

XIII. A NOTE ON CERTAIN OPHIUROIDS  
IN THE INDIAN MUSEUM.

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(Plate xiii.)

This note deals with four species obtained by the R.I.M.S. "Investigator." Three are members of the Gorgonocephalinae, while the fourth is a *Trichaster*. The generic names employed are in accordance with the definitions given by Professor Döderlein in his recent review of the Euryalae (5).

*Astrodendrum laevigatum* (Koehler), 1897.

This specimen (Regd. no. ZEV  $\frac{1415}{7}$ ), from Station No. 284, is considerably larger than the type described and figured by

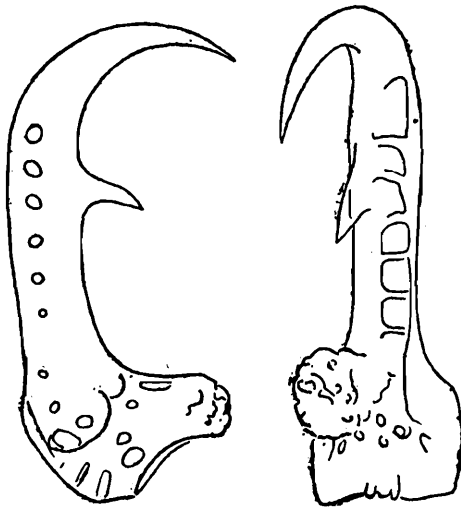


FIG. 1.—Girdle hooks of *Astrodendrum laevigatum*,  $\times 200$ .

Koehler (3) as *Gorgonocephalus laevigatus*. It was obtained off the east coast of Ceylon from a depth of 506 fathoms.

The radial shields on the dorsum of the disc are developed irregularly, and some are imperfect. In addition they are bent, forming a dorsal loop (resembling in outline a Geometrid caterpillar): this, being probably due to the shrinkage of the disc after immersion in spirit, indicates the weakness of the shields.

The madreporite plate is very evident, standing up as a prominent convexity from the general surface, and projecting so as partially to occupy the soft inter-brachial space.

This species is readily distinguished from the following by the complete absence of small granular ossicles on the dorsal surface of the disc and by the much greater relative size of the openings of the genital bursae, which, in this specimen which has a disc 60 mm. in diameter, measure from 16 to 18 mm.

The form of the girdle hooks is seen in text-fig. 1.

#### *Astrodendrum sagaminum* (Döderlein), 1902.

I include under this name two small specimens from Station 333 (Regd. no. ZEV  $\frac{2135}{7}$ ).

The larger of these has a disc measuring 12.5 mm. in diameter, the smaller is clinging to the larger specimen and its disc measures 5.8 mm.

The skin of the disc is very nearly transparent, and contains numerous small granules, which are also present on the upper surface of the radial shields. The upper surfaces of the arms also are finely granular.

The apertures of the genital bursae, though relatively smaller than those of *A. laevigatum*, are comparatively larger than in the example of *A. sagaminum* which is figured by Döderlein (5). They measure 2 mm. in the larger and 0.9 mm. in the smaller specimen. But it may well be that the relative sizes of these apertures and the disc would be subject to alteration during growth up to the attainment of maturity. These are both young specimens and their discs are small, so that the basal end of each arm is quite free from the disc: in a dorsal view of the larger specimen two arm segments, and of the smaller four arm segments, are visible beyond the disc margin and before the occurrence of the first bifurcation of the arms.

#### *Astrocladus dofleini*, Döderlein, 1910.

(Pl. xiii, fig. 1.)

One specimen (Regd. no. ZEV  $\frac{5533}{7}$ ) from Station 467, at a depth of between 42 and 75 fathoms, off the west coast of the south of India. This specimen, though the disc is complete, has all its arms fractured just beyond their first bifurcation.

The disc, measuring from the end of a radial shield to the opposite inter-brachial margin, has a diameter of 28 mm. The skin on the upper surface of the disc is opaque and finely granular, the shields being indicated by radiating ridges. Besides the fine granulations there are tuberosities which are very regular in their arrangement. In the centre of the disc they form a cluster of small round tubercles of various sizes. In each inter-radial and inter-brachial depression many of these tubercles are rather larger than

those in the centre, and distinctly conical. On the radial shields these conical tuberosities attain their greatest development: there are three or four on each shield and they are separated by intervals; at the outer end of each shield, except on one, are two large cones in contact at their bases. The outermost of these cones is the larger and measures 4 mm. in height.

Each inter-brachial space forms a semicircular bight in the disc margin. The thick, but unsupported skin of this space is bounded above by four or five tuberosities, not distinct from those on the dorsum of the disc, and there may be a feeble indication of a few small tubercles under the skin of this region. At the sides of this space are the openings of the genital bursae. The skin of the space forms a valve-like flap which closes the upper and outer ends of these openings, reducing the aperture to a curved slit, but leaves a wider piriform opening below. The length of the bursal slit is 4 mm.

The madreporite does not project into the soft inter-brachial

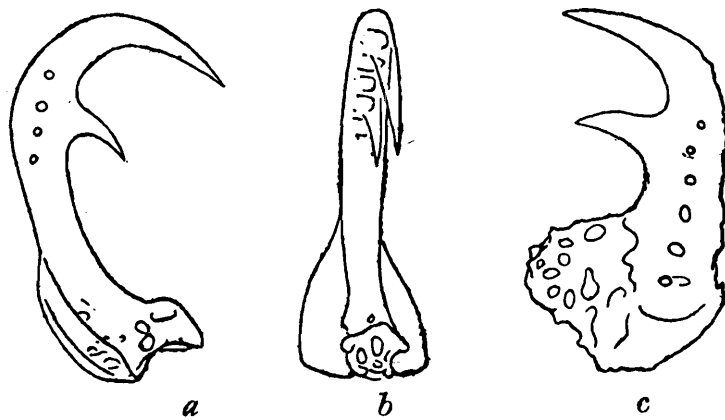


FIG. 2.—Girdle and tentacle hooks of *Astrocladus dofeini*,  $\times 200$ .

area, but is wholly situated on the firm skeleton of the under side of the disc. It forms an almost circular area, about 1.2 mm. in diameter, and is slightly concave.

The skin on the under side of the disc is also thick and finely granular.

The teeth and mouth papillae are spiniform but not so slender as in the genus *Astrodendrum*. The arms divide at the disc margin, the primary divisions being equally well developed. Each primary division begins to branch at a distance of 10 mm. from the disc, and the branching is unequal as in *Astrocladus exiguus* (Lamarck).

The dorsum of the arms is beset with tuberosities, like those on the disc; there are generally two on each segment. At the proximal part of the arm they form blunt cones, on bases measuring 1 mm. or more. These tuberosities, diminishing in size, can be traced beyond the ninth division of each arm.

Tentacle papillae begin at the second bifurcation of the arms, and form three rough rounded knobs close together. In the more

distal parts of the arms there are two tentacle papillae close to each tentacle. Text-fig. 2c shows a tentacle hook from the thinner part of the arm. A girdle hook is shown in text-fig. 2a-b.

It is one of my misfortunes that I have only been able to compare this specimen with one other member of this genus, namely with *A. exiguus* (Lamarck)=*G. cornutus*, Koehler (3). From this it differs in having more than one conical tuberosity on each radial shield. From *A. euryale* (Retzius), it differs in having numerous tuberosities in the inter-brachial regions on the dorsum of the disc.<sup>1</sup>

The specimen examined shows points of resemblance to *A. ludwigi* (Döderlein) (4). Both have well developed tuberosities on the radial shields. *A. ludwigi*, however, differs in having no tuberosities on the arms and having its madreporite projecting into the soft inter-brachial area. But for these differences (which might not obtain in an example of *A. ludwigi* which measured more than 7 mm. in the diameter of the disc) I feel inclined to include this specimen in that species. But it agrees sufficiently well with that variety of *A. dofleini*, Döderlein, which has conical tuberosities. It shows a general resemblance to the example Döderlein figures in his review of Japanese Ophiuroids (5, plate 4, fig. 4), but has the tuberosities on the disc much more prominent.

### *Trichaster elegans*, Ludwig, 1878.

(Pl. xiii, figs. 3—4.)

This species (Regd. no. ZEV  $\frac{5480}{7}$ ), founded on a single specimen from the Bay of Bengal, has apparently not been met with since Ludwig (2) published his description. Döderlein (5) has concluded that Ludwig's specimen was but a young example of *T. palmiferus* (Lamarck). For these two reasons it may be well to give a short description of a specimen recently obtained by the R.I.M.S. "Investigator" in the neighbourhood of the Mergui Archipelago (Station No. 533. Lat. 12°55'50" N., Long. 96°51'50" E.).

This example is considerably larger than the one described by Ludwig, its linear measurements being nearly twice as great. It was living on a sandy bottom at 58 fathoms depth, and its general colour was a sandy grey on the upper and almost white on the lower surface. The centre of the disc, however, was of a very dark olive green, and this same colour extended as a band to each inter-brachial margin of the disc, and also in the same manner along the dorsum of each arm. On the arms the intensity of the colour gradually diminished through brown into the general grey colour, so that after the first bifurcation, the dark streak was hardly noticeable.

<sup>1</sup> The only figure of this species with which I have been able to compare the specimen is that given by L. Agassiz (1) under the name of *Gorgonocephalus verrucosus*.

The upper surface of the disc was even, and not elevated above the level of the upper surface of the arms: since its immersion in spirit the soft parts have somewhat collapsed in the centre (as can be seen in plate xiii, fig. 4), and the radial shields of the disc, and the lateral arm plates also, are now clearly distinguishable

I have been able to compare this specimen with an example of *T palmiferus* (Lam.) (Regd. no. ZEV  $\frac{5481}{7}$ ) presented to the Museum many years ago by Dr. Hungerford, who obtained it in Hong Kong.

The following features serve to distinguish the two species:—

- (1) In comparison with the size of the disc, the inter-brachial spaces in *T elegans* are much wider than in *T palmiferus*; or, in other words, the arms at their bases are narrower.
- (2) The arms of *T elegans* are much more slender: not only

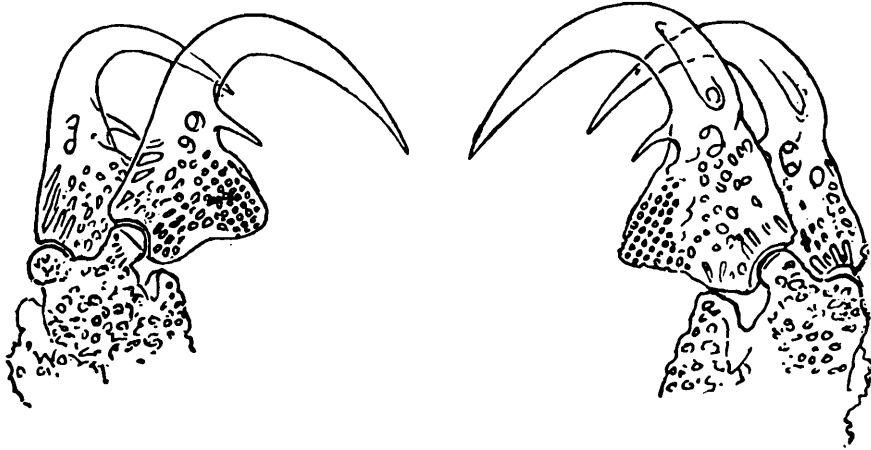


FIG. 3.

*Trichaster elegans*, × 107.*Trichaster palmiferus*, × 107.

are they relatively narrow at their bases, but at the first bifurcation their breadth has diminished to less than one fourth part, while in *T palmiferus* the breadth at this point is one third of the breadth at the base of the arms.

- (3) The apertures of the genital bursae are much more widely separated in *T elegans*. In the specimen of *T palmiferus* from Hong Kong, the two apertures in each inter-brachial space practically unite to form one and the surface that should intervene is drawn in, and forms an almost linear septum. This difference, which is illustrated in plate xiii, figs. 2 and 3, is the consequence of the reduced size of the inter-brachial space.
- (4) The radial shields on the disc, at their outer end, and the lateral arm plates, at their upper ends, are only slightly expanded: the latter nowhere form conical elevations.

- (5) The upper ends of the lateral plates on opposite sides of an arm are not closely approximated, so that, in *T elegans*, there is a wide dorsal surface (or shallow furrow in a spirit specimen) on the upper surface of the arms. In other words, the arm is more quadrangular in section, while in *T palmiferus*, the approximation of the upper ends of these plates makes the arm almost triangular in section. (This point of difference only refers to the proximal part of the arm—in the more distal parts the arm remains flat below, while the dorsum and sides form a continuous curve.)
- (6) The talons borne on the tentacle papillae (text-fig. 3) show no great difference. Those of *T palmiferus* generally show a fluted appearance, and the outlines of the convex surface are different.

I have been able to count six bifurcations of an arm in this example.

Though I do not think that the actual number of segments in an arm and its branches are of any particular importance, for they vary in different arms of the same specimen, yet I have included some facts concerning them in the following table of measurements, for comparison with other tables giving these particulars in the case of *T palmiferus*.

Diameter of disc	28 mm.
Vertical diameter of the bursal aperture	2 mm.
Interval between a pair of bursal apertures	2.5 mm.

Arms:—

	<i>Breadth.</i>	<i>Height.</i>
At base	13 mm.	10 mm.
At 20th segment	6.7 mm.	7 mm.
At 40th segment	4.0 mm.	3.5 mm.

	<i>Length.</i>	<i>No. of segments.</i>
From base to 1st bifurcation..	90 to 112 mm.	39 to 52
From 1st to 2nd ,,	16 to 30 mm.	17 to 26
From 2nd to 3rd ,,	15 to 17 mm.	about 18
From 3rd to 4th ,,	14 to 17 mm.	about 16

Beyond the 4th bifurcation I have not unravelled the fine branches to take measurements.

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