L. Clark 1921, p. 130; 1939, p. 94: Zanzibar; 1946, p. 246:

Australia. Ely, 1942, p. 60: Hawaii. James, 1969, p. 56: Andamans, Lakshadweep; 1983, p. 90: Port Blair (Andamans).

**Material:** Port Blair (Andamans), 4 specimens, intertidal; Minicoy Island (Lakshadweep), 1 specimen, intertidal.

**Remarks:** According to Devaney (1970) *O. dentata* and *O. doderleini* occur in at least two colour forms. From Port Blair specimens with black spots on the disc (Pl. II C) and one specimen with reticulated pattern on the disc (Pl. II D) have been collected. Of the four species of *Ophiocoma* occurring at Andamans this species is very rare being collected only on a few occasions. In order of abundance *O. scolopendrina* ranks first followed by *O. erinaceus*, *O. brevipes* and *O. dentata*.

**Distribution:** This species is known from the Islands of Western Indian Ocean, Mauritius, East African coast, Maldives, Northern Australia, Philippine Islands, Southern Japan, South Pacific Islands and the Hawaiian Islands (A. M. Clark and Rowe, 1971). It was recorded for the first time from the Andamans and the Lakshadweep by the author in 1969.

REFERENCES

- BALINSKY, J. B. 1957. The Ophiuroidea of Inhaca Island. *Ann. Natal Mus.*, **14**: 1-33.
- BELL, F. J. 1882. Note on the Echinoderm Fauna of the Island of Ceylon, together with some observations on heteractinism. *Ann. Mag. nat. Hist.*, (5) **10**: 218-225.
- 1887 a. Report on a collection of Echinodermata from the Andaman Islands. *Proc. zool. Soc. Lond.*, **1887**: 139-145.
- 1887 b. The Echinoderm fauna of the Island of Ceylon. *Scient. Trans. R. Dubl. Soc.*, (2) **3** (14): 643-658.
- 1888. Report on a collection of Echinoderms made at Tuticorin, Madras, by Mr. E. Thurston. *Ibid.*, **1888**: 383-389.
- 1902. The Actinogonidiate Echinoderms of the Maldive and Laccadive Islands. In: Gardiner, J. S. (Ed.) *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*. Cambridge **1** (3): 223-233.
- CLARK, A. H. 1954. Records of Indo-Pacific Echinoderms. *Pacif. Sci.*, **8**: 243-263.
- CLARK, H. L. 1921. The Echinoderm Fauna of Torres Strait. *Pap. Dep. mar. biol. Carnegie Instn Wash.*, **10**: 1-223.
- 1938. The Echinoderms from Australia. *Mem. Mus. comp. zool. Harv.*, **55**: 1-596.
- 1939. Ophiuroidea. *Scient. Rep. John Murray Exped.*, **6**: 29-136.
- 1946. The Echinoderm Fauna of Australia. *Publs Carnegie Instn.*, **566**: 1-567.
- CLARK, A. M. 1952. The 'Manihine' Expedition to the Gulf of Aqaba, 1948-1949. VII. Echinodermata. *Bull. Br. Mus. nat. Hist.*
- AND P. SPENCER DAVIES 1966. Echinoderms of the Maldive Islands. *Ann. Mag. nat. Hist.*, (13) **8**: 597-612.
- 1967. Echinoderms from the Red Sea. Part 2. (Crinoids, Ophiuroids, Echinoids and more Asteroids). *Bull. Sea Fish. Res. Sin Israel*, **41**: 26-58.
- AND F. W. E. ROWE 1971. *Monograph of the shallow-water Indo-West Pacific Echinoderms*. London. 238 pp.

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D. B. JAMES, PLATE I

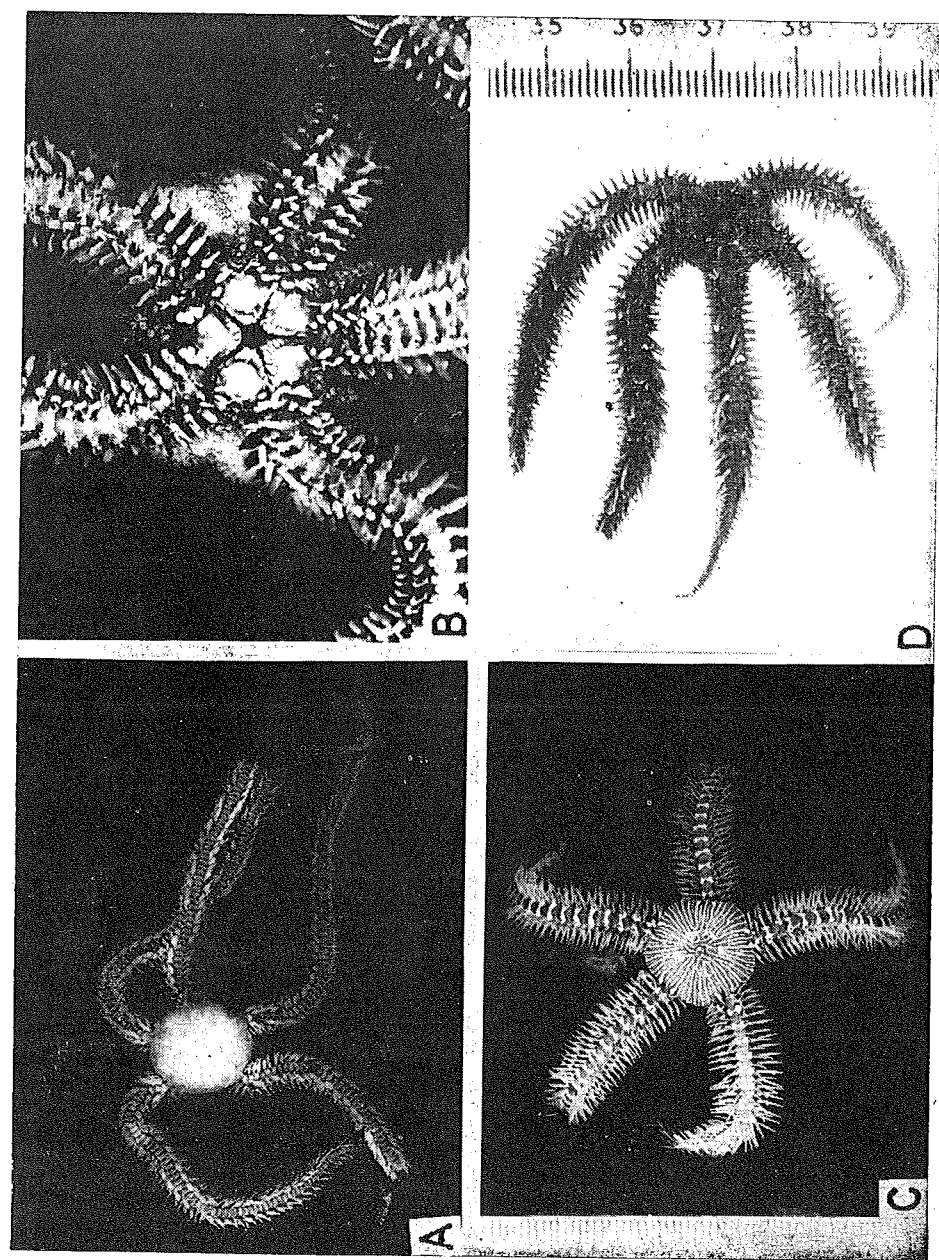


PLATE I A. *Ophiocoma anaglyptica*, B. *O. anaglyptica* - ventral side of disc showing enlarged circular scales (D.D. 20 mm), C. *Ophiocomia pica* and D. *Ophiocomia erinaceus*.

D. B. JAMES, PLATE II

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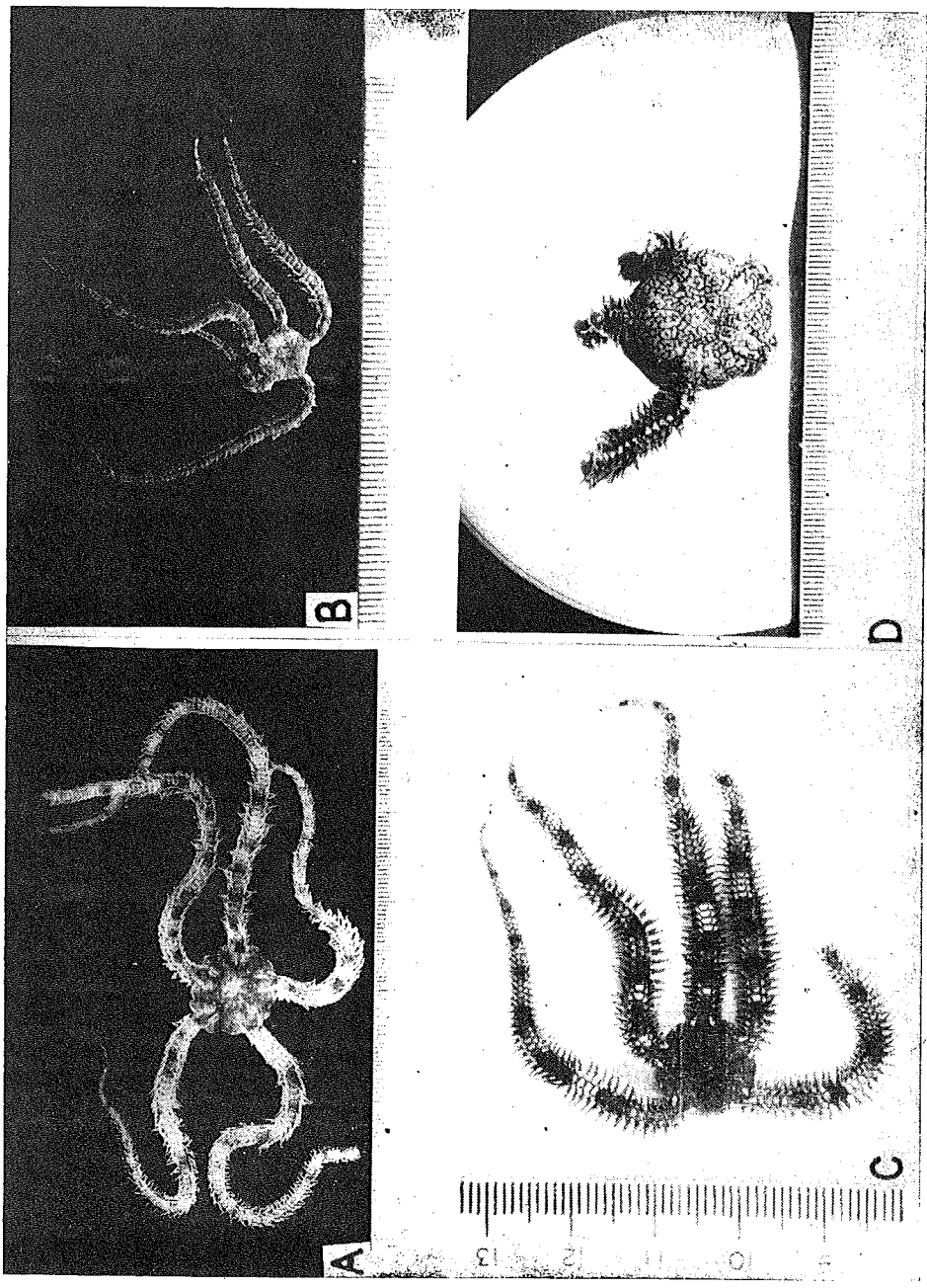


PLATE II A. *Ophiocoma scolopendrina*, B. *Ophiocoma brevipes*, C. *Ophiocoma dentata* (spotted disc) and D. Disc of *Ophiocoma dentata* (reticulated disc).

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- AND J. COURTMAN-STOCK 1976. *The Echinoderms of Southern Africa*. British Museum, London, pp. 277.
- 1984. 5. *Echinodermata of the Seychelles*. In: D. R. Stoddart (Ed). Biogeography and ecology of the Seychelles Islands. Dr. W. Junk Publishers.
- DEVANEY, D. M. 1970. Studies on Ophiocomid brittle stars. I. (*Clarkomoa*) of Ophiocominae with re-valuation of the genus *Ophiocomia*. *Smithson. Contrib. Zool.*, **51**: 1-41.
- 1974. Shallow-water asterozoans of Southeastern Polynesia. II. Ophiuroidea. *Micronesica*, **10**: (1): 105-204.
- DODERLEIN, L. 1889. Echinodermen von Ceylon Bericht über die von den Herren Dres. Sarasin gesammelten Asteroidea, Ophiuroidea und Echinoidea. *Zool. Jb.*, **3**: 822-846.
- ELY, C. A. 1942. Shallow-water Asteroidea and Ophiuroidea of Hawaii. *Bull. Bernice P. Bishop Mus.*, **176**: 1-163.
- ENGEL, H. 1938. Resultats scientifiques du voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Leopold de Belgique. Asteries et Ophiures. *Mem. Mus. r. Hist. nat. Belg.*, **3** (18): 3-31.
- GRAVELY, F. H. 1927. The littoral fauna of Krusadai Island in the Gulf of Mannar: Echinodermata. *Bull. Madras Govt. Mus.* (Nat. Hist.), **1**(1): 163-173.
- HERDMAN, W. A. AND J. B. HERDMAN 1904. On the Echinoderma. *Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Mannar*. London (Royal Society) Suppl. rep., **10**: 137-147. (with notes and additions by F. J. Bell).
- JAMES, D. B. 1969. Catalogue of echinoderms in the reference collection of the Central Marine Fisheries Research Institute. *Bull. cent. Mar. Fish. Res. Inst.*, **7**: 51-62.
- AND J. S. PEARSE 1971. Echinoderms from the Gulf of Suez and northern Red Sea. *J. mar. biol. Ass. India*, **11**: 78-123.
- 1972. Sea cucumber and sea urchin resources. *Bull. cent. Mar. Fish. Res. Inst.*, **34**: 85-93.
- KOEHLER, R. 1922. Ophiurans of the Philippine Seas. *Bull. U. S. nat. Mus.* **100** (5): 1-486.
- LYMAN, T. 1961. Descriptions of new Ophiuridae. *Proc. Boston Soc. Hist.*, **8**: 75-86.
- 1879. Ophiuridae and Astropytidae of the 'Challenger' Expedition 2. *Bull. Mus. comp. Zool. Harv.*, **6**(2): 17-83.
- 1882. Ophiuroidea. *Rep. scient. Results Voy. 'Challenger' (Zool)*, **5**: 1-386.
- MATSUMOTO, H. 1917. A monograph of Japanese Ophiuroidea arranged according to a new classification. *J. coll. Sci. imp. Univ. Tokyo*, **38**: 1-408.
- MORTENSEN, T. 1940. Echinoderms from the Iranian Gulf. Asteroidea, Ophiuroidea and Echinoidea. *Dan. scient. Invest. Iran*, **2**: 55-110.
- MULLER, J. AND F. H. TROSCHEL, 1842. *System der Asteriden*. Braunschweig. pp. 1-134.
- MURAKAMI, S. 1943. Report on the Ophiurans of Yaeyama, Ryu-Kyu. Ophiurans from some gulfs and bays of Nippon. *J. dep. Agric. Kyushu. imp. Univ.*, **7**(4): 159-204; (5): 205-222 and (6): 223-234.
- PETERS, W. 1851. Übersicht der von ihm an der Küste von Mossambique eingesammelten Ophiuren, unter denen sich neue Gattungen befinden. *Ber. K. preuss. Akad. Wiss.*, **1851**: 463-466.
- POPE, E. C. 1967. Lesser known echinoderms of the Great Barrier Reef. *Aust. nat. Hist.*, **15**: 310-314.
- PRICE, A. R. G. 1982. Echinoderms of Saudi Arabia, comparison between Echinoderm fauna of Arabian Gulf, SE Arabia, Red Sea and Gulfs of Aqaba and Suez. *Fauna Saudi Arabia*, **4**: 1-21.
- SMITH, E. A. 1876. Diagnoses of new species of Echinodermata from the Island of Rodriguez. *Ann. Mag. nat. Hist.*, (4) **17**: 406.
- SLOAN, N. A., A. M. CLARK AND J. D. TAYLOR 1979. The echinoderms of Aldabra and their habitats. *Bull. Br. Mus. Nat. Hist. (Zool.)*, **37** (2): 81-128.
- TORTONESE, E. 1949. Echinodermi delle Somalia Italiani. *Annali. Mus. civ. Ster. nat. Giacoma Doria*, **64**: 30-42.
- 1979. Echinoderms collected along the eastern shore of the Red Sea (Saudi Arabia). *Atti. Sco. ital. Sci. nat. Museo civ. Store. nat. Milano*, **120** (3-4): 314-319.
- WALTER, A. 1885. Ceylons Echinodermen. *Z. Z. Naturw.*, **18**: 365-384.
- YULIN, L. 1973. The echinoderms of Xish Islands, Guangdong Province, China. II. Ophiuroidea. *Studia Marina Sinica*, **12**: (12): 69-102.