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The Littoral Holothurians of the Bahama Islands

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Very little is known about the echinoderms of the Bahama Islands, and in particular the holothurians have been almost completely forgotten. In Ives's paper (1891) on the echinoderms of the Bahamas not one holothurian is included, and in the survey of the littoral echinoderms of the West Indies, H. L. Clark (1919) lists only one. In 1933 Clark notes under the individual species merely whether or not it has been reported from that area, but gives no list. Evidently he overlooked Edwards' account (1909) of the early stages of *"Holothuria floridana,"* based on material from Green Turtle Key in the Bahamas, and here tentatively referred to *H. mexicana,* which apparently is the most common species in that region.

As the Bahamas form the northern outpost of the West Indies, with rather extreme ecological conditions, and as they probably serve as a stepping stone for the migration of a number of species to the Bermudas, it would be of great interest to know more about their littoral fauna and to compare it with that of other areas—as for example, that of Biscayne Bay on the eastern coast of Florida. The chance to give a preliminary account of the holothurian fauna of the shallow water of the Bahamas came in the summer of 1952 when I received a small collection made by Libbie Hyman during her six weeks' visit to the Lerner Marine Laboratory on Bimini Island. In addition I went over the Bahamas material which had accumulated during the years in the Museum of Comparative Zoölogy, and, last but not least, I was able to include what so far constitutes the most interesting catch, namely, a specimen of one of the most

common Mediterranean species, collected several years ago by one of the American Museum's expeditions. As that institution owns nothing from the Mediterranean region, mislabeling seems out of the question, and in later years several Mediterranean-Lusitanian species have been discovered in West Indian waters at moderate depths (50–200 fathoms), hence there is nothing absurd in the presence of this form in Bahama waters.

We still lack data about the ecology of the holothurians of the littoral zone, though small progress has been made here and there. A number of species are known to move around freely in the lagoons, making no efforts to conceal themselves, or hiding beneath flat rocks; at low tide often covered by sand or bits of algae (possibly as a protection against the sun), these forms (*Stichopus badionotus, Actinopyga agassizii, Holothuria parvula, Holothuria mexicana*) have usually numerous feet on the ventral side and few, often conical, appendages on the dorsum. In burrowing species (*H. impatiens, H. princeps*) the feet are usually almost equally well developed on the ventral and the dorsal side, and the mouth is apt to be terminal. The large apodous *Euapta lappa* usually hides among coral rocks, while the smaller species burrow in the sand or mud just as do the majority of the dendrochirotes. The latter are plankton feeders that spread their tentacles out as a funnel to catch what micro-organisms may drop down through the water. A special adaptation is exhibited by *Holothuria glaberrima,* which clings by its numerous feet to the rocks in the surf zone and has reduced its armor of spicules so it can contract to a slippery rounded mass, not unlike a contracted sea anemone against which the waves roll off; also it has unusually bushy tentacles, suggesting that it lives on plankton.

Captured holothurians may be narcotized by adding a few crystals of chloretone or some Epsom salt to the water in which they are kept. If neither of these chemicals is available, one may often relax the animals by keeping them in a small amount of sea water so that they slowly become asphyxiated. After they have relaxed they are preferably placed in weak alcohol (50%) and later transferred to about 70 per cent strength. Formalin is absolutely destructive.

Preparations of the spicules are made by placing a piece of the skin in a few drops of "chlorox" on a slide and then replacing the chemical with water when the tissue has been destroyed. Permanent mounts can be made by running the well-washed spicules through distilled water, alcohol, xylol, and balsam. In many cases it is advisable to make special preparations of the different parts of the body, as the spicules may be unlike in the ventral and the dorsal regions. Where minute spicules are present in the outer layer one places the skin for a moment in a drop of

chlorox with the external side downward so that the outer spicules alone are liberated.

Littoral species not included in the present list may be found in Clark (1933, 1942) or Deichmann (1939). Dredged material is included in Deichmann (1930, 1940), unless it has not yet been taken in West Indian waters; in that case one must go through the literature pertaining to the Mediterranean and Lusitanian fauna. Specially useful will probably be Mortensen (1927) and Théel (1886).

Key to the Species Hitherto Reported from the Littoral Zone of the Bahama Islands

1. Worm-like animals lacking tube feet completely. Spicules as anchors, and anchor plates . . . . . *Euapta lappa* (J. Müller)
   Not worm-like; tube feet present; among spicules no anchors and anchor plates 2
2. Tentacles tree-like, used for catching plankton 3
   Tentacles disk-shaped, used for shoveling sand into the mouth 4
3. Feet in five double rows. Spicules minute baskets, mostly three-armed, and crowded, irregular, strongly knobbed buttons and plates; feet without end plate but with numerous stout supporting rods, broadest near the middle. Muddy bottom, from a few fathoms to about 90 fathoms in depth . . . . . *Pentacucumis planci* (Brandt)
   Feet scattered over entire body. Spicules small baskets and oval, regular, strongly knobbed buttons. Feet with end plate and band-like supporting rods with small holes. Clings to rocks or buries in sand or mud in the tide pools . . . . . *Parathyone surinamensis* (Ludwig)
4. Large, thick-skinned form with thickened flanks. Black or dull orange, with black stripes or patches. Ventral side with numerous tube feet. Spicules a crowded layer of tables, often a few C-shaped bodies. Gonads in two tufts. The adult lives openly on the sandy bottom from a few feet in depth to about 20 feet; young individuals are semi-transparent and rarely seen, as they hide among rocks . . *Stichopus badionotus* Selenka
   Small to large forms, not with thickened flanks 5
5. Mottled gray, warted upper side; ventral side with numerous soft feet. Five large anal teeth (rarely concealed). Spicules simple rosettes, often bone-shaped or forming large, X-like figures. Common in lagoons or under coral slabs . . . . . *Actinopyga agassizi* (Selenka)
   No large anal teeth 6
6. Large forms, up to 50 cm. long, smooth, dark above and paler below, sometimes completely black. Spicules predominantly small, biscuit-shaped plates with minute holes and more large-holed oval or squarish plates; tables with few long teeth on spire, present in varying number, often reduced. Young individuals mottled, sand-colored, rarely seen. Common in lagoons . . . . . *Holothuria mexicana* Ludwig
   Smaller forms, 15 cm. or less; spicules not biscuit-like plates 7
7. Cigar-shaped or flask-shaped, with small terminal tentacles; no pronounced difference between ventral and dorsal side. Burrowing forms 8

Flattened forms with numerous feet on ventral side; tentacles large. Not burrowing forms 9

8. Color mottled gray, skin sandy to the touch, slender, more or less flask-shaped body; feet not crowded. Spicules a complete layer of regular tables with eight large marginal holes and oval buttoms with six large holes . . . . . *Holothuria impatiens* (Forskål)

Color yellowish whitish, with dark spots, to almost completely dark brown but always with a pale ring at the base of the numerous conical appendages. Spicules an incomplete layer of tables with dentate margin and disk often incomplete; buttons knobby, irregular. Near tip of appendages huge, tack-like tables with a conical spire . . . *Holothuria princeps* Selenka

9. Dorsal side mottled gray, in life often with specks of vivid red, yellow, black, etc.; ventral side with numerous soft tube feet. Spicules tables with small disk and few long spines on top; an inner layer of oval plates, with two to four central holes, smaller marginal holes and dentate margin. Found on sandy bottom . . . . . *Holothuria grisea* Selenka

Color not mottled gray 10

10. Dark brown, almost black, smooth-skinned, with unusually large, bushy tentacles. Skin smooth, with few small curved rods. Clings to the rocks in the surf zone . . . . . *Holothuria glaberrima* Selenka

Greenish brown; spicules a complete layer of tables with 10 to 12 holes in the margin, and oval smooth plates with six rather small holes. Under slabs in shallow water, often in large numbers. Multiplies by transverse fission . . . . . *Holothuria parvula* (Selenka)

Not included in the key is *Holothuria floridana* Pourtalès, characterized by an abundance of minute rosettes, mostly three-armed, which only in very old individuals may fuse into small plates. It is discussed under *H. mexicana* and its spicules are figured for comparison (figs. 39–53).

ORDER ASPIDOCHIROTA

FAMILY STICHOPODIDAE

Stichopus badionotus Selenka

Figures 1–4

Stichopus badionotus SELENKA, 1867, p. 316, pl. 18, fig. 26. CROZIER, 1916, pp. 297–356; 1918, pp. 379–389. DEICHMANN, 1930, p. 80, pl. 5, figs. 30–36. CLARK, 1933, p. 109.

Stichopus macroparenthesis CLARK, 1922, p. 61, pl. 1, figs. 1–7; 1933, p. 110. DEICHMANN, 1930, p. 82, pl. 5, figs. 37–43.

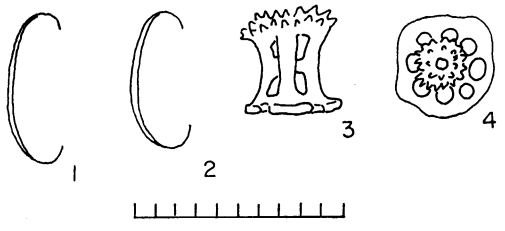
DIAGNOSIS: Large species, 50 cm, or more, with warted, thick-skinned dorsal side and numerous feet in crowded bands on the ventrum, where the mouth is also found. Color black or dark brown, often dark yellow

or orange, with spots or bands of black. Young individuals semi-translucent. Spicules a uniform layer of small tables with small disk and numerous small spines on top of the spire. C-shaped bodies scattered. Feet with end plate and flat, perforated rods; smaller, more curved ones in the dorsal appendages where the end plate is reduced or lacking.

DISTRIBUTION: The species is known from shallow water to 10 to 15 fathoms in depth. It ranges all over the West Indies from Tobago, British West Indies, to Colon, Panama, Gulf of Mexico, Florida, and Bermuda. It was not collected by H. L. Clark in Biscayne Bay, Florida, in 1933, but it may be an accident that it escaped his attention.

SPECIMENS EXAMINED: One, adult, collected by Libbie Hyman; one, half-grown, contracted, probably 15 cm. long when alive, picked up at night on rock near coral patch, Tibut Bay, Bimini (M. S. Gordon).

REMARKS: In the large lagoon next to the Lerner Laboratory on North Bimini the species was found in plain sight in 1 to 4 feet of water



FIGS. 1–4. *Stichopus badionotus* Selenka. 1, 2. C-shaped bodies. 3, 4. Tables seen from side and from above.

at low tide. According to Hyman the species was not common in the lagoon; during her six weeks' stay she saw only three specimens.

Small individuals are almost unknown; the few that have been collected measure up to 12 cm. in length, are more or less translucent, and possess excessively large, C-shaped bodies. Clark based his new species *S. macroparenthesis* on such individuals, but from what we have learned about the modification of spicules in these forms there is no reason to uphold that species. The immature individuals are always found hidden beneath rock fragments (in Jamaica, Antigua, Tortugas), and it should be possible to find them in all localities where the big Seapudding is common.

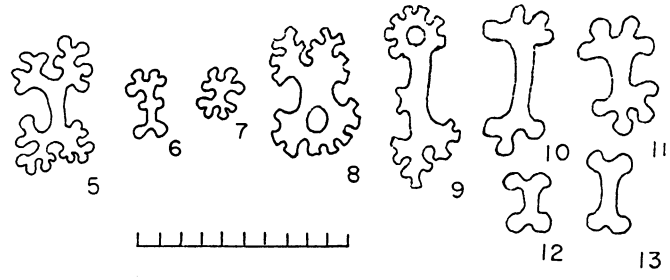
The species seems to be unpalatable to most animals and is unsuited for preparation of trepang.

FAMILY HOLOTHURIIDAE
ACTINOPYGA BRONN
Actinopyga agassizii (Selenka)

Figures 5–13

Mülleria agassizii SELENKA, 1867, p. 311, pl. 17, figs. 10–12.
Actinopyga agassizii, CROZIER, 1917b, pp. 405–406. DEICHMANN, 1930, p. 78, pl. 5, figs. 21–29; 1939, p. 131. CLARK, 1933, p. 108.

DIAGNOSIS: Robust, thick-skinned forms with a crowded sole of ventral feet, while the dorsal side carries well-spaced papillae placed on low warts. The ventral mouth is surrounded by 25 to 29 broad tentacles. Anus with five large teeth. Color faded brown or mottled, ventral side usually paler, with yellow tube feet and tentacles. Spicules short rods, bone-shaped, and rosettes varying from small to large, X-shaped rods or plates; feet with end plate and elongate, perforated rods.



FIGS. 5–13. *Actinopyga agassizi* (Selenka). 5–9. Rosettes and branching rods from dorsal side. 10–13. Bone-shaped rods from ventral side.

DISTRIBUTION: Definitely known from Barbados to Florida and may very well extend into the Gulf of Mexico and the Caribbean Sea. It was taken by H. L. Clark in Biscayne Bay in 1938, and it has once been reported by Crozier from Bermuda, but has never been observed since in that region, though it is common in the Bahamas.

SPECIMENS EXAMINED: One, collected by Hyman in the lagoon at the Lerner Laboratory. Several, from various localities in the Bahamas, collected by Burnham Porter during a cruise with the "Dusky" in February, 1952.

REMARKS: The species appears to reach a length of 30 cm. when fully expanded. According to Hyman it is one of the most common species in the lagoon "every 3 or 4 feet in the good spots," that is, on sand with some growth of "eelgrass." In many individuals the cloaca is inhabited by a "pearl fish" (*Carapus*). The Cuvierian organs, found at the base

of the cloaca, have been found when liberated to be very poisonous to other animals, including *Carapus*.

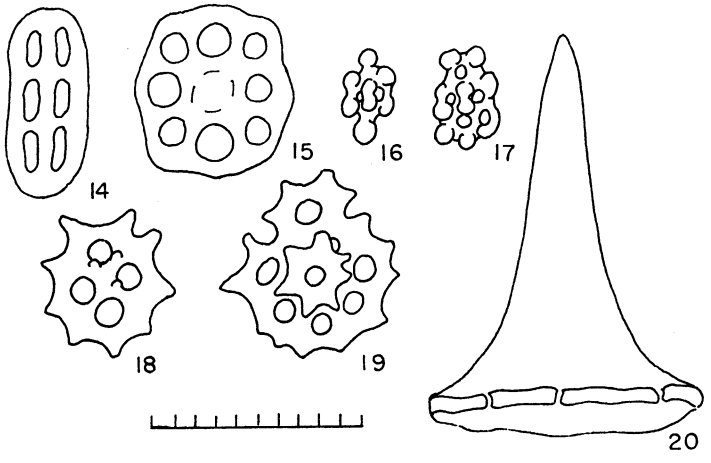
HOLOTHURIA LINNAEUS

Holothuria impatiens (Forskål)

Figures 14, 15

Fistularia impatiens FORSKÅL, 1775, p. 121, pl. 39, fig. B.
Holothuria impatiens, DEICHMANN, 1930, p. 64, pl. 3, figs. 17–18; 1939, p. 131. CLARK, 1933, p. 102; 1942, p. 385.

DIAGNOSIS: Slender, flask-shaped, medium-sized form (15 cm.) with terminal tentacles and appendages fairly evenly scattered on ventrum and dorsum, somewhat more papilliform in the latter area and with tendency to contract into low warts; sandy to the touch. Color dull, mottled gray. Spicules an external layer of stout tables with squarish disk with eight marginal holes and a spire ending in numerous short teeth; an inner



FIGS. 14, 15. *Holothuria impatiens* (Forskål). 14. Button. 15. Table disk.
FIGS. 16–20. *Holothuria princeps* Selenka. 16, 17. Irregular knobbed buttons. 18, 19. Tables with more or less reduced spire. 20. Large, tack-like table from base of tube foot.

layer of oval buttons with three pairs of large, oblong holes. Ventral feet with end plate and large, flat, supporting rods; dorsal appendages with reduced end plate and more curved supporting rods.

DISTRIBUTION: Almost circumtropical, but lives well hidden under rocks or in sand and mud, often a little deeper than the average shore collector can reach even at low tide. Where it is found in accessible

places, under flat rocks, etc., it occurs frequently in numbers. It has few, rather thick Cuvierian organs and is known to use these most efficiently. It has been recorded from many localities in the West Indies, as well as in the Mediterranean Sea and adjacent waters. In 1942 a large specimen was taken for the first time in Bermuda, while it had been taken previously in the Bahamas, according to the records of the Museum of Comparative Zoölogy.

SPECIMENS EXAMINED: One specimen dug out from an "eelgrass" patch in the lagoon near the Lerner Laboratory, sent in by Hyman; two specimens from Cat Island, Bahamas (M.C.Z. No. 1775).

Holothuria princeps Selenka

Figures 16–20

Holothuria princeps SELENKA, 1867, p. 332, pl. 18, figs. 67–69. DEICHMANN, 1930, p. 58, pl. 2, figs. 1–8; 1939, p. 130. CLARK, 1933, p. 101. CHERBONNIER, 1949, p. 255.

Holothuria imperator DEICHMANN, 1930, p. 62, pl. 3, figs. 1–11.

DIAGNOSIS: Stout, ovoid to cigar-shaped, burrowing form with small tentacles around the terminal mouth and numerous conical appendages distributed evenly over the surface; may reach a length of about 30 cm. Skin packed with spicules. Color varying from yellowish white, with dark spots, to almost blackish brown, but invariably with a narrow pale ring around the base of the appendages. Spicules an incomplete outer layer of tables of varying size with dentate margin and low spire, often reduced, and a deeper layer of crowded, irregular knobbed buttons, often imperfect. Feet with small end plate and large supporting rods or plates and a varying number of huge, tack-like tables with solid conical spire which perforates the skin, sometimes lacking.

DISTRIBUTION: Recent collections have shown that this species is by no means uncommon in the Gulf of Mexico, and Cherbonnier has reported it recently from the shores of Columbia-Venezuela. H. L. Clark reports it from San Domingo and Biscayne Bay, so its occurrence in the Bahamas is not surprising. It has, however, so far not been taken in Bermuda.

SPECIMENS EXAMINED: Three young individuals, 12–13 cm. long, from Bimini, collected by Hyman, 1952. Found burrowing in sand in "eelgrass" patch.

Holothuria mexicana Ludwig

Figures 21–38

Holothuria mexicana LUDWIG, 1875, p. 101, pl. 7, fig. 47. DEICHMANN, 1930, p. 74, pl. 5, figs. 15–20. CLARK, 1933, p. 107.

DIAGNOSIS: Large species, up to 50 cm. or more, with smooth skin; dorsal side with papillae on more or less prominent warts, ventral side with numerous cylindrical feet; mouth ventral, with 20 broad tentacles. Color usually dark brown or black on dorsal side, and pink to reddish on under side, often with darker patches; some individuals are completely black; spicules a scattered layer of tables with about 12 long spines on top of spire, and an inner layer of crowded biscuits with minute holes in several rows and oval or rectangular, loose-meshed plates. Ventral feet with end plate and a few rods; dorsal papillae with a vestige or no end plate and curved rods. In very young individuals a few rosettes may be present.

DISTRIBUTION: The species is definitely known from Barbados and northward around Cuba, probably also Yucatan (Ives's three species). In the Bahamas it is the most common species after *Actinopyga agassizii.* The few records from around Florida need re-investigation. It is also reported from Africa (Théel) and the Azores (Hérouard).

SPECIMENS EXAMINED: Eight large individuals collected in the lagoon at the Lerner Laboratory by Hyman. A small individual (0.8 cm.) from Cat Island (M.C.Z. No. 588), still with some simple rosettes. Several large individuals in the Museum of Comparative Zoölogy.

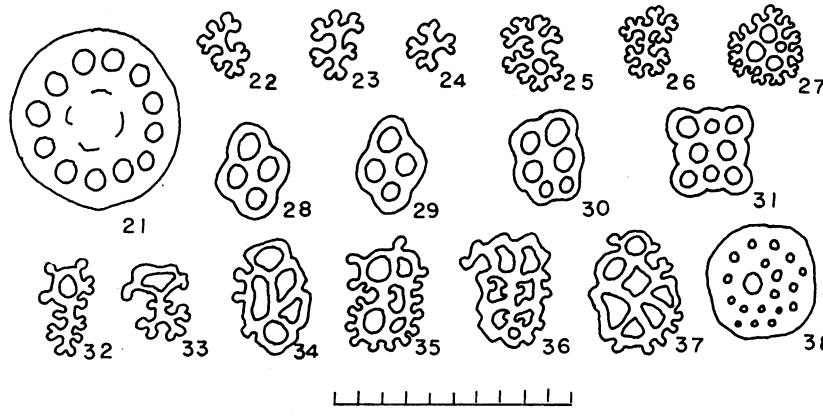
REMARKS: Hyman's finding exclusively large individuals, all with the typical biscuit-shaped plates and large-holed oval or rectangular plates, is in accordance with what we know from other localities where *H. mexicana* has been found. As with *Stichopus badionotus,* its young are almost unknown and must have an unusual ability to conceal themeslves. This is a striking contrast to the closely related form *H. floridana,* of which almost all collectors bring back large series of individuals, ranging in size from a few centimeters to about a foot in length.

The early stages of *H. mexicana* have been followed by Edwards on the basis of material from Green Turtle Key in the Bahamas, but he paid no attention to the spicules in these individuals of only a few millimeters in length, merely listing them as *H. floridana,* as he considered *H. mexicana* the aged stage of Pourtalès' *H. floridana* from the Florida reefs.

The small individual from Cat Island was originally referred to *H.*

floridana on account of the presence of a few simple rosettes. It has, however, in addition the characteristic loose-meshed plates, also rosettes which almost have become biscuit-shaped plates, spicules that one never finds in the small individuals of *H. floridana,* hence I have had no hesitation in re-identifying it as *H. mexicana.*

Pourtalès gave the name *H. floridana* to the most common species of the Florida reefs and described the characteristic simple rosettes as "star-shaped small spicules." His material ranged up to individuals 1 foot

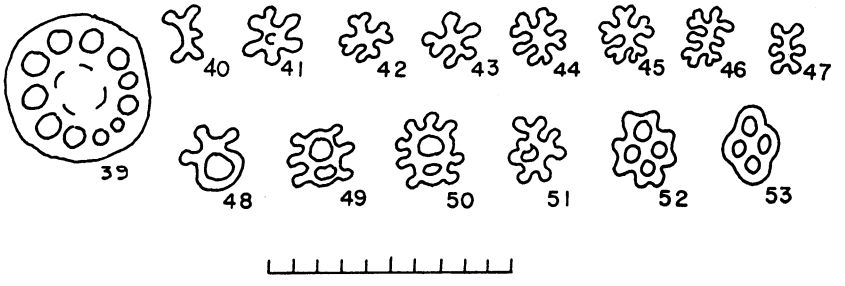


FIGS. 21–38. *Holothuria mexicana* Ludwig. 21. Disk of tables. 22–38. Rosettes and various stages of biscuit-shaped plates.

long, and he noticed that the smallest individuals lived hidden under mangrove branches or similar objects, while the large individuals were found exposed in the lagoons. In 1875 Ludwig described *H. mexicana,* without definite locality (simply "Mexico"), and his type was one of the few small individuals known (6 cm. long) and mottled gray; he figured the characteristic spicules, a small biscuit-like plate with minute holes, and an oval plate with a few large holes. These spicules are easily recognized, and they have been found to be characteristic of a large, mostly dark, thick-skinned species common in Barbados, Jamaica, and Cuba, but apparently not often, if ever, taken in the Florida waters where *H. floridana* dominates.

In 1908 Edwards attempted to unite the two forms and made a statistical analysis of the spicules to prove his point. The two species are definitely related, both have clusters of free stone canals and spicules of the same type, namely, tables and minute flat bodies of somewhat similar size, and derived from the same type, a minute bifurcate rod. In large or moderately large individuals it is easy to distinguish the two types, but

in the very young one may find rosettes in both species, and in the aged *floridana* the rosettes may develop into plates, although smaller and with fewer holes than those characteristic of *H. mexicana,* and the large-meshed plates are totally lacking.



FIGS. 39–53. *Holothuria floridana* Pourtalès. 39. Disk of table. 40–53. Various stages of rosettes and four-holed plates.

The relationship between the two species represents a most interesting problem, and it would be most desirable if Edwards' studies could be repeated in the Bahamas, and a similar series of experiments made on *H. floridana,* for example, in Biscayne Bay, where *H. mexicana* appears to be unknown.

Holothuria grisea Selenka

Holothuria grisea SELENKA, 1867, p. 328, pl. 8, figs. 52–56. DEICHMANN, 1930, p. 76, pl. 5, figs. 1–4. CLARK, 1933, p. 105.

DIAGNOSIS: Free-living, medium-sized form (15 cm.) with rows of warts on dorsal side and numerous yellowish tube feet on the ventrum. Color mottled gray, in life sometimes with specks of red, yellow-brown, and black interspersed. Anatomy similar to that of *H. floridana* and *H. mexicana,* but only one stone canal present. Spicules an external layer of tables with 12 large teeth on top of spire, and oval plates with two to four central holes and smaller ones at the end; margin blunt dentate, or scalloped.

DISTRIBUTION: From Rio de Janeiro northward to Colon, Panama, also taken at Jamaica and Puerto Rico. Records from Florida need re-investigation, as in one case (Sluiter, 1910) it has proved to represent misidentification of *H. floridana.* The species has been reported as being numerous on the islands Rolas and Sao Tomé on the west coast of Africa (Greef, 1882). Whether it is a permanent element in the Bahamas fauna seems doubtful.

SPECIMENS EXAMINED: Four individuals, labeled New Providence, Bahamas (M.C.Z. No. 621).

Holothuria glaberrima Selenka

Holothuria glaberrima SELENKA, 1867, p. 328, pl. 18, figs. 57–58. DEICHMANN, 1930, p. 69, pl. 4, figs. 10–13. CLARK, 1933, p. 104.

DIAGNOSIS: Stout, soft-skinned form with unusually bushy tentacles and numerous cylindrical feet on the ventrum and few papilliform appendages on the dorsal side. Color black. Spicules reduced to scattered, slightly curved rods and, in very small individuals, a few degenerate tables. Ventral feet with large end plate.

DISTRIBUTION: The species ranges from Trinidad northward to the Greater Antilles and as far westward as Colon, Panama. (Selenka's record from that locality, which hitherto has been considered dubious, has been confirmed by material received in 1924 by a Mr. Shropshire, United States Government official in the Canal Zone.) It is not known from Bermuda nor from Florida, and it is not known from where in the Bahamas the cotype came; Selenka's other cotype came from Haiti.

SPECIMENS EXAMINED: Selenka's cotype, labeled Bahamas (M.C.Z. No. 607).

REMARKS: W. K. Fisher has observed that the species clings to the outer side of surf-washed rocks, usually where a tough kelp is growing. Superficially it resembles a dendrochirote with its unusually bushy tentacles, and it probably uses them for plankton catching. Often three or four are hidden in shallow depressions in the rocks.

Holothuria parvula (Selenka)

Mülleria parvula SELENKA, 1867, p. 314, pl. 17, figs. 17–18.

Holothuria parvula, DEICHMANN, 1930, p. 70, pl. 4, figs. 14–22. CLARK, 1933, p. 103. KILLE, 1937, pp. 93–94; 1942, pp. 55–66, pl. 1.

Holothuria captiva, CROZIER, 1914, pp. 8–20; 1915, pp. 196–202; 1917a, pp. 510–513; 1917c, pp. 560–566; 1920, pp. 57–59.

DIAGNOSIS: Small, flattened form with ventral sole of numerous cylindrical feet and large ventral tentacles; dorsal side with scattered papillae on more or less distinct low warts. Color light brownish to greenish. Spicules an external layer of tables with 10 to 12 marginal holes and numerous teeth on top of the low, squat spire; an inner layer of thin, oval buttons with about three pairs of small holes. Feet with end plate and supporting rods or plates; dorsal papillae with reduced end plate and curved rods.

DISTRIBUTION: The species is known to be common in Tobago, Barbados, and the Tortugas as well as in Bermuda. Although it was not reported by Clark from Biscayne Bay in 1938, it may very possibly occur there, and one would naturally expect it to extend its range to the Bahamas.

SPECIMENS EXAMINED: Four specimens from Nassau, Bahamas (M.C.Z. No. 823).

REMARKS: The species occurs usually in large numbers under flat rocks exposed at low tide. As another West Indian species, *H. surinamensis,* not yet reported from the Bahamas, it multiplies by transverse fission, so one may encounter individuals which lack either oral or anal opening. Various phases of the biology of this animal have been studied by Crozier and Kille.

ORDER DENROCHIROTA

FAMILY CUCUMARIIDAE

PENTACUCUMIS, NEW GENUS

DIAGNOSIS: Cucumariids with feet restricted to the ambulacra, simple, low calcareous ring, and numerous spicules. The latter consists of minute, simple baskets in the outer layer and a crowded layer of irregular, strongly knobbed buttons or plates. Feet without end plates but the wall strengthened by numerous heavy supporting rods, which are shorter, broader, more triangular in the dorsal appendages.

TYPE SPECIES: *Cladodactyla planci* Brandt, 1835.

REMARKS: The new genus appears most closely related to *Pentacta,* but is less modified for a sedentary mode of life, the ventral feet being about as numerous as those on the dorsal side, and the latter have not become reduced to wart-like papillae, spreading into the interambulacra.

As the name *Cucumaria* has been restricted to take in the *frondosa*-like forms, it has been necessary to establish a new genus for Brandt's Mediterranean species. At the present moment only one species is referred to the genus.

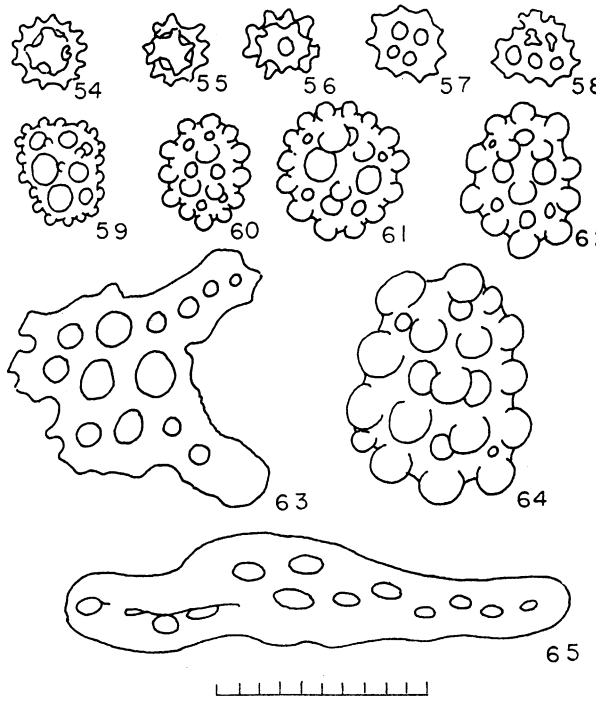
Pentacucumis planci (Brandt)

Figures 54–71

Cladodactyla planci BRANDT, 1835, p. 45.

Cucumaria planci, MARENZELLER, 1874, p. 300. MORTENSEN, 1927, p. 403, fig. 241. KOEHLER, 1927, p. 164, pl. 16, fig. 3.

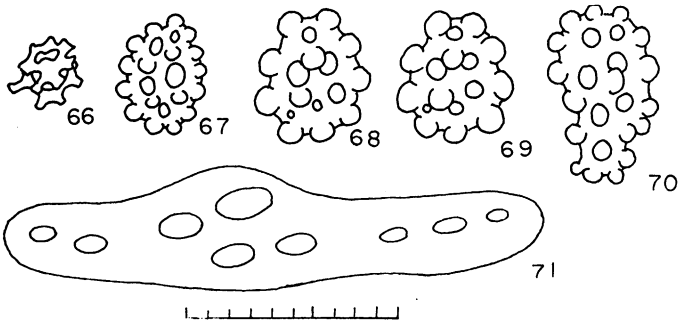
DIAGNOSIS: Medium-sized form (up to 15 cm. long) with the two ventral tentacles slightly smaller than the others and conical tube feet in five sharply defined double rows, giving the body a prismatic form. Calcareous ring simple, low, one Polian vesicle, one (rarely two) stone canals; color light brown, sometimes spotted. Spicules an external layer of minute baskets, mostly tri-radiate; an inner layer of strongly knobbed buttons, mostly with three central knobs arranged in a triangle and marginal knobs of different size; besides larger, more plate-like bodies, simple plates, and some loose-meshed plates with small knobs. Feet lacking end plate (at least in the adult stage), but walls stiffened by heavy, perforated, supporting rods, mostly with four large central holes and smaller ones towards the ends; in the dorsal feet the rods tend to become triangular or plate-like. Introvert with scattered knobbed buttons or plates. Tentacles with heavy perforated rods



FIGS. 54–65. *Pentacucumis planci* (Brandt). 54–58. Baskets from outer layer of skin. 59–62, 64. Knobbed buttons and plates from deeper layer of skin. 63. Supporting plate from dorsal tube foot. 65. Supporting rod from ventral tube foot. All from specimen from Bahamas.

in the stem and smaller ones in the branches. Rosettes present in varying number in introvert and tentacles.

DISTRIBUTION: The most common species in the Mediterranean Sea and also known from the coasts of Portugal and West Africa. Records from the coasts of England need verification, as it definitely in many cases has been confused with other species. As far as I know it has never been taken at the Azores, but it may very well occur there without having been discovered, because very little systematic exploration has been made around those islands. It is now reported, for the first time, from the Bahamas Islands. It is usually taken at 3 to 90 fathoms in depth.



FIGS. 66–71. *Pentacucumis planci* (Brandt). 66. Basket. 67–70. Knobbed buttons. 71. Supporting rod from ventral tube foot. All from specimen from the Mediterranean.

SPECIMENS EXAMINED: One from Andros Island, Bahamas, collected by B. E. Dahlgreen and H. Mueller, in March-April, 1908 (A.M.N.H. No. A3575); several from Cette, France (M.C.Z. No. 210).

REMARKS: There are no data about the depth at which the Andros specimen was taken, but it seems most reasonable to assume it was dredged, probably at somewhat greater depth than that at which it commonly occurs in the Mediterranean, as Bahama waters are more turbulent. This may also explain why it hitherto has remained undiscovered.

The Andros specimen measures about 13 cm. in length, and the gonads are well developed and appear to be almost ripe. (Selenka, 1876, memtions that the species breeds during "spring" in the Mediterranean.)

The development is abbreviated, with a barrel-shaped larva which directly is transformed into a small cucumariid. In the Mediterranean

Selenka finds that it lives attached to rocks, usually several together. Koehler mentions, on the other hand, that it often is found on sandy or muddy bottom at a few meters in depth, and it is so common that the fishermen regularly use the eviscerated animal as bait.

PARATHYONE, NEW GENUS

DIAGNOSIS: Medium-sized forms (10–15 cm. long), with tentacles of equal size and stout feet spreading out into the interambulacra, with simple ring and spicules consisting of baskets and regular, strongly knobbed buttons; feet with end plates and large supporting rods.

TYPE SPECIES: *Thyone surinamensis* Semper, 1868.

REMARKS: As the name *Thyone* recently has been restricted to the forms with two small ventral tentacles, long tubular calcareous ring, and spicules developed as tables or derivatives of tables, it is necessary to establish a new genus for those that have tentacles of equal size, simple ring, and knobbed regular buttons and baskets. Besides *surinamensis,* two other species in the West Indies, *T. suspecta* and *T. solida,* are tentatively placed in the genus, and there may be other species, incompletely described, in other parts of the world, which should be transferred to the genus.

Parathyone surinamensis (Semper)

Thyone surinamensis SEMPER, 1868, p. 65, pl. 15, fig. 15. DEICHMANN, 1930, p. 77, pl. 16, figs. 5–8; 1939, p. 135. CLARK, 1933, p. 116.
Cucumaria punctata, CLARK, 1919, p. 73.

DIAGNOSIS: As for the genus; length up to about 10 cm.; color mottled grayish brown. Spicules numerous knobbed buttons and more scattered baskets; feet with large end plate and peculiar narrow, band-like, supporting rods with small holes in the ends.

MATERIAL EXAMINED: One young individual from Arthurs Town, Cat Island, Bahamas (M.C.Z. No. 1774).

DISTRIBUTION: Ranges from Brazil to Bermuda; in 1938 H. L. Clark found it in Biscayne Bay, the first authentic record from Florida. It seems most reasonable that H. L. Clark's record (1919) of *"C. punctata"* from the Bahamas is trustworthy, because the species was found there again in 1935 by the Malacological Expedition from the Museum of Comparative Zoölogy, but I have been unable to trace the specimen listed by Clark in 1919 (his only record of a holothurian from the Bahamas). According to Clark's observation in Biscayne Bay, it lives "near low water, under and among rocks to which it clings tightly with its numerous feet."

ORDER APODA

FAMILY SYNAPTIDAE

EUAPTA OESTERGREN, 1898

Euapta lappa (J. Müller)

Synapta lappa J. MÜLLER, 1850, p. 134.
Euapta lappa, DEICHMANN, 1930, p. 205. CLARK, 1933, p. 118.
Synapta polii LUDWIG, 1875, p. 80, pl. 6, fig. 5.

DIAGNOSIS: Large form, reaching a length of 2 feet or more; 15 tentacles with up to 35 pairs of lateral pinnae, not united by webbing at the base; color silvery gray mottled with dark so the animal appears longitudinally striped. Spicules large anchors with branched stock and anchor plates with six, rarely seven, dentate holes and a varying number with smooth margin at the posterior end where a well-developed bridge is present. Miliary grains present.

SPECIMENS EXAMINED: None, but several were examined by Libbie Hyman from the shores along South Bimini, among rotting coral rocks in a few inches of water at low tide.

DISTRIBUTION: Reported from "West Indies" (J. Müller), Barbados (Ludwig, type of *polii*), and northward to Florida; also taken at Cuba and Jamaica. How far it extends westward into the Caribbean and the Gulf of Mexico is not known; apparently it has not been taken in Bermuda. There is also one old record from Teneriffe, in the Canaries, but whether the species normally belongs to the fauna is not known (Théel, 1886).

REMARKS: According to H. L. Clark, it is an extremely sluggish form which apparently stays in the same spot for a very long time. However, Wm. D. Clarke observed at Bimini, Bahama Islands, that this species was nocturnal in habits, being active at night throughout the *Thalassia* beds of the lagoon. During the day it secretes itself in or around uninhabited conch shells and under slabs of coral. He also observed that specimens kept in aquaria where suitable cover was provided remained inactive and hidden during the day but became most active at night. W. K. Fisher quotes Nutting ("Narrative of the Barbados Antiqua Expedition," p. 194) as saying that it is "the most active holothurian by far that I have ever seen." Possibly it is restless in aquaria, as many holothurians are.

REFERENCES

BRANDT, J. F.
1835. Prodromus descriptionis animalium ab H. Mertensio in orbis terrarum circum navigatione observatorum. St. Petersburg, fasc. 1, pp. 42–61.

CHERBONNIER, G.
1949. Note préliminaire sur quelques holothuries. Bull. Mus. Natl. d'Hist. Nat., ser. 2, vol. 21, pp. 255–258.

CLARK, H. L.
1919. The distribution of the littoral echinoderms of the West Indies. Publ. Carnegie Inst. Washington, no. 281, pp. 49–74, pls. 1–3.
1922. The holothurians of the genus *Stichopus*. Bull. Mus. Comp. Zoöl., vol. 65, pp. 39–74, pls. 1–2.
1933. A handbook of the littoral echinoderms of Puerto Rico and other West Indian islands. *In* Scientific survey of Puerto Rico and the Virgin Islands. New York, New York Academy of Sciences, vol. 16, pt. 1, pp. 1–148, pls. 1–7.
1942. The echinoderm fauna of Bermuda. Bull. Mus. Comp. Zoöl., vol. 89, pp. 367–394, 1 pl.

CROZIER, W. J.
1914. The orientation of a holothurian by light. Amer. Jour. Physiol., vol. 36, pp. 8–20.
1915. A note on the physiology of the Cuvierian organs of *Holothuria captiva* Ludw. *Ibid.*, vol. 36, pp. 196–202.
1916. The rhythmic pulsation of the cloaca of holothurians. Jour. Exp. Zool., vol. 20, pp. 297–356.
1917a. The behavior of holothurians in balanced illumination. Amer. Jour. Physiol., vol. 43, pp. 510–513.
1917b. Occurrence of a holothurian new to the fauna of Bermuda. Ann. Mag. Nat. Hist., ser. 8, vol. 19, pp. 405–406.
1917c. Multiplications in holothurians. Amer. Nat., vol. 51, pp. 560–566.
1918. The amount of bottom material ingested by holothurians (*Stichopus*). Jour. Exp. Zool., vol. 26, pp. 379–389.
1920. On the role of an integumentary pigment in photoreception in *Holothuria*. Jour. Gen. Physiol., vol. 3, pp. 57–59.

DEICHMANN, E.
1921. Papers from Dr. Th. Mortensen's Pacific Expedition 1914–16. IX. On some cases of multiplication by fission and of coalescence in holothurians; with notes on the synonymy of *Actinopyga parvula* (Sel.). Vidensk. Meddel. Dansk Naturhist. For. København, vol. 73, pp. 199–215, text figs.
1930. The holothurians of the western part of the Atlantic Ocean. Bull. Mus. Comp. Zoöl., vol. 71, pp. 43–226, pls. 1–21.
1939. Holothurians from Biscayne Bay, Florida. Proc. Florida Acad. Sci., vol. 3 (1938), pp. 128–137, 1 pl. (Biological notes by H. L. Clark.)
1940. Report on the holothurians, collected by the Harvard-Havana Expeditions 1938 and 1939, with a revision of the Molpadonia of the Atlantic Ocean. Mem. Soc. Cubana Hist. Nat., vol. 14, pp. 183–240, pls. 31–41.

EDWARDS, C. L.
1908. Variation, development and growth in *Holothuria floridana* Pourtalès and in *Holothuria atra* Jäger. Biometrika, vol. 6, pp. 236–301, pls. 1–5.
1909. The development of *Holothuria floridana* Pourtalès with especial reference to the ambulacral appendages. Jour. Morph., vol. 20, pp. 211–230, pls. 1–3.

GREEF, R.
1882. Echinoderms beobachtet auf einer Reise nach der Guinea Insel São Tomé. Zool. Anz., vol. 5, pp. 135, 158.

HÉROUARD, E.
1902. Holothuries provenant des compagnes de la Princesse-Alice (1892–1897). *In* Resultats des campagnes scientifiques . . . Albert . . . Prince de Monaco. Monaco, fasc. 21, pp. 1–62, pls. 1–8.

IVES, J. E.
1890. Echinoderms from the northern coast of Yucatan and the harbor of Vera Cruz. Proc. Acad. Nat. Sci. Philadelphia, pp. 317–340, pl. 8.
1891. Echinoderms from the Bahamas Islands. *Ibid.*, pp. 337–341.

KILLE, F. R.
1937. Regeneration in the genus Holothuria. Yearbook Carnegie Inst. Washington, no. 36, pp. 93–94.
1942. Regeneration of the reproductive system following binary fission in the sea cucumber *Holothuria parvula* Selenka. Biol. Bull. Marine Biol. Lab. Woods Hole, vol. 83, pp. 55–66, pl. 1.

KOEHLER, R.
1927. Les échinodermes des mers d'Europe. Paris, vol. 2, p. 167.

LUDWIG, H.
1875. Beiträge zur Kenntniss der Holothurien. Arb. Zool.-Zoot. Inst. Würzburg, vol. 2, pp. 77–118, pls. 6–9.

MARENZELLER, E. VON
1874. Kritik Adriatischer Holothurien. Verhandl. K. K. Zool.-Bot. Gesell. Wein, pp. 299–320.

MORTENSEN, TH.
1927. Echinoderms of the British Isles. Oxford, pp. 1–471, figs. 1–269.

MÜLLER, J.
1850. Anatomischen Studien über die Echinodermen. Archiv f. Anat., Physiol., u. Wiss. Med., pp. 129–147.

OESTERGREN, H.
1898. Das System der Synaptiden. Öfvers. K. Vetensk.-Akad. Förhandl., Stockholm, vol. 55, pp. 111–120. (*Euapta* on p. 112.)

SELENKA, E.
1867. Beiträge zur Anatomie und Systematic der Holothurien. Zeitschr. f. Wiss. Zool., vol. 17, pp. 291–374, pls. 17–20.
1876. Zur Entwicklung der Holothurien (*H. tubulosa* u. *C. doliolum*). *Ibid.*, vol. 27, pp. 179–237, pls. 17–18.

SEMPER, C. G.
1868. Reisen im Archipel der Philippinen. II Theil (Wissenschaftliche Resultate). Leipzig and Wiesbaden, vol. 1, pt. 2, Holothurien, pp. 1–288, pls. 1–40.

SLUITER, C. P.
1910. West Indische Holothurien. Zool. Jahrb., suppl. vol. 11, no. 2, pp. 331–342, text figs.

THÉEL, H.
1886. Report on the Holothurioidea dredged by H.M.S. Challenger, during the years 1873–1876. Part 2. *In* Murray, John (ed.), Report on the scientific results of the voyage of H.M.S. Challenger. London, vol. 14, pt. 39, pp. 1–290, pls. 1–16.