

STUDIES ON THE FAUNA OF CURAÇAO AND OTHER
CARIBBEAN ISLANDS: No. 67.

OPHIUROIDEA OF THE LESSER ANTILLES

by

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This paper deals mainly with a collection of ophiuroids from the Lesser Antilles sent to the British Museum (Natural History) by Dr. P. WAGENAAR HUMMELINCK in 1959. The identifications were made by ROSEMARY PARSLow, but the discussion and figures of *Amphiodia* and *Ophiocomella* are by AILSA CLARK.

The material was collected in 1948/49 and 1955. Specimens gathered by HUMMELINCK in 1930 and 1936 are mentioned in ENGEL's report on "Echinoderms from Aruba, Curaçao, Bonaire and northern Venezuela" (1939).

In 1919 H. L. CLARK published a table showing the known distributions of the various littoral species of West Indian echinoderms. A modified and up-to-date version of the part dealing with ophiuroids is given here (Table 1). Except for the "reliable records" of earlier workers included by Dr. CLARK (distinguished here as H') only records of specimens personally examined by H. L. CLARK himself (H), AUSTIN H. CLARK (A), ENGEL (E), FONTAINE (F), KOEHLER (K) and LÜTKEN (L) are shown, the new data from Dr. HUMMELINCK's collection being distinguished by X. This survey is not intended to be an exhaustive one, but includes the more authoritative records, particularly from Lesser Antillean localities, from depths of not more than 10 fathoms (18 metres). Also owing to lack of space not more than three records for any one column are given. Other records have been omitted, notably those of VERRILL from the Tortugas, Florida, the Bahamas and Bermuda - areas which have been covered more reliably by H. L. CLARK.

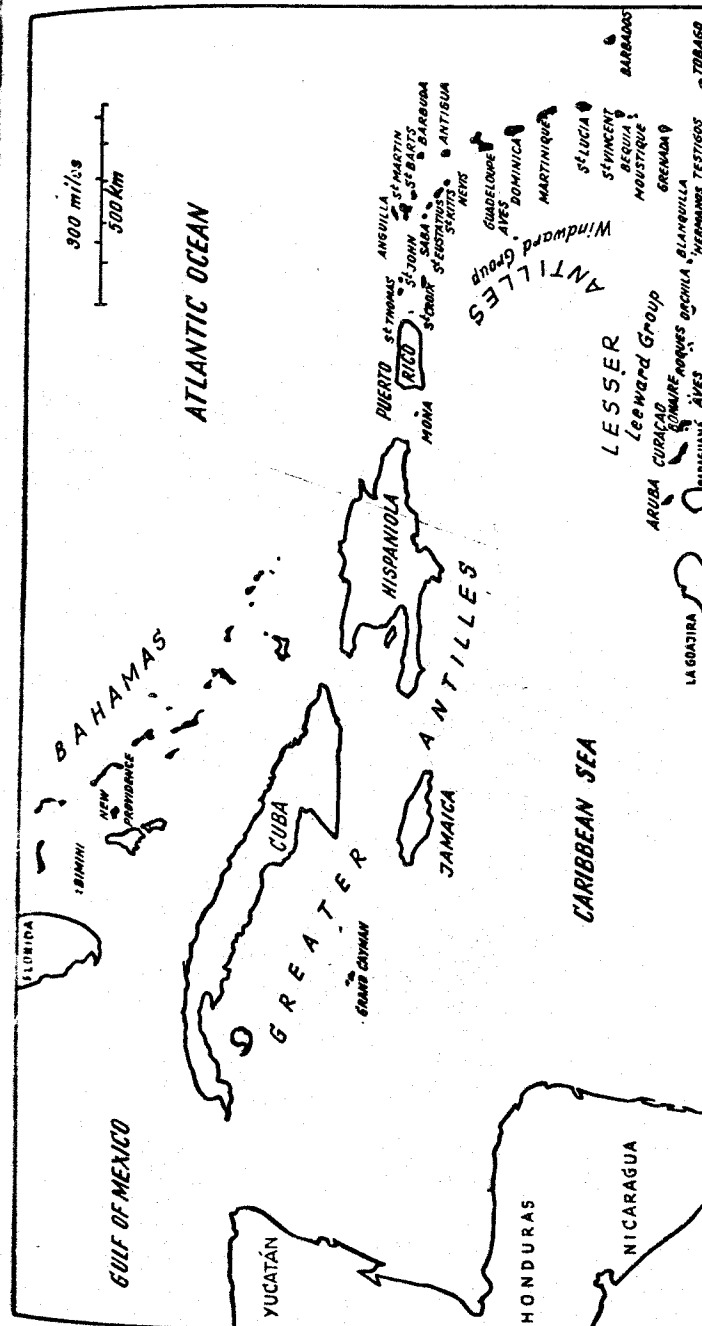


TABLE 1

The known distribution of the species of West Indian Ophiuroids
in depths of not more than 10 fathoms.

[Including records of LUTKEN (L), KOEHLER (K), H. L. CLARK (H, H'), AUSTIN H. CLARK (A), ENGEL (E), FONTAINE (F),
and the new data from HUMMELINCK's collection (X). See text.]

	Aruba	Curaçao	Bonaire	Trinidad & Tobago	Grenada, Barbados, St. Vincent, St. Lucia, Martinique, Dominica, Guadeloupe & Montserrat	Antigua & Barbuda	St. Barts, Fourche, St. Martin & Anguilla	Nevis, St. Kitts, St. Eustatius, Saba & Aves	St. Croix, St. John, St. Thomas, Tortola, etc.	Puerto Rico	Hispaniola	Jamaica	Cuba	Tortugas	Florida	Bahamas & Bermuda	South America
<i>Astrophyton muricatum</i>	—	AE	X	—	A	—	—	—	—	—	—	HF	—	—	—	—	—
<i>Ophiomyxa flaccida</i>	—	AE	—	H	H'A	A	—	—	KH	H	HA	KHF	—	H	H	H	H
<i>Ophiotreta littoralis</i>	—	—	—	—	—	—	—	—	K	—	—	—	?K	—	—	—	—
<i>Ophiomitrella glabra</i>	—	—	—	—	—	—	—	—	L	—	—	—	—	—	—	—	—
<i>Ophioblenna antillensis</i>	—	—	—	—	—	—	—	—	K	—	—	—	—	—	—	—	—
<i>Amphiura palmeri</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. fibulata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. stimpsoni</i>	—	AE	E	H	—	X	X	—	L	H	—	F	—	—	H	K	—
<i>Ophionephthys limicola</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophionema intricata</i>	—	—	—	H	—	—	—	—	H	H'	—	—	—	—	—	—	—
<i>Ophiophragmus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i> wurdemanni</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. filigraneus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	H	—	—
<i>O. pulcher</i>	E	—	—	—	—	—	—	—	—	—	—	—	—	—	H	—	—
<i>O. septus</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. luetkeni</i>	—	—	—	H	—	—	—	—	L	—	—	—	—	—	—	—	—
<i>Amphiodia gyraspis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. limbata</i>	—	—	—	(K)	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. planispina</i>	—	—	—	—	?A?X	—	—	—	—	—	—	—	—	—	—	—	H'
<i>A. rhabdota</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	H'
<i>A. riisei</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. trychna</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. tymbara</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. pulchella</i>	—	—	—	H	H'	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. repens</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophiocoma scabrituscula</i>	—	—	—	—	—	—	—	—	LK	—	—	HF	—	—	—	—	—
<i>O. robusta</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophiocoma vacillans</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Amphiprion abditus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. thrombodes</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>A. concolor</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Hemiphysalis elongata</i>	—	—	—	H'	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophiactis algicola</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. muelleri</i>	—	—	—	(H)	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. quinqueradial</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophiactis savignyi</i>	E	AEX	X	HX	—	X	X	X	LHX	HA	HA	HF	—	—	—	—	H'
<i>O. notabilis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophiotrix angulata</i>	E	AEX	EX	HX	KA	—	X	—	KHX	HA	HA	HF	—	—	—	—	H
<i>O. platyactis</i>	—	—	—	—	H(A)	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. hartfordi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. suensoni</i>	—	AEX	X	H	KA	A	X	—	KH	A	H	HF	—	—	—	—	H
<i>O. lineata</i>	—	AE	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. oerstedii</i>	EX	AEX	EX	H	KA	A	X	X	KHA	HA	A	HF	—	—	—	—	H
<i>O. brachyactis</i>	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ophiocoma ophiactoides</i>	—	(A)X	X	X	—	—	—	—	(A)	H	—	—	—	—	—	—	—
<i>Ophiocoma echinata</i>	EX	AEX	EX	HX	KAX	A	X	X	KHX	HA	HA	KHF	—	—	—	—	H'
<i>O. riisei</i>	—	AEX	X	H	K	XA	X	—	KAH	HA	HA	KHF	—	—	—	—	H'
<i>O. pumila</i>	EX	AEX	X	HX	KAX	A	X	—	KHX	HA	HA	KHF	—	—	—	—	H'
<i>Ophiopsila riisei</i>	—	—	—	—	—	—	—	—	LK	H'	—	—	—	—	—	—	H'
<i>O. vittata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. hartmeyerii</i>	—	—	—	—	H'	—	—	—	K	—	—	—	—	—	—	—	H'
<i>Ophioneis olivacea</i>	—	AE	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. reticulata</i>	EX	AEX	X	HX	K	A	X	—	LKH	H	A	KHF	—	—	—	—	H
<i>O. squamulosa</i>	—	—	—	H	—	—	—	—	K	—	A	—	—	—	—	—	—
<i>Ophioderma appressum</i>	EX	AX	E	HX	KHA	A	X	—	LKH	HA	HA	KHF	—	—	—	—	H
<i>O. brevicaudum</i>	EX	AEX	E	H	KAX	A	—	—	LHX	HA	HA	HF	—	—	—	—	H
<i>O. brevispinum</i>	EX	—	—	—	—	—	—	—	LKH	H	H	HF	—	—	—	—	—
<i>O. januarii</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>O. cinereum</i>	E	AEX	—	HX	K	A	—	—	LH	HA	H	HF	—	—	—	—	—
<i>O. phoeniceum</i>	—	—	—	H	—	—	—	—	—	—	—	—	—	—	—	—	—

The use of round brackets indicates a record under another name, for instance *Ophiophragmus wundermanni* (sic) for *Amphiodia limbata* by KOEHLER; *Ophiactis cyanosticta* for *O. muelleri* and *O. muelleri* for *O. quinqueradia*, both by H. L. CLARK; *Ophiacantha oligacantha* by H. L. CLARK and *Ophiocomella caribbaea* by A. H. CLARK, both for *Ophiocomella ophiactoides*; also certain records of *Ophiocoma pumila*.

The queries beside some of the records of *Amphiodia planispina* signify specimens lacking the disc.

Few of the species included in the present collection need any further remark since most of them have been dealt with in detail by LÜTKEN and by H. L. CLARK. The latter's work on the Echinoderms of Porto Rico, published in 1933, gives fairly adequate keys to the species. Two genera only evoke comment here, namely *Amphiodia* and *Ophiocomella* (the latter including *Ophiacantha ophiactoides* and *O. oligacantha*, both of H. L. CLARK), supposedly the only littoral representatives in the West Indies of the family Ophiacanthidae.

Genus *Amphiodia*

Fig. 9-10

There are eight species of *Amphiodia* with two tentacle scales known from the West Indian and adjacent areas, namely *A. gyraspis* H. L. Clark 1915, *limbata* (Grube) 1857, *planispina* (von Martens) 1867, *rhabdota* H. L. Clark 1918, *tymbara* H. L. Clark 1918, *trychna* H. L. Clark 1918, *riisei* (Lütken) 1860 and *atra* (Stimpson) 1852. All of them have been recorded from the West Indies proper, except for *A. atra*, which is known from South Carolina. Neither *riisei* nor *atra* was included in H. L. CLARK's table of West Indian species in 1919 or in his keys of 1933, although St. Thomas in the Virgin Islands was the type locality of *A. riisei*.¹⁾

I have examined the holotypes of *A. gyraspis*, *rhabdota*, *tymbara* and *trychna*, a syntype of *A. planispina* from Rio de Janeiro, a specimen of *A. limbata* also from Rio, the type locality, a specimen named *atra* by H. L. CLARK from Charleston, South Carolina, the

¹⁾ Since this account was written a paper by L. P. THOMAS (1962) on the Amphiuroid brittle stars of Florida has been published. In this interesting and very well illustrated paper, based on much additional material, Mr. THOMAS comes to the conclusion that *Amphiodia tymbara* is a synonym of *A. trychna* (but without comparison with *riisei* Lütken) and that *A. rhabdota* is a synonym of *Ophiophragmus pulcher*.

type locality of that species, as well as one named *rii* but which differs slightly from LÜTKEN's description of the holotype. All these are in the Museum of Comparative Zoology at Harvard, except for the type of *A. gyraspis*, which is in the National Museum.

Among the characters used by H. L. CLARK to distinguish the first six of these species are the density of the scaling and the relative size of the radial shields. In most, if not all, species concerned the disc is very easily lost. When a specimen regenerates its disc the radial shields are at first very large, larger than the adjacent scales and their increase in size keeps pace with the growth of the whole disc. I think that the density of the scaling may also differ in a regenerated disc from the original density and the regular arrangement and distribution of the primary scales may be lost.

I can find no published work dealing specifically with the effects of disc loss on the structure of the disc in Amphiuroids and the samples of material I have seen are too small to give much help. However, a few observations on apparently regenerated specimens of other Amphiuroid species differing only in the character of the disc, give support to my theory. For instance, NIELSEN (1931, *Naturh. Foren. Kbh.* 91, p. 292) has described a specimen under the name *Amphipholis platydisca* var. *microplax*, which differs from *A. microplax* in having finer scales and unnaturally diminutive radial shields. If this specimen, if it was a regenerated one, had reached approximately the size of the original disc since the first exposed dorsal arm plate was complete, the specimen of *Amphipholus integer* which MORTENSEN (1933, *Vidensk. Meddel. Naturh. Foren. Kbh.* 93, p. 370) illustrated, this was not so, since the two dorsal arm plates abut on to a mosaic of several irregular plates in the position of the radial shields. MORTENSEN noted that the disc was remarkably regenerated, described it as probably abnormally regenerated. Clearly the regeneration was not complete. — In 1955 (*Journ. W. African Sci. Assoc.* 1, p. 44) I noted differences in the regenerating discs of specimens of *Amphipholus arcuatus*. Only two specimens out of the twelve with discs intact having the primary scales, these two being also the only specimens to have the primary scales

In 1915, H. L. CLARK published some good photographs of specimens of *Amphiodia gyraspis*, *atra*, *limbata* and *planispina*, and of *A. rhabdota*, *tymbara* and *trychna* which he gave in 1919. The photographs are poor. I am therefore publishing drawings of the type of the three species. Other relevant figures extant include LÜTKEN's, though small, ones of *riisei* (under the name of *Amphipholus*) and KOEHLER's photographs of the ventral side of *Amphiodia* and of both sides of *A. limbata* (the latter under the name *Ophiophragmus wundermanni*).

The eight species are alike, not only in having two tentacle scales, but also in that the oral shields are approximately rhombic in shape, the two infra-dental papillae of each pair are often widely spaced from each other, the outermost oral papilla on each side is distinctly larger than the other two, sometimes verging on the opercular form characteristic of the genus *Amphipholis*, the arm spines number three and the colouration is patchy with irregular dark bands across the arms on the dorsal side. The available information concerning the eight species indicates that they can be arranged in three groups, as follows:

A. Species with the adoral shields meeting more or less widely, their surfaces distinctly convex; oral shields with the two inner sides straight (rarely slightly convex); arm spines blunt at the tips but not conspicuously flattened; disc scales usually distinctly thickened; dorsal arm plates of larger specimens (disc diameter > 7 mm) with the distal edge straight or even concave and with a pale belt across the distal end, often contrasting with a darkened stripe immediately proximal to it (fig. 9) *A. riisei*, *trychna* & *tymbara*

B. Species with the adoral shields also meeting more or less widely, but their surfaces not conspicuously convex; oral shields with the two inner sides slightly concave; arm spines tapering and pointed; disc scales not very thick; dorsal arm plates with a slight convex angle in the middle of the distal edge and not individually striped *A. limbata*, *atra* & *gyraspis*

C. Species with the adoral shields usually slightly separated from each other, rarely just meeting within the oral shields which have their two inner sides slightly convex; arm spines distinctly flattened and paddle-shaped, wide and blunt at the tip, especially the uppermost one; disc scales not very thick; dorsal arm plates with the distal edge straight or slightly concave; in *A. rhabdota* at least, a dark longitudinal stripe is developed along the arms, both on the dorsal and the ventral sides *A. rhabdota* & *planispina*

With regard to the first group (A), both *A. trychna* and *A. tymbara* were described from single specimens taken in sandy mud in 2 to 3 feet of water at Sandy Point, Buccoo Bay, Tobago. The type of *trychna* had the disc diameter only 3.5 mm, while that of *tymbara* was more than twice as large, with the diameter 8 mm. The larger of LÜTKEN's two specimens of *A. riisei* also had the diameter 8 mm. KOEHLER's photograph of the ventral side of *riisei* shows that it had the adoral shields widely

joined and their surfaces distinctly convex, just as in the holotypes *trychna* and *A. tymbara*. In addition, all three have the outermost tentacle scales particularly heavy, the radial shields widely in contact as well as individual oral shields of the same kind though the outer lobe in *A. riisei* is more widely separated. Also the arm spines seem to be similarly rather thick and blunt-tipped. The colour pattern is probably the same. In both *A. trychna* and *A. tymbara* the dorsal arm plates are darker than the others so that the arms are banded at intervals. At the same time all the plates have the distal margin pale, contrasting with a dark transverse band just short of the distal end. LÜTKEN's figure suggests that *A. riisei* also has the distal margins of the plates pale, though he does not show the dark bands as well.

As for the differences between them, H. L. CLARK did not compare *A. trychna* directly with any other species, apparently assuming that its rugged surface was sufficient to distinguish it. However, *A. tymbara* he compared with

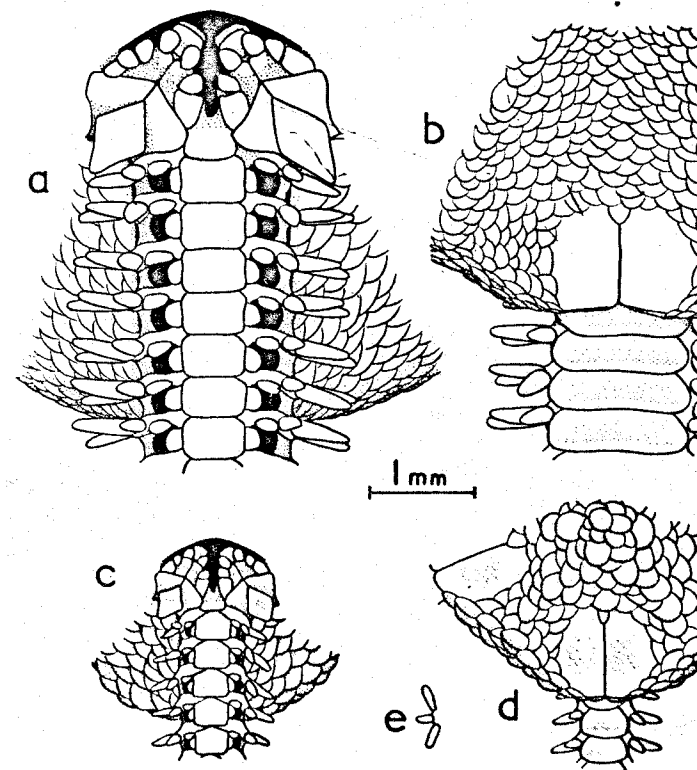


Fig. 9. - a) and b) *Amphiodia tymbara* H. L. Clark, holotype; part of the base of an arm in a) ventral and b) dorsal view. - c) to e) *A. trychna* holotype; part of the disc and the base of an arm in c) ventral and d) dorsal view. e) arm spines.

Amphiurids, noting first that it is superficially very like *Ophiophragmus wurdemanni*, but differs in the absence of marginal papillae, in the form of the disc scales and in the shape of the arm spines. From *Amphiodia atra*, he said, it differs in the smaller radial shields and tentacle scales and the smaller and sharper arm spines (though with this last point he clearly made a slip since *atra* is the one with sharp arm spines); from *A. riisei* he distinguished *tymbara* by the longer arms and from *A. planispina* by the finer disc scaling and the more slender arm spines. The relative length of the arm does seem to be markedly different in *A. tymbara* and *A. riisei*. With the same disc diameter (8 mm) the arm length of the type of *A. tymbara* was at least 150 mm (a ratio of about 1:19) while that of *A. riisei* was hardly more than 50 mm (a ratio of about 1:6). In the type of *A. trychna* the ratio was about 1:10. However, H. L. CLARK noted that in the type specimen of *A. tymbara* "the disk has probably been recently regenerated and would perhaps ultimately be a little larger but it is clear that the arms are fully 15 times the diameter of the disk." The first exposed dorsal arm plate is fully formed, so the original disc could not have been much larger and I concur with Dr. CLARK's estimate.

The proportions of the disc scales seem to be very much the same in the types of *A. trychna* and *A. riisei* despite the size difference. If my translation of Danish is correct, LÜTKEN describes the scales of *A. riisei* as "rounded or rimmed." This also describes the scales of *A. trychna*, which I noted as being thickened around their rims but thin in the centre. In KOEHLER's photograph of *A. riisei* the scales appear thickened and seem to stand out around the edge of the disc as they do in *A. trychna* and to a lesser extent in the larger *A. tymbara*, though the scales of *A. tymbara* are much more numerous, numbering about 13 or 15 across each interradial area as opposed to five in the types of both *A. trychna* and *A. riisei*. The radial shields are D-shaped in all three, with the inner ends rounded, not prolonged. I think that the fact of the disc being a regenerated one in the type of *A. tymbara* may be responsible for the relatively small size of the scales and for the absence of enlarged primary ones in the centre, however, the difference in the proportions of the arms may provide a valid distinction. The shapes of the oral and adoral shields, the oral papillae and the arm plates are so similar in all three (allowing for the immaturity of the holotype of *A. trychna*) that it is difficult to believe they are not all representatives of a single species.

There are several other specimens in the Museum of Comparative Zoölogy relevant to this problem. One, no. 6639, from off Boynton, Florida, in 146 metres, labelled *Amphiodia tymbara*, has lost its disc, but it has convex, widely meeting, adoral shields and transverse dark stripes across the dorsal arm plates like the type of *A. tymbara*. — A second specimen, no. 4734, a complete one from White Shoal, Tortugas, in 14.5–16.5 metres, had been named *planispina* by H. L. CLARK, though it too has the adoral shields widely meeting, unlike those of the type of *A. planispina*. Its disc scales are almost as numerous as those of the type of *A. tymbara*, but appear thicker, as in the type of *trychna*, though the radial shields are smooth, not bumpy. The arm spines are neither as wide nor as flat as those of *A. planispina* and I believe that Dr. CLARK was mistaken in giving it that name. — Nos. 6644 and 6646, both from off Destin, Florida, have oral and adoral shields like *A. tymbara* and *A. trychna*. In dorsal view they are more like the holotype of *Ophiophragmus brachyactis* (figured by H. L. CLARK 1915, pl. 10 fig. 13) but without the marginal papillae, having large, somewhat thickened scales and distinct primaries. Their dorsal arm plates do not have individual transverse stripes, though the arms are banded, several consecutive

plates being similar in colour. The type of *O. brachyactis* had relative diameter according to Dr. CLARK only about four times the disc diameter, though from the photographs, with the arms intact the ratio would be nearer 10. One of these two also has the arms relatively short but in the larger one ten times the disc diameter. — Finally, no. 1455 from Rio de Janeiro, named *riisei*. It came from the Kinberg collection in the Stockholm Museum. The disc diameter is 10 mm and the arms were probably about 50 mm long. The scales of the disc are distinct and there are about nine scales across each arm. However, the disc scales are not noticeably thickened and the adoral shields meet very widely, unlike those of the type of *riisei*, also the ventral shields are widened distally and the radial shields are separated for over half the disc diameter.

The second group (B), consists of *Amphiodia atra*, *gyraspis* and *limbata*. The locality of *Ophiophragmus atra* Stimpson was Charleston, South Carolina. No. 4343 in the Museum of Comparative Zoölogy, from Charleston, named *atra* by CLARK (though with a manuscript new name for the genus) closely resembles *gyraspis* from Porto Rico (U.S. Nat. Mus. no. E. 5454) named *A. gyraspis* by ALCOCK. It has the ventral arm plates tapered distally and the infra-dental shields reduced in size, but equal to the second papilla on each side. *A. gyraspis* has been recorded from Porto Rico. The holotype has the sides of the ventral shields more or less parallel and the infra-dental papillae appear to be divergent, but this is at least partly illusory and due to the foreshortening effect of the upward angle at which they are inclined, and to contrast with the enlarged papillae.

STIMPSON's description of *atra* was not very detailed but agrees with *gyraspis*, the "interbranchial plates" (oral shields) being similarly rhomboid. The shields are ovate, short and broad and the margin of the disc marked by small scales. His description of the sides and lower surface of the disc is very smooth to the naked eye from the minuteness of the granules which are rather puzzling; it sounds more like the condition found in *Ophiophragmus* (Lyman) but that species has been recorded only from Florida. STIMPSON's description (1865, p. 127) of a specimen of *atra* also from Charleston, he noted that the scaling is finer on the lower side of the disc. He also noted that the infra-dental papillae were inclined upwards towards the teeth, just as the holotype of *gyraspis*.

When describing *Amphiodia gyraspis*, H. L. CLARK commented that *atra* but differs in having the radial shields relatively smaller and the disc scaling coarser. Like STIMPSON he noted that several of his specimens of *gyraspis* have a regenerated disc. The most proximal dorsal arm plates are comparatively small. The disc must be about the same size as the original one. Despite this, the arms are still much smaller than those of the type of *A. gyraspis*. If the condition is that of other specimens from Porto Rico are found with the radial shields larger than in the type, then *A. gyraspis* can hardly be other than *A. atra*.

Amphiodia limbata (Grube) recorded first from Rio de Janeiro and Trinidad and Porto Rico, resembles *A. atra* and *A. gyraspis* in the shape of the shields, widely joined adorals, enlarged outer oral papilla and tapering arm plates. It seems to differ in having the radial shields prolonged and tapering

is more pear-shaped than D-shaped, with a length to breadth ratio of about 2:1 rather than nearer 1.5:1 as in the few specimens of *A. atra* and *A. gyraspis* studied. H. L. CLARK (1933) in his key, also distinguished *gyraspis* from *limbata* by the distinctly carinate basal dorsal arm plates of *A. gyraspis*, as well as by a difference in the density of the disc scaling, though the latter point may not be significant if the possibility of variation with regeneration is taken into account.

The third group of species (C) consists of *Amphiodia planispina* and *A. rhabdota*. Their type localities were respectively Rio de Janeiro and the Dry Tortugas. The syntype of *A. planispina* seen by me unfortunately had no disc. However, H. L. CLARK in 1915 published good photographs of another specimen that was complete, the disc diameter being about 10 mm, judging from the magnification. The arm spines are markedly flattened obliquely and rounded at the tips, in contrast to those of *A. atra*, *gyraspis* and *limbata*. The oral shields also differ; although they are similarly rhombic, only the two outer sides are concave, the inner ones being

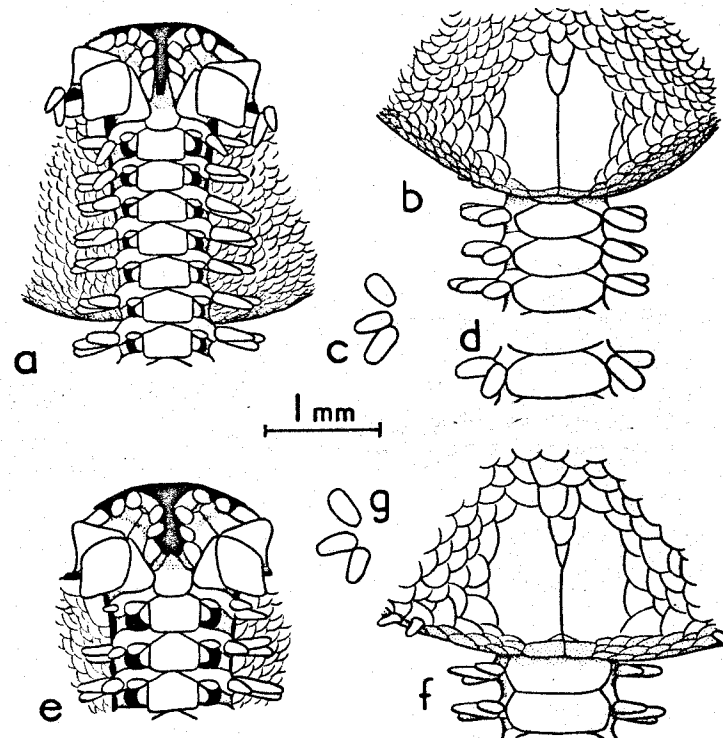


Fig. 10. - a) to d) *Amphiodia rhabdota* H. L. Clark, holotype; part of the disc and the base of an arm in a) ventral and b) dorsal view; c) arm spines; d) the segment including the twelfth dorsal arm plate. - e) to g) *Ophiophragnus pulcher* H. L. Clark, holotype; e) two jaw angles and the first three arm segments in ventral view; f) part of the disc and the base of an arm in dorsal view; g) arm spines.

slightly convex. Also the adoral shields are separate or barely meet in *A. atra* and *rhabdota*. The dorsal arm plates tend to be much more nearly rounded in *A. planispina* with straight sides for much of their length.

H. L. CLARK noted that the type of *A. rhabdota* is almost identical to *A. planispina* in ventral view but differs dorsally in the much finer scaling (50/sq.mm), longer radial shields (l:br nearly 3:1) and less square arm plates. The last feature could be partly attributable to the relatively small size of the type of *A. rhabdota* (disc diameter 6 mm). Also H. L. CLARK himself described *A. planispina* a specimen from Loggerhead Key, Tortugas, with the disc diameter 10 mm, which was clearly intermediate with *A. rhabdota* in the shape of the disc, the radial shields (l:br = 1.8:1) and the density of the scaling (20-25/sq.mm). The radial shields with l:br about 1.4:1 and 10-15 scales/sq.mm in most specimens of *A. planispina* seen by H. L. CLARK. However, the Tortugas specimen has a disc diameter to arm length ratio of only 1:7 as opposed to 1:13 in von M. *A. planispina* from Rio. On the basis of a similar difference in proportions maintained *A. tymbara* to be distinct from *A. riisei*.

It should also be pointed out that several species of *Ophiophragnus* from the West Indies are extraordinarily similar to some of these species of *Amphiodia*. A specimen has lost the disc it may be almost impossible to say to which it belongs, since only the papillae along the margin of the disc distinguish *O. phragmus*. Group A of *Amphiodia* species (*riisei*, *trychna* and *tymbara*) is distinguished from *O. phragmus* by the presence of a longitudinal dark stripe along the arms. *O. phragmus* *brachyactis* H. L. Clark, while *O. septus* (Lütken) H. L. Clark are not only very similar to each other, but also to *Amphiodia* (in group C), even to the tendency for a longitudinal dark stripe along the arms.

"*Ophiophragnus*" *sesquipedalis* Bell (1888, Ann. Mag. Nat. Hist. (3) 17: 100) was described from three disc-less Amphiuroids collected at Itamaracá, Pernambuco, Brazil. BELL assumed that their disc diameters were equal to the oral frame, that is 4 mm, whereas the extent of the missing proximal part of the arm plates shows that the disc diameter was at least 8 mm and probably 10 mm. Even so, the ratio of arm length to disc diameter was between 17 and 20. The most nearly complete arms of the specimens measure about 170 mm. The papillae are of the *Amphiodia* (or *Ophiophragnus*) type, the outermost on each side being moderately enlarged, as in the species under discussion. There are two large tentacle scales, not one as BELL noted. The colour pattern is that of *Amphiodia tymbara* and *A. trychna*, each dorsal arm plate having a dark area across the distal end, contrasting with a darker area proximal to it. The adoral shields are separated or barely meet unlike those of *A. tymbara* and *A. trychna*, but in *Amphiodia planispina* and *rhabdota*. Although the middle arm spine of *sesquipedalis* is distinctly flattened and somewhat paddle-shaped, the flattening is much less marked than in *A. planispina*. H. L. CLARK has doubtfully distinguished a specimen from the Tortugas as *planispina* although it similarly flattens of the spines. *A. rhabdota* is distinguished from *sesquipedalis* by the presence of longitudinal dark stripes on the arms (though the known specimens of *rhabdota* is insufficient to establish that this character is diagnostic). The longitudinal markings also distinguishes *sesquipedalis* from *luctuosa* and *septus* in the genus *Ophiophragnus*, to which it might belong if it

have marginal papillae. *O. wurdemani* and *O. filigraneus*, also known from the West Indian area, differ in the shape of the oral shields, which are not rhombic, while the specimen I have seen of *wurdemani* has the outermost oral papilla no larger than the second one; both species too have the adoral shields in contact. The closest relative of *sesquipedalis* seems to be *Amphiodia planispina*.

Until complete specimens from the vicinity of Pernambuco are known, the systematic position of *sesquipedalis* must remain uncertain. It certainly does not belong to *Ophionephthys*, of which the type species, *O. limicola* Lütken, has the two outer oral papillae diminutive and both based on the oral plates, the dorsal arm plates are relatively narrow, no wider than they are long and the tentacle scales are single and very small (though this last character may not be of generic significance). All the other species currently included in *Ophionephthys* and which I believe should be distinguished in a separate genus, in accordance with the usual practice in subdividing this family, have oral papillae of the *Amphiura*-type, with only one outer papilla arising at least partly from the edge of the adoral shield.¹⁾

The only specimen in Dr. HUMMELINCK's collection which may be referable to *Amphiodia* or to *Ophiophragmus* has also lost its disc. It was collected at Point Salines, Grenada. Its adoral shields do not meet, the arm spines are all markedly flattened and paddle-shaped and the colour is pale but marked with purple, in the form of transverse bars on some of the dorsal arm plates and coloured tips to the arm spines. There are no traces of longitudinal markings. These characters suggest that the specimen is referable to *Amphiodia planispina*, since the only species of *Ophiophragmus* that agree morphologically with its oral and arm structure have longitudinal stripes like *Amphiodia rhabdota*.

A. H. CLARK has also recorded as *Amphiodia planispina* a disc-less specimen from Barbados, while H. L. CLARK found another at Porto Rico.

Finally, there are at least two species of Amphiurids from the west coast of central America which are closely related to certain of these West Indian species of *Amphiodia*, despite the fact that NEILSEN included them in the genus *Amphipholis*. These are *Amphipholis elevata* Neilsen, from Panama, which is very like *Amphiodia planispina*, and *Amphipholis platydisca* Neilsen, which is reminiscent of *Amphiodia atra* and *limbata*. It is controversial whether or not the enlarged third oral papilla of these species can be called opercular, the criterion of *Amphipholis*.

¹⁾ Since this paper was written, H. B. FELL (1962, p. 8) has published a revision of many of the genera of the family Amphiuridae, in which *Ophionephthys* has been restricted by removal of the species with *Amphiura*-type mouth parts to another genus (*Ophiopeltis*).

Much more material from tropical American waters is available, and it will show the ranges of variation with regard to the relative size of disc and arms, the size of the disc scales and radial tentacle scales, the occurrence of marginal papillae around the disc and the validity of some of the before a true appreciation of the validity of some of the *Amphiodia* can be reached.

Ophiocomella ophiactoides (H. L. Clark)

Ophiocoma pumila (part) LÜTKEN, 1859, p. 248, pl. iv fig. 5d; A. H. CLARK, 1939a, p. 451, pl. liv fig. 3; (?) H. L. CLARK, 1942, p. 377.
Ophiacantha ophiactoides H. L. CLARK, 1901, p. 249, pl. xv figs. 5-8.
Ophiacantha oligacantha H. L. CLARK, 1918, p. 265-267, pl. vii fig. 5.
Ophiocomella caribbaea A. H. CLARK, 1939b, p. 7-8.
 (?) *Ophiostigma isacanthum* (pt), H. L. CLARK, 1942, p. 377 (six-armed from Bermuda).

The size of the 80 specimens in the present collection is about 2 mm to 5.5 mm disc diameter. The characters of the type specimen of *Ophiacantha ophiactoides* from off Porto Rico, which had a disc diameter of 2 mm, are similar to those of the type specimen of *Ophiacantha oligacantha*, the spines of the disc are relatively more prominent than those shown in figure 11a, resembling H. L. CLARK's figure. The description is obviously inaccurate as far as the proximal dorsal arm plates are concerned, since these are shown as unnaturally long and just to the other, whereas Dr. CLARK writes that they are all separated from the lateral arm plates, as in my smaller specimens.

The holotype of *Ophiacantha oligacantha* was from Tortugas and had the disc diameter 3 mm. It was supposed to be a new species from *O. ophiactoides* in 'the arms, arm spines, oral parts and mouth parts'. It seems clear from the description and the figures that here again we have the same species and that these can all be accounted for by the slightly larger size.

I have examined the holotype of *Ophiocomella caribbaea* from the U.S. National Museum (fig. 11c, d). It came from St. John, Virgin Islands and had the disc diameter 4 mm. It differs from CLARK's type specimens of *Ophiacantha ophiactoides* and *Ophiacantha oligacantha*, which were both smaller, in having relatively more numerous disc spines, relatively shorter arm spines, and more tentacle scales on the pores of the first segments of each arm. The larger specimens of the present series. The exist-

series links together the three unique holotypes and shows that they simply represent stages in the development of a single species.

Apart from the variations correlated with the difference in size, such as the armature of the disc and the form of the arm plates, there are some other variable characters, notably the shape of the oral shields, on which size seems to have no bearing. These shields may be diamond-shaped, pentagonal or hexagonal, with the widest part towards either the proximal or the distal end.

Since it clearly belongs within the family Ophiocomidae, the generic name for this species cannot be *Ophiacantha* but it may be *Ophiocomella*, if that genus is to be distinguished from *Ophiocoma*. *Ophiocomella caribbaea* is the type species of the genus, but *caribbaea*, together with *Ophiacantha oligacantha*, is a synonym of *Ophiacantha ophiactoides* and the correct combination is therefore *Ophiocomella ophiactoides* (H. L. Clark).

As the list of references shows, LÜTKEN, A. H. CLARK and H. L. CLARK, at various times, all referred small, six-armed West Indian Ophiocomids (including some from Curaçao [A.H.C., 1922]) to the normally five-armed species *Ophiocoma pumila* Lütken.

A number of six-armed fissiparous (self-dividing) species of ophiuroids have been described, notably several belonging to the genus *Ophiactis*, such as the "tropicopolitan" *O. savignyi*, also *Ophionereis dictydisca* from Japan, *Ophiocomella parva* from the Indo-West Pacific and other species of the genus *Ophiocomella*.

H. L. CLARK followed LÜTKEN, LYMAN and other nineteenth century workers in assuming that such six-armed ophiuroids are conspecific with sympatric five-armed forms and represent the juvenile phase of these. MORTENSEN pointed out that if this were so, then, following some autotomies, half specimens with three arms would have to regenerate only two instead of the usual three. He maintained that such a thing has never been recorded.

In 1939, H. L. CLARK named nineteen specimens from the John Murray Expedition collections in the western Indian Ocean as *Ophiactis savignyi* (Müller & Troschel). He noted that of these, "most of them are 6-rayed and one has but 5 rays and 2 of the arms are much smaller than the other 3, demonstrating the origin of a 5-armed adult by schizogony." I have examined thirteen of these specimens retained in the British Museum collection and (thanks to the kindness of Dr. ELISABETH DEICHMANN) four others from the Museum of Comparative Zoölogy; the whereabouts of the other two are unknown. All the specimens seen have six arms, but one appears to have only five, the middle one of the three regenerating being extremely small and inconspicuous. I think this is the one upon which H.L. CLARK commented.

In 1918 H. L. CLARK noted that the number of arms in *O. savignyi* "is typically 5 or 6, though individuals with 4 or 7 are by no means rare." The biggest sample of the species from any one area in the British Museum collection consists of 392 specimens from the region of Panama. 385 of these have six arms, more than half of them with three of the arms larger than the other three, though five of them have four large arms and two small and another four have two large arms and four small. There are

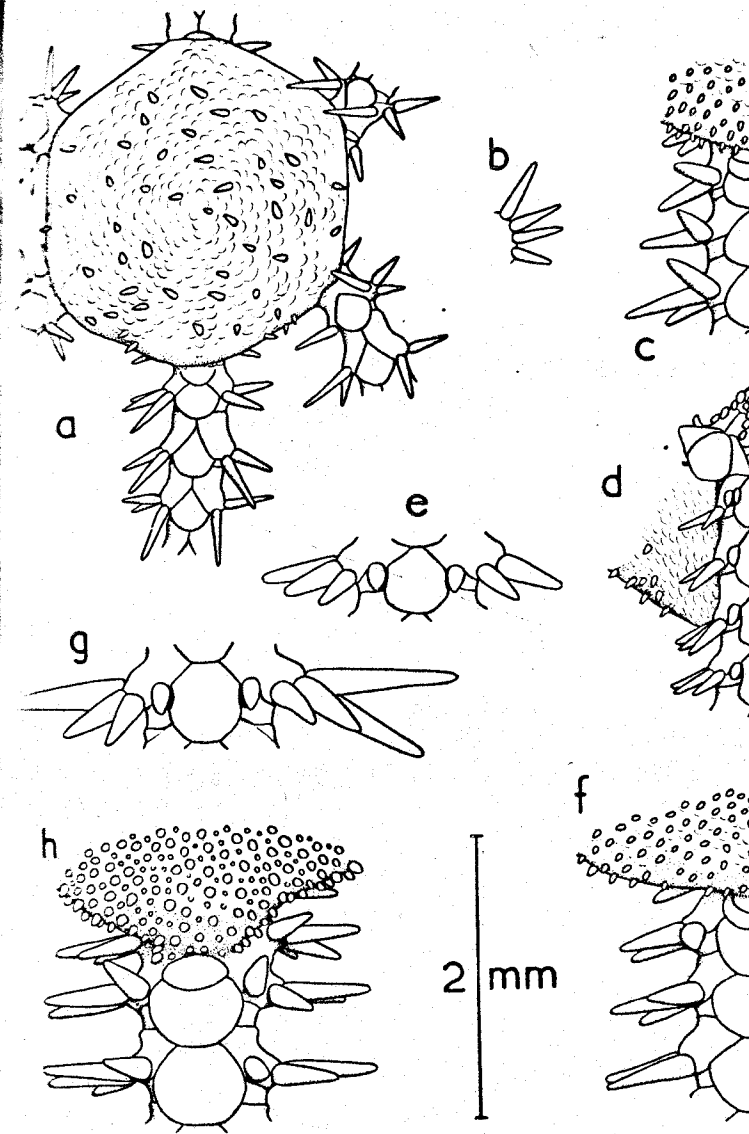


Fig. 11. — a) to f) *Ophiocomella ophiactoides* (H. L. Clark); a) Disc of a specimen from Curaçao with disc diameter 2.3 mm; b) c) and d) dorsal and ventral views of part of the disc and the base of an arm of *Ophiocomella caribbaea* A. H. Clark with disc diameter 4 mm; e) ventral view of the eleventh arm segment of a specimen from St. Martin with disc diameter 5.5 mm. — g) and h) *Ophiocoma pumila* Lütken; g) ventral view of the ventral arm segment, and h) dorsal view of specimen from Jamaica with disc diameter 5.5 mm.

also three specimens with seven arms (one of which has three large arms and four regenerating) and finally only four specimens with five arms (one of which has two larger arms and three regenerating ones – and so could be a potential stable five-armed adult).

The smaller samples available to me from other parts of the range of *O. savignyi* also suggest that five-armed specimens are rare, though in certain areas their incidence may be higher, notably in Indian waters. Also KOEHLER (1922, Bull. U.S. Nat. Mus. 100 (5), p. 195) records ten specimens with five arms out of fifty taken in the Philippine area.

As for *Ophiocomella*, although in 1915 H. L. CLARK asserted that *O. parva* (then included in the genus *Ophiocoma*) is quite distinct from the young of the five-armed *Ophiocoma* species also occurring in the vicinity of Torres Strait (the type locality of *parva*), in 1921 he noted that it is very like the young of the West Indian *Ophiocoma pumila*. Later still, he apparently identified as a young *Ophiocoma alexandri* the very similar six-armed specimen from Clipperton Island in the east Pacific attributed by A. H. CLARK in 1939 to *Ophiocomella parva* (with the tentative alternative name of *clippertoni*).

All the 80 specimens from the Caribbean that are now referred to *Ophiocomella ophiactoides* have six arms. The largest, with a disc diameter of 5.5 mm, has been compared with a specimen of *Ophiocoma pumila* the same size, originating from Port Royal, Jamaica. There are many points of similarity between the two, notably in the form and armature of the jaws, allowing for the fact that those of *Ophiocomella ophiactoides* are narrower since there are six of them. The points of comparison are listed in the following table.

Ophiocomella ophiactoides

1. Six arms.
2. Arm length 23 mm.
3. Disc spinelets granuliform but about half again as long as thick and tapering only in the outermost third of their length; spinelets spaced so that the underlying scales are just visible, especially in the proximal parts of the ventral interradii where there are no spinelets.
4. Four tapering arm spines, the two middle ones at their

Ophiocoma pumila

1. Five arms.
2. Arm length 36 mm.
3. Disc spinelets also granuliform and generally similar in shape but distinctly coarser, smaller granules developing between them so that the density is greater than in *ophiactoides*; also the underlying scales are obscured; ventrally the spinelets extend to the proximal ends of the genital slits.
4. Five tapering arm spines on the first free segments, then

longest hardly more than half the width of the arm (unlike those of smaller specimens which are relatively much longer); no marked increase in the length of the spines beyond the bases of the arms.

5. Only a few pores of the first segment on each arm with two tentacle scales, the rest with one.

6. No pronounced colour banding on the arms.

four; the length of the segments increasing to a maximum about the twelfth segment; the middle spines are equal to the width of the arm.

5. The pores of the segments mostly with one scale, the rest with

6. Conspicuous broad bands of colour at intervals on the arms.

A specimen of *Ophiocoma pumila* from Curaçao with a disc diameter 6.5 mm agrees with the Jamaican one in all respects except that the disc spinelets or granules are more densely crowded in the peripheral area of the dorsal side, though they are more widely spaced centrally. Two smaller specimens of *O. pumila* from Barts, with disc diameters about 3 mm, have the disc granules more widely spaced, just as in the one compared above. *O. pumila* has five arm spines on the first two free segments but the *O. ophiactoides* only four. Both have the longest arm spines nearly equal to the width of the arm and the colour pattern is banded. Unlike the larger specimens they have no spinelets on the proximal parts of the first two interradii and only one of them has two tentacle scales on the second pores as well as on some of the first ones.

These few small specimens of *Ophiocoma pumila* are the only ones available to me, but they suggest that in this five-armed species the armature of the disc scales is more nearly granuliform and of a smaller size than in *Ophiocomella ophiactoides*, the second tentacle scale develops earlier, the arm spines do not become relatively longer when the size approaches 5 mm disc diameter, but increase in number and the arms are probably relatively longer.

More small specimens of *Ophiocoma pumila* and, if possible, breeding experiments carried beyond metamorphosis,

before the problem of whether or not the five- and the six-armed specimens are conspecific can be resolved. Even if the six-armed forms prove to be the progeny of five-armed adults, I doubt whether the form can then be reversed by three-armed halves regenerating only two arms to produce five. There seems to be no reason why the six-armed form should not be perpetuated indefinitely.

In the present collection *Ophiocomella ophiactoides* was taken twice at the same station as *Ophiocoma pumila* (St. Barts 1121 and Tobago 1387) though *Ophiocomella ophiactoides* alone was taken at fifteen other stations and *Ophiocoma pumila* at five. *Ophiactis savignyi* and *Ophiocomella ophiactoides* were both taken at four stations (St. Martin 1126, St. Barts 1121, Bonaire 1065 and Curaçao 1344a) and each was taken at thirteen further stations where the other was not.

A comparison between the West Indian *Ophiocomella ophiactoides* and the various Pacific species included in the genus by AUSTIN CLARK shows only slight differences. I have examined the holotype of *O. parva* (H. L. Clark) 1915, from Murray Island in Torres Strait. It has the disc diameter 5 mm and resembles *O. ophiactoides* of the same size in the armature of the disc and of the jaws, as well as in the proportions of the four arm spines with the uppermost one the longest. There are slight differences in the shapes of the arm plates, both dorsal and ventral ones of *parva* being rather more convex at the distal end, whereas those of *ophiactoides* have the curve more or less flattened.

The name *Ophiocomella parva* is a synonym of *Ophiocnida sexradia* DUNCAN, 1857 (J. Linn. Soc. Lond. 21, p. 92), which should be referred to *Ophiocomella* instead of to *Amphiacantha*, where MATSUMOTO placed it in 1917. The tooth papillae may be only two in number, particularly on regenerating jaws, so that they resemble the paired papillae of an Amphiurid. DUNCAN himself noted that there is a third papilla below the lowest tooth. My attention was drawn to this species by a specimen in the Museum of Comparative Zoölogy, Harvard, from the Gulf of Siam, identified by KOEHLER in 1930 as *Amphiacantha sexradia*. The type specimen (in the collection of the Indian Museum) was from the Mergui Archipelago on the other side of the Malay Peninsula. Though DUNCAN's figures are poor, when taken with his description, they leave me in no doubt that his type and KOEHLER's specimen are conspecific, and the latter I found to be indistinguishable from the holotype of *Ophiocomella parva*.

The other species of *Ophiocomella* were all described by AUSTIN CLARK. They are *O. schultzi* from Canton Island in the west central Pacific, *O. schmitti* from the Galapagos Islands and *O. clippertoni* from Clipperton Island to the west of Mexico (and in 1952 also recorded from the Marshall Islands). The last name was published conditionally on the specimens proving distinct from *parva*, but according to the rules cannot be rejected on that account since a description was given. In his key to the three species *O. clippertoni* (under the name of *parva*), *caribbaea* and *schmitti*. AUSTIN CLARK distinguished them by the shape and density of the disc spinelets (or spinules), characters which the present series of specimens show to be variable

and dependant on the total size. The unique type of *O. schmitti* had the disc diameter 4.3 mm in diameter so its disc spinelets might be expected to be fewer and larger, as indeed they are. The type of *schultzi* (also unique) was larger, with disc diameter 4.3 mm and more numerous and relatively shorter disc spinelets. The arm plates are more mature in form with their proximal angles more obtuse. The scales on the first tentacle pores might prove to be a valid point of distinction and two on most of the first pores of the type of *schmitti*, but more often one on the type of *schultzi* despite its larger size.

Morphologically there seems to be small justification for distinguishing any of these forms as separate species. Zoogeographically, the probabilities are that three species or subspecies exist in the Indo-West Pacific (*Ophiocomella sexradia*, including *schultzi* and *schmitti* as synonyms), one in the East Pacific (*O. clippertoni*) and one in the West Indies (*O. ophiactoides* including *oligacantha* and *caribbaea*). Only two brittle-stars, *Ophiactis savignyi* and *Amphipholis squamata*, are found in the tropics on both sides of central America and on both sides of the Pacific. If there should prove to be only a single species of *Ophiocomella* in this similarly wide range, then it might be expected to turn up on the West African coast as well, like the other two.

LIST OF SPECIES COLLECTED AND LOCALITIES

Asteroporpa annulata (Lütken)

25 miles North of MARGARITA island, about 20 fathoms deep, 26.II.1955, T. J. Clark (1 specimen).

Astrophyton muricatum (Lamarck)

BONAIRE: Sta. 1056Ca, Paloe Lechi (= Playa Lechi), sandy shore with beach, 1 meter deep, 30.VIII.1948 (1 specimen).

Amphiura stimpsoni Lütken

BARBUDA: Sta. 1395, Two Feet Bay, 10.VII.1955 (3 specimens).
ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (1 spec.).

Amphiura sp. prob. *stimpsoni*

TOBAGO: Sta. 1385, Buccoo Bay, 2 m deep, 16.I.1955 (1 juvenile).

Amphiodia sp. prob. *planispina* (von Martens)

GRENADA: Sta. 1389, White Bay, Point Salines, 26.I.1955 (1 specimen lacking the disc).

Amphipholis squamata (D. Chiaje)

ARUBA: Sta. 1310A, Rincón, 7.V.1955, J. S. Zaneveld coll. (1 specimen).
CURAÇAO: Sta. 1017, Knip Baai, S. side, 8.I.1949 (1 spec.); 1021, St. Kruis Baai, S. side, 26.IV.1930 (1 spec.); 1036, Spaanse Water, New Haven landing, 10.IV.1949 (1 spec.); Fuik Baai, 16.IV.1949, A. D. Ringma coll. (1 spec.).
BONAIRE: Sta. 1064b, Lac, Poejito, 17.IX.1948 (4 spec.).
ANTIGUA: Sta. 1393, Deep Bay at Fort Barrington, 17.VII.1955 (7 spec.).
BARBUDA: Sta. 1394, Martello Tower beach, 8.VII.1955 (13 spec.).
ST. EUSTATIUS: Sta. 1116B, Gallows Bay, near Oranjestad, 15.VII.1949 (1 spec.).
ST. BARTS: Sta. 1121, S. of Public, near Gustavia, 4.VI.1949 (1 spec.).
ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (5 spec.).
ST. CROIX: Sta. 1404, Krausse Lagoon, seaside, 15.VI.1955 (1 juvenile); 1405, Krausse Lagoon, entrance, 15.VI.1955 (13 spec.).

Amphipholis sp.

BONAIRE: Sta. 1066, Lac, NE. shore of Cay, 1.IX.1948 (1 juvenile).

Ophiostigma isacanthum (Say)

CURAÇAO: Sta. 1036 and 1036A, Spaanse Water, New Haven landing, 10.IV.1949 (12 specimens); 1344a, Fuik Baai, lagoon side W. wall, 13.III.1955, J. S. Zaneveld coll. (2 spec. lacking the disc).

Ophiactis savignyi (Müller & Troschel)

CURAÇAO: Sta. 1017, Knip Baai, S. side, 8.I.1949 (1 specimen); 1020A, Boca Lagoon, 13.XI.1948 (1 spec.); 1020D, Boca Lagoon, S. side, 27.XI.1948 (1 spec.); 1344a, Fuik Baai, lagoon side, W. wall, 13.III.1955, J. S. Zaneveld coll. (2 spec.).
BONAIRE: Sta. 1064b, Lac, Poejito, 17.IX.1948 (5 spec.); 1065, Lac, entrance to Poejito, 17.IX.1948 (5 spec.).
TRINIDAD: Sta. 1382, Monos island, Avalon Bay, 10.I.1955 (5 spec.).
TOBAGO: Sta. 1385, Buccoo Bay, near reef, 2 m, 16.I.1955 (1 spec.); 1386, the same 1½ m, 16.I.1955 (2 spec.).
ANTIGUA: Sta. 1393, Deep Bay at Fort Barrington, 17.VII.1955 (15 spec.).
ST. KITTS: Sta. 1397, Frigate Bay, 20.VII.1955 (1 juvenile); 1398, W. of Basseterre, 30.VI.1955 (9 spec.).
ST. BARTS: Sta. 1121, S. of Public, 4.VI.1949 (1 spec.).
ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (9 spec.); 1128A, Great Bay, beach, 26.V.1949 (2 spec.).
ST. JOHN: Sta. 1407, Turner Bay, 18.VI.1955 (1 juv.).

Ophiothrix angulata (Say)

CURAÇAO: Sta. 1017, Knip Baai, S. side, 8.I.1949 (6 specimens, 4 of them 1025 and 1028A, Piscadera Baai, near Enoch, 2.II.1940 (27 spec.); 1036, Spaanse Water, New Haven, landing, 10.IV.1949 (9 and 23 spec.); 1039, Fuik Baai, Duitse Bad, 2.III.17.IV. and 2.III.1949 (13 spec.).
ARUBA: Sta. 1310A, Newport Bath, 20.XI.1948 (139 spec.); 1342, Spaanse Water, Aruba peninsula, 19.XII.1954, J. S. Zaneveld coll. (47 spec.); Spaanse Water, Ariba, jetty, 29.XII.1954, Zaneveld coll. (1 atypical spec.); 1343, lagoon side W. wall, 11.I.1955, Zaneveld coll. (65 spec.).
BONAIRE: Sta. 1056C, Paloe Lechi, 1½ m, 4.IX.1948 (2 spec., 1 atypical spec.); Punt Vierkant, 1½ m, 9.IX.1948 (1 spec.).
TOBAGO: Sta. 1385 and 1386, Buccoo Bay, 1½ m, 16.I.1955 (121 spec.).
FURCHER: Sta. 1124, Five Island Bay, 2.VI.1949 (1 atypical spec.).
ST. JOHN: Sta. 1408, Bay S. of Cruz Bay, 19.VI.1955 (1 juv.).
NEW PROVIDENCE: Sta. 1149, between Hog Island and Athol Islands, 19.VI.1955 (1 atypical spec.).

Ophiothrix suensoni Lütken

CURAÇAO: Sta. 1022, Boca Santoe Pretoe, S. of St. Kruis Baai, 10.I.1949 (1 specimen, one with 4 arms); 1029 and 1029A, Piscadera Baai, S. side, 2.II.1949 (18 spec.).
BONAIRE: Sta. 1058, De Hoop, S. of Kralendijk, 11.V.1930 (1 juvenile); Punt Vierkant, 9.IX.1948 (2 spec.).
KLEIN BONAIRE: Sta. 1049C, E. coast, landing, 2 m, 13.IX.1948 (1 spec.).

Ophiothrix oerstedii Lütken

ARUBA: Rincón, 1955, J. G. van den Bergh coll. (1 specimen).
CURAÇAO: Sta. 1017, Knip Baai, S. side, 8.I.1949 (1 spec.); 1036A, S. side, New Haven, 10.IV.1949 (1 spec.); 1039, Fuik Baai, Newport Bath, 10.IV.1949 (1 spec.); 1344a, Fuik Baai, lagoon side of W. wall, 13.III.1955, J. S. Zaneveld coll. (2 spec.).
BONAIRE: Sta. 1056A, Ba, C and Ca, Paloe Lechi, 4.IX.1948, 27.II.1949 and 30.VIII.1948 (18 spec.); 1058C, De Hoop, 2½ m, 10.IX.1948, (2 spec.); Punt Vierkant, 1½ m, 9.IX.1948 (7 spec.); Kralendijk, 24.III.1949, A. D. Ringma coll. (1 spec.).
KLEIN BONAIRE: Sta. 1049B, E. coast at landing, 13.IX.1948 (1 spec.).
ST. EUSTATIUS: Sta. 1116B, Gallows Bay, 15.VII.1949 (1 spec.).
ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (1 spec.).
ANGUILLA: Sta. 1142, N. of Sandy Ground, N. coast, 19.VI.1949 (3 spec.).

Ophiothrix brachyactis H. L. Clark

GRENADA: Sta. 1389, White Bay, Point Salines, 26.I.1955 (1 specimen).
ST. BARTS: Sta. 1121, S. of Public, 4.VI.1949 (8 spec.).

Ophiocomella ophiactoides (H. L. Clark)

CURAÇAO: Sta. 1038a, Fuik Baai, Duitse Bad, 17.IV.1949 (6 specimens); 1039a, Fuik Baai, Newport Bath, 20.XI.1948 (6 spec.); 1323, Santa Marta Baai, thir. lagoon, 25.II.1955 (42 spec.); 1344a, Fuik Baai, lagoon side, W. wall, 13.III.1955 (1 spec.).
 J. S. Zaneveld coll. (1 spec.).
 BONAIRE: Sta. 1056C, Paloe Lechi, 4.IX.1948 (1 spec.); 1065, Lac, entrance to Poejito, 17.IX.1948 (1 spec.); 1066, Lac, NE. shore of Cay, 1.IX.1948 (1 spec.).
 1373A, Lac, Soerebon reef flat, 17.IV.1955 (1 spec.).
 KLEIN BONAIRE: Sta. 1049B, E. shore, landing, 13.IX.1948 (1 spec.); 1049C, near landing, 13.IX.1948 (2 spec.); 1367, W. point, 28.III.1955 (1 juvenile).
 TOBAGO: Sta. 1385, Buccoo Bay, 2 m, 16.I.1955 (3 spec.); 1386, Buccoo Bay, near reef, 1½ m, 16.I.1955 (5 spec.); 1387, Buccoo Reef, high tide zone, 16.I.1955 (1 spec.).
 ST. BARTS: Sta. 1121, S. of Public, 4.VI.1949 (1 spec.).
 ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (7 spec.); 1131, Simson Bay Lagoon, W. shore of Little Key, 2.VIII.1949 (1 spec.).

Ophiocoma echinata (Lamarck)

ARUBA: Sta. 1301, Malmok, Arasji, 14.VIII.1955 (31 specimens); 1310, Rincón, 7.V.1955 (2 spec.); 1310A, Rincón, 7.V.1955, J. S. Zaneveld coll. (4 spec.).
 CURAÇAO: Sta. 1017, Knip Baai, S. side, 8.I.1949 (1 juvenile); 1020C, Boca Lagoen, S. side, 2½ m deep, 27.XI.1948 (3 spec.); 1023A, Playa Hoeloe (Playa Hulu), 19.III.1949 (1 spec.); 1038a, Fuik Baai, Duitse Bad, 17.IV.1949 (1 spec.); 1039, Fuik Baai, Newport Bath, 20.XI.1948 (4 spec.); 1314, Playa Kalkie, Westpunt, 4.I.1955, Zaneveld coll. (6 spec.); 1317, Playa Frankie, rocky, 27.II.1955 (1 spec.); 1318, the same, sandy, 27.II.1955 (7 spec.); 1324, E. Santa Marta Baai, 24.II.1955 (2 spec.); 1325A, St. Jan lagoon, 6.III.1955 (1 spec.); 1342, Spaanse Water, Brakke Put, 19.XII.1954, Zaneveld coll. (1 spec.); 1361, Boca Bartool, entrance, 12.II.1955 (2 spec.); Boca Spaanse Baai, SE. of beach, 16.X.1948 (20 spec.); Fuik lagoon, at wall 30.III.1955, Zaneveld coll. (7 spec.).
 BONAIRE: Sta. 1055, Paloe Lechi, overflow of salina, 4.IX.1948 (7 spec.); 1056A, B. Ba and Ca, Paloe Lechi, beach rock, 4.IX.1948, 27.II.1949, 30.VIII.1948 (11 spec.); 1058C, De Hoop, S. of Kralendijk, 10.IX.1948 (1 spec.); 1068, Lac, behind reef, 5.9.4 26.X.1930 (4 spec.); 1373A, Lac, Soerebon reef flat, 17.IV.1955 (4 spec.); 1375, Boca Washikemba, 7.IV.1955 (12 spec.).
 KLEIN BONAIRE: Sta. 1367, W. point, 28.III.1955 (9 spec.).
 TOBAGO: Sta. 1385, Buccoo Bay, 2 m, 16.I.1955 (1 spec.); 1386, Buccoo Bay, near reef, 1½ m, 16.I.1955 (2 spec.); 1387, Buccoo Reef, high tide zone, 16.I.1955 (3 spec.).
 GRENADA: Sta. 1389, White Bay, Point Salines, 26.I.1955 (7 spec.).
 ISLOTE AVES: Sta. 1114, northern lagoon, 12.V.1949 (1 spec.).
 ST. KITTS: Sta. 1398, W. of Basseterre, 30.VI.1955 (1 spec.).
 ST. EUSTATIUS: Sta. 1116B, Gallows Bay, 15.VII.1949 (several spec.).
 ST. BARTS: Sta. 1121, S. of Public, 4.VI.1949 (1 arm).
 POURCHE: Sta. 1124, Five Island Bay, 2.VI.1949 (1 spec.).
 ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (12 spec.).
 ANGUILLA: Sta. 1142, N. of Sandy Ground, 19.VI.1949 (8 spec.).

Ophiocoma rilsei Lütken

ARUBA: Sta. 1304, Boekoeti, lagoon side, 6.V.1955 (1 specimen).
 CURAÇAO: Sta. 1020C, Boca Lagoen, S. side, 27.XI.1948 (2 spec.); Frankie, 27.II.1955 (2 spec.); 1344a, Fuik Baai, lagoon side W. wall, J. S. Zaneveld coll. (3 spec.); 1354, St. Joris Baai, entrance, 1½ m, 1 spec.); Boca Spaanse Baai, SE. of beach, 16.X.1948 (2 spec.).
 BONAIRE: Sta. 1055, Paloe Lechi, overflow of salina, 4.IX.1948 (1 spec.); 1373A, Lac, Soerebon reef flat, 17.IV.1955 (2 spec.).
 BARBUDA: Sta. 1395, Two Feet Bay, pool, 10.VII.1955 (arms only).
 ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (1 spec.).
 NORTH BIMINI, Bahamas: Sta. 1151, Lagoon at Laboratory Dock, 1 spec.).

Ophiocoma pumila Lütken

ARUBA: Sta. 1301, Malmok, Arasji, 14.VIII.1955 (2 specimens).
 CURAÇAO: Sta. 1354, St. Joris Baai, entrance, 20.II.1955 (3 spec.).
 BONAIRE: Sta. 1068a, Lac, behind reef, 1.X.1948 (1 spec.).
 TOBAGO: Sta. 1387, Buccoo Reef, 16.I.1955 (3 spec.).
 GRENADA: Sta. 1389, White Bay, Point Salines, 26.I.1955 (2 spec.).
 ST. BARTS: Sta. 1121, S. of Public, 4.VI.1949 (7 spec.).
 ST. JOHN: Sta. 1407, Turner Bay, 18.VI.1955 (1 spec.).

Ophionereis reticulata (Say)

ARUBA: Sta. 1301, Malmok, Arasji, 14.VIII.1955 (1 specimen).
 CURAÇAO: Sta. 1344a, Fuik Baai, lagoon side W. wall, 13.III.1955, J. S. Zaneveld coll. (4 spec.); Caracas Baai, 29.XII.1954, Zaneveld coll. (1 spec.).
 BONAIRE: Sta. 1056Ca, Paloe Lechi, 2 m, 30.VIII.1948 (1 spec.); 1068, behind reef, 1.X.1948 (1 spec.).
 KLEIN BONAIRE: Sta. 1367, W. point, 28.III.1955 (1 spec.).
 TOBAGO: Sta. 1387, Buccoo reef, 16.I.1955 (1 spec.).
 ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (2 spec.).
 ANGUILLA: Sta. 1142, N. of Sandy Ground, 19.VI.1949 (1 spec.).

Ophionereis squamulosa Koehler

SOUTH BIMINI, Bahamas: Sta. 1150A, Mangrove lagoon, 17.VIII.1949

Ophioderma appressum (Say)

ARUBA: Sta. 1301, Malmok, Arasji, 14.VIII.1955 (5 specimens).
 CURAÇAO: Sta. 1318, Playa Frankie, Spaanse Put, 27.II.1955 (1 spec.).
 Baai, lagoon side W. wall, 13.III.1955, J. S. Zaneveld coll. (1 spec.).
 Spaanse Baai, SE. of beach, 16.X.1948 (3 spec.).

TOBAGO: Sta. 1387, Buccoo reef, 16.I.1955 (2 spec.).
 ST. MARTIN: Sta. 1126, Great Bay, E. shore, 11.VI.1949 (2 spec.).
 ANGUILLA: Sta. 1142, N. of Sandy Ground, 19.VI.1949 (17 spec.).

Ophioderma brevicaudum Lütken

ARUBA: Sta. 1301, Malmok, Arasji, 14.VIII.1955 (1 specimen).
 CURAÇAO: Sta. 1317, Plaja Frankie, Spaanse Put, rocky, 27.II.1955 (1 spec.); 1318, Plaja Frankie, sandy, 27.II.1955 (2 spec.); Boca of Spaanse Baai, SE. of beach, 16.X.1948 (15 spec.).
 GRENADA: Sta. 1389, White Bay, Point Salines, 26.I.1955 (1 spec.).
 ST. JOHN: Sta. 1407, Turner Bay, 18.VI.1955 (1 spec.).

Ophioderma brevispinum (Say)

ARUBA: Beach near Rincón, E. coast, 1955, J. G. van den Bergh coll. (1 specimen).

Ophioderma cinereum Müller & Troschel

CURAÇAO: Sta. 1036A, Spaanse Water, New Haven, landing, 10.IV.1949 (2 specimens); 1038, 1038a and 1038A, Fuik Baai, Duitse Bad, 2.III., 17.IV. and 2.III.1949 (10 spec.); Boca of Spaanse Baai, SE of beach, 16.X.1948 (1 spec.); Caracas Baai, XII.1954, J. S. Zaneveld coll. (2 spec., the smaller with disc diameter only 6 mm has granules on the lateral arm plates and on part of the oral shield, like *Ophiocryptus*); 1342, Spaanse Water, Brakke Put Ariba peninsula, 19.XII.1954, Zaneveld coll. (1 spec.); 1344 and 1344a, Fuik Baai, lagoon side W. wall, 11.I. and 13.III.1955, Zaneveld coll. (4 spec.).
 TOBAGO: Sta. 1386, Buccoo Bay, near reef, 1½ m, 16.I.1955 (1 spec.).

Ophioderma sp.

TOBAGO: Sta. 1386, Buccoo Bay near reef, 1½ m, 16.I.1955 (1 juv. in "*Ophiocryptus*" stage, disc diameter 4.5 mm).

Ophiolepis paucispina (Say)

ARUBA: Sta. 1004, Boekoeti lagoon, 29.XII.1948 (1 specimen); 1006a and 1006b, Boekoeti reef, sea side, 17.I.1949 and 6.V.1955 (2 spec.); 1301 Malmok, Arasji, 14.VIII.1955 (1 spec.).
 CURAÇAO: Sta. 1344a, Fuik Baai, lagoon side W. wall, 13.III.1955, J. S. Zaneveld coll. (1 spec.).
 TOBAGO: Sta. 1386, Buccoo Bay, near reef, 1½ m, 16.I.1955 (1 spec.).

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STUDIES ON THE FAUNA OF THE CARIBBEAN ISLANDS

SYSTEMATICS AND SIPHOCYPRID PROPUSTULARIA

(Gastropoda)

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There are six living species of *Siphocyprid*. Three of them are common throughout the Caribbean: *Siphocyprid spurca acicularis* (Gmelin), *Lurid* (Linné), *Trona cervus* (Linné) and part of the Caribbean: Florida, the Virgin Islands. (This distribution of the species is only the female, suggested by WARMKE & ABBOY). *Siphocyprid cypraea mus* (Linné), is rare; it is found in Venezuela, and is said to be found in *pustularia surinamensis* (Perry) from nineteenth century records of islands of the Lesser Antilles, and a specimen was collected in Aruba.

SYSTEMATICS OF *Siphocyprid*

Genus *Siphocyprid*